**3GPP TSG-CT WG3 Meeting #128 *C3-232162r1***

**Bratislava, Slovakia, 22nd May – 26th May 2023 (Revision of C3-231553)**

|  |
| --- |
| *CR-Form-v12.2* |
| **CHANGE REQUEST** |
|  |
|  | **29.520** | **CR** | **0695** | **rev** | **2** | **Current version:** | **18.1.0** |  |
|  |
| *For* [***HE******LP***](http://www.3gpp.org/3G_Specs/CRs.htm#_blank)*on using this form: comprehensive instructions can be found at* [*http://www.3gpp.org/Change-Requests*](http://www.3gpp.org/Change-Requests)*.* |
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| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ***Proposed change affects:*** | UICC apps |  | ME |  | Radio Access Network |  | Core Network | **X** |

|  |
| --- |
|  |
| ***Title:***  | Support Nnwdaf\_MLModelTraining Service |
|  |  |
| ***Source to WG:*** | , Nokia, Nokia Shanghai Bell |
| ***Source to TSG:*** | CT3 |
|  |  |
| ***Work item code:*** | eNA\_Ph3 |  | ***Date:*** |  |
|  |  |  |  |  |
| ***Category:*** | **B** |  | ***Release:*** |  |
|  | *Use one of the following categories:****F*** *(correction)****A*** *(mirror corresponding to a change in an earlier release)****B*** *(addition of feature),* ***C*** *(functional modification of feature)****D*** *(editorial modification)*Detailed explanations of the above categories canbe found in 3GPP [TR 21.900](http://www.3gpp.org/ftp/Specs/html-info/21900.htm). | *Use one of the following releases:Rel-8 (Release 8)Rel-9 (Release 9)Rel-10 (Release 10)Rel-11 (Release 11)…Rel-16 (Release 16)Rel-17 (Release 17)Rel-18 (Release 18)Rel-19 (Release 19)* |
|  |  |
| ***Reason for change:*** | In clauses 6.2F and 7.10 of TS 23.288, Nnwdaf\_MLModelTraining service is introduced to enable an NWDAF service consumer, i.e. an NWDAF containing MTLF, to subscribe to another NWDAF, i.e. an NWDAF containing MTLF, for a trained ML model based on the ML model provided by the service consumer NWDAF. The service may be used by an NWDAF containing MTLF to enable e.g. Federated Learning or to update ML model. The service is also used by an NWDAF to request an NWDAF containing MTLF to prepare training ML model or modify existing ML Model training subscription.When NWDAF service consumer determine to further update the ML model, NWDAF service consumer modifies the subscription by invoking Nnwdaf\_MLModelTraining\_Subscribe service operation including Subscription Correlation ID with ML Model Information (i.e. file address (e.g. URL or FQDN) of the ML Model that needs to update).This CR proposes to support the Nnwdaf\_MLModelTraining service in stage 3 and add Nnwdaf\_MLModelTraining API to TS 29.520. |
|  |  |
| ***Summary of change:*** | The following changes are made:* Added introduction of Nnwdaf\_MLModelTraining service to clause 4.1.
* Added new clause 4.6 for introducing service description and service operations of Nnwdaf\_MLModelTraining Service.
* Added new clause 5.5 for the design of Nnwdaf\_MLModelTraining API.
* Added A.6 as the OpenAPI file for the Nnwdaf\_MLModelTraining service API.
 |
|  |  |
| ***Consequences if not approved:*** | Misalignment with stage 2. No support of Nnwdaf\_MLModelTraining service in stage 3. |
|  |  |
| ***Clauses affected:*** | 4.1, 4.6(new), 5.5(new), A.1, A.6(new) |
|  |  |
|  | **Y** | **N** |  |  |
| ***Other specs*** |  | **X** |  Other core specifications  | TS/TR ... CR ...  |
| ***affected:*** |  | **X** |  Test specifications | TS/TR ... CR ...  |
| ***(show related CRs)*** |  | **X** |  O&M Specifications | TS/TR ... CR ...  |
|  |  |
| ***Other comments:*** | This CR introduces backward compatible feature to the OpenAPI Nnwdaf\_MLModelTraining. |
|  |  |
| ***This CR’s revision history:*** | CT3#128:According to the proposal from rapporteur on corrections to the OpenAPI, the following change is made in A.6:* Moved “content:” after the description “… Successfully and a representation of that resource is returned.” to a new line.

In addition, change the first letter of “Successfully” in above sentence to lower letter “s”. Add descriptions for optional attributes to "NwdafMLModelTrainNotif" structure in clause 4.6.2.4.2. |

**Additional discussion(if needed):**

**Proposed changes:**

\*\*\* 1st Change \*\*\*

## 4.1 Introduction

The Nnwdaf services are used by the NWDAF to provide specific analytics information and ML models.

Analytics information is either statistical information of past events, or predictive information.

The following services are specified for the NWDAF:

Table 4.1-1: Services provided by NWDAF

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Service Name | Description | Service Operations | OperationSemantics | Example Consumer(s) |
| Nnwdaf\_EventsSubscription(NOTE 1) | This service enables the NF service consumers to subscribe to/unsubscribe from notifications for different analytics information from the NWDAF. It also enables the transfer of subscriptions between NWDAFs | Subscribe | Subscribe / Notify | PCF, NSSF, AMF, SMF, NEF, AF, OAM, CEF, NWDAF, DCCF |
| Unsubscribe |
| Notify |
| Transfer | Request / Response | NWDAF |
| Nnwdaf\_AnalyticsInfo | This service enables the NF service consumers to request and get specific analytics or context information related to analytics subscriptions from the NWDAF. | Request | Request / Response | PCF, NSSF, AMF, SMF, NEF, AF, OAM, NWDAF, DCCF |
| ContextTransfer | Request / Response | NWDAF |
| Nnwdaf\_DataManagement | This service enables the NF service consumers to subscribe to/unsubscribe from notifications when subscribed event(s) are detected or retrieve the subscribed data from the NWDAF. | Subscribe | Subscribe / Notify | NWDAF, DCCF, MFAF |
| Unsubscribe |
| Notify |
| Fetch | Request / Response | NWDAF, DCCF, MFAF |
| Nnwdaf\_MLModelProvision(NOTE 2) | This service enables the NF service consumers to subscribe to/unsubscribe from notifications when a ML model matching the subscription parameters becomes available. | Subscribe | Subscribe / Notify | NWDAF |
| Unsubscribe |
| Notify |
| Nnwdaf\_MLModelTraining | This service enables the NF service consumers to subscribe to/unsubscribe/modify from notifications for a ML model training. | Subscribe | Subscribe / Notify | NWDAF |
| Unsubscribe |
| Notify |
| NOTE 1: This service corresponds to the Nnwdaf\_AnalyticsSubscription service defined in 3GPP TS 23.288 [17].NOTE 2: This service implements also the Nnwdaf\_MLModelInfo service as specified in 3GPP TS 23.288 [17] by using immediate and one-time reporting requirement. |

Table 4.1-2 summarizes the corresponding APIs defined in this specification.

Table 4.1-2: API Descriptions

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Service Name | Clause | Description | OpenAPI Specification File | apiName | Annex |
| Nnwdaf\_EventsSubscription | 5.1 | Nnwdaf Events Subscription Service. | TS29520\_Nnwdaf\_EventsSubscription.yaml | nnwdaf-eventssubscription | A.2 |
| Nnwdaf\_AnalyticsInfo | 5.2 | Nnwdaf Analytics Information Service | TS29520\_Nnwdaf\_AnalyticsInfo.yaml | nnwdaf-analyticsinfo | A.3 |
| Nnwdaf\_DataManagement | 5.3 | NWDAF Data Management Service | TS29520\_Nnwdaf\_DataManagement.yaml | nnwdaf-datamanagement | A.4 |
| Nnwdaf\_MLModelProvision | 5.4 | NWDAF ML Model Provision Service | TS29520\_Nnwdaf\_MLModelProvision.yaml | nnwdaf-mlmodelprovision | A.5 |
| Nnwdaf\_MLModelTraining | 5.5 | NWDAF ML Model Training Service | TS29520\_Nnwdaf\_MLModelTraining.yaml | nnwdaf-mlmodeltraining | A.6 |

\*\*\* 2nd Change (new) \*\*\*

## 4.6 Nnwdaf\_MLModelTraining Service

### 4.6.1 Service Description

#### 4.6.1.1 Overview

The Nnwdaf\_MLModelTraining service as defined in 3GPP TS 23.288 [17], is provided by the Network Data Analytics Function (NWDAF) containing Model Training Logical Function (MTLF).

This service:

- allows the NF service consumers to subscribe to and unsubscribe from different ML model training events;

- allows the NF service consumers to modify different ML model training events; and

- notifies the NF service consumers with a corresponding subscription about ML model information.

#### 4.6.1.2 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 [17]. The ML Model training signalling flows are defined in 3GPP TS 29.552 [25].

The Nnwdaf\_MLModelTraining service is part of the Nnwdaf service-based interface exhibited by the Network Data Analytics Function (NWDAF) containing Model Training Logical Function (MTLF).

Known consumers of the Nnwdaf\_MLModelTraining service are:

- Network Data Analytics Function (NWDAF) containing Model Training Logical Function (MTLF)



Figure 4.6.1.2-1: Reference Architecture for the Nnwdaf\_MLModelTraining Service; SBI representation



Figure 4.6.1.2-2: Reference Architecture for the Nnwdaf\_MLModelTraining Service: reference point representation

#### 4.6.1.3 Network Functions

##### 4.6.1.3.1 Network Data Analytics Function (NWDAF)

The Network Data Analytics Function (NWDAF), containing Model Training Logical Function (MTLF), provides ML model information for different analytic events to NF service consumers.

The Network Data Analytics Function (NWDAF) allows NF service consumers to subscribe to and unsubscribe from one-time, periodic notification or notification when an event is detected.

##### 4.6.1.3.2 NF Service Consumers

The Network Data Analytics Function (NWDAF) supports (un)subscription to the notification of different ML model information from the NWDAF which contains Model Training Logical Function (MTLF).

### 4.6.2 Service Operations

#### 4.6.2.1 Introduction

Table 4.6.2.1-1: Operations of the Nnwdaf\_MLModelTraining Service

| Service operation name | Description | Initiated by |
| --- | --- | --- |
| Nnwdaf\_MLModelTraining\_Subscribe | This service operation is used by an NF service consumer to subscribe to ML model training from NWDAF. | NF service consumer (NWDAF) |
| Nnwdaf\_MLModelTraining\_Unsubscribe | This service operation is used by an NF service consumer to unsubscribe to ML model training. | NF service consumer (NWDAF) |
| Nnwdaf\_MLModelTraining\_Notify | This service operation is used by the NWDAF to notify the ML model information to the NF service consumer instance which has subscribed to. | NWDAF |

#### 4.6.2.2 Nnwdaf\_MLModelTraining\_Subscribe service operation

##### 4.6.2.2.1 General

The Nnwdaf\_MLModelTraining\_Subscribe service operation is used by an NF service consumer to subscribe or update subscription for event notifications from the NWDAF which contains Model Training Logical Function (MTLF).

##### 4.6.2.2.2 Subscription for event notifications

Figure 4.6.2.2.2-1 shows a scenario where the NF service consumer sends a request to the NWDAF to subscribe for event notification(s) (as shown in 3GPP TS 23.288 [17]).



Figure 4.6.2.2.2-1: NF service consumer subscribes to notifications

The NF service consumer shall invoke the Nnwdaf\_MLModelTraining\_Subscribe service operation to subscribe to event notification(s). The NF service consumer shall send an HTTP POST request with "{apiRoot}/nnwdaf-mlmodeltraining/<apiVersion>/subscriptions" as Resource URI representing the "NWDAF ML Model Training Subscriptions", as shown in figure 4.6.2.2.2-1, step 1, to create a subscription for an "Individual NWDAF ML Model Training Subscription" according to the information in message body.

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

- an URI where to receive the requested notifications as the "notifUri" attribute;

- a description of the subscribed events as the "mLEventSubscs" attribute that, for each event, the MLEventSubscription data type shall include:

1) an event identifier as the "mLEvent" attribute;

2) event filter information as the "mLEventFilter" attribute;

- the interoperability information as the "modelInterInfo" attribute; and

- a notification correlation identifier assigned by the NF service consumer for the requested notifications as "notifCorreId" attribute;

and may include:

1) an identification of UE information for which data for ML model training is requested as the "tgtRepUe" attribute;

2) the ML model information as the "mLModelInfos" attribute;

3) the ML model training information as the "mLModelTrainInfos" attribute;

4) identification of the ML procesure for training the ML model as the "mLCorreId" attribute;

5) an indication of preparation request for ML model training as the "mLPreFlag" attribute;

6) an indication of request using the local training data as the testing dataset to calculate the Model Accuracy of the global ML model provided by the consumer as the "mLAccChkFlg" attribute;

7) the ML model training reporting information as the "mLTrainRepInfo" attribute;

8) the round number of the training in a multi-round training process as the "roundInd" attribute;

Editor’s Note: Whether need the "roundInd" attribute is FFS and will align with stage 2 requirements.9) the use case context of the ML model as the "uCaseCont" attribute; and

10) the reporting requirement information of the subscription as the "eventReq" attribute.

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

If the NWDAF created an "Individual NWDAF ML Model Training Subscription" resource, the NWDAF shall respond with "201 Created" with the message body containing a representation of the created subscription, as shown in figure 4.6.2.2.2-1, step 2. The NWDAF shall include a Location HTTP header field. The Location header field shall contain the URI of the created subscription i.e. "{apiRoot}/nnwdaf-mlmodeltraining/<apiVersion>/subscriptions/{subscriptionId}".

If the immediate reporting indication in the "immRep" attribute within the "eventReq" attribute sets to true during the event subscription, the NWDAF shall include the reports of the subscribed events, if available, as the "mLModelInfos" attribute in the HTTP POST response.

If not all the requested events in the subscription are accepted, then the NWDAF may include the "failEventReports" attribute indicating the event(s) for which the subscription failed and the associated reason(s).

If there is no associated ML model training available for all the listed "mLEvent" attribute, the NWDAF which contains MTLF shall send a "500 Internal Server Error" status code to the NF service consumer. Also, the corresponding failure reason via a "problemDetails" attribute with the "cause" attribute set to "UNAVAILABLE\_ML\_MODEL\_TRAINING\_FOR\_ALLEVENTS".

If other errors occur when processing the HTTP POST request, the NWDAF shall send an HTTP error response as specified in clause 5.5.7.

##### 4.6.2.2.3 Update subscription for event notifications

Figure 4.6.2.2.3-1 shows a scenario that the NF service consumer sends an HTTP PUT request to the NWDAF to modify an existing subscription (as shown in 3GPP TS 23.288 [17]).



Figure 4.6.2.2.3-1: Modification of events subscription information using HTTP PUT

The NF service consumer shall invoke the Nnwdaf\_MLModelTraining\_Subscribe service operation to modify an existing ML Model Training subscription. The NF service consumer shall send an HTTP PUT request with: "{apiRoot}/nnwdaf-mlmodeltraining/<apiVersion>/subscriptions/{subscriptionId}" as Resource URI, where "{subscriptionId}" is the event subscriptionId of the existing subscription to be modified, to update an "Individual NWDAF ML Model Training Subscription" according to the information in the message body. The NwdafMLModelTrainSubsc data structure provided in the request body shall include the same contents as described in clause 4.6.2.2.2.

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

- modify the concerned subscription; and

- store the subscription.

If the NWDAF successfully processed and accepted the received HTTP PUT request, the NWDAF shall update an "Individual NWDAF ML Model Training Subscription" resource, and shall respond with:

- HTTP "204 No Content" response (as shown in figure 4.6.2.2.3-1, step 2a); or

- HTTP "200 OK" response (as shown in figure 4.6.2.2.3-1, step 2b) with a response body containing a representation of the updated subscription in the NwdafMLModelTrainSubsc data type.

If not all the requested events in the subscription are modified successfully, then the NWDAF may include the "failEventReports" attribute indicating the event(s) for which the subscription failed and the associated reason(s).

If other errors occur when processing the HTTP PUT request, the NWDAF shall send an HTTP error response as specified in clause 5.5.7.

If the NWDAF determines that the received HTTP PUT request needs to be redirected, the NWDAF shall send an HTTP redirect response as specified in clause 6.10.9 of 3GPP TS 29.500 [6].

##### 4.6.2.2.4 Partial update subscription for event notifications

Figure 4.6.2.2.4-1 shows a scenario that the NF service consumer sends an HTTP PATCH request to the NWDAF to partial modify an existing subscription (as shown in 3GPP TS 23.288 [17]).



Figure 4.6.2.2.4-1: Partial modification of events subscription information using HTTP PATCH

The NF service consumer shall invoke the Nnwdaf\_MLModelTraining\_Subscribe service operation to partial modify an existing ML Model Training subscription. The NF service consumer shall send an HTTP PATCH request with: "{apiRoot}/nnwdaf-mlmodeltraining/<apiVersion>/subscriptions/{subscriptionId}" as Resource URI, where "{subscriptionId}" is the event subscriptionId of the existing subscription to be modified, to update an "Individual NWDAF ML Model Training Subscription" according to the information in the message body.

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

- partial modify the concerned subscription; and

- store the subscription.

If the NWDAF successfully processed and accepted the received HTTP PATCH request, the NWDAF shall partial update an "Individual NWDAF ML Model Training Subscription" resource, and shall respond with:

- HTTP "204 No Content" response (as shown in figure 4.6.2.2.4-1, step 2a); or

- HTTP "200 OK" response (as shown in figure 4.6.2.2.4-1, step 2b) with a response body containing a representation of the updated subscription in the NwdafMLModelTrainSubsc data type.

If not all the requested events in the subscription are modified successfully, then the NWDAF may include the "failEventReports" attribute indicating the event(s) for which the subscription failed and the associated reason(s).

If other errors occur when processing the HTTP PATCH request, the NWDAF shall send an HTTP error response as specified in clause 5.5.7.

If the NWDAF determines that the received HTTP PATCH request needs to be redirected, the NWDAF shall send an HTTP redirect response as specified in clause 6.10.9 of 3GPP TS 29.500 [6].

#### 4.6.2.3 Nnwdaf\_MLModelTraining\_Unsubscribe service operation

##### 4.6.2.3.1 General

The Nnwdaf\_MLModelTraining\_Unsubscribe service operation is used by an NF service consumer to unsubscribe from event notifications.

##### 4.6.2.3.2 Unsubscribe from event notifications

Figure 4.6.2.3.2-1 shows a scenario where the NF service consumer sends a request to the NWDAF to unsubscribe from event notifications (see also 3GPP TS 23.288 [17]).



Figure 4.6.2.3.2-1: NF service consumer unsubscribes from notifications

The NF service consumer shall invoke the Nnwdaf\_MLModelTraining\_UnSubscribe service operation to unsubscribe to event notifications. The NF service consumer shall send an HTTP DELETE request with: "{apiRoot}/nnwdaf-mlmodeltraining/<apiVersion>/subscriptions/{subscriptionId}" as Resource URI, where "{subscriptionId}" is the event subscriptionId of the existing subscription that is to be deleted.

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

- remove the corresponding subscription; and

- respond with HTTP "204 No Content" status code.

If the NWDAF determines the received HTTP DELETE request needs to be redirected, the NWDAF shall send an HTTP redirect response as specified in clause 6.10.9 of 3GPP TS 29.500 [6].

If errors occur when processing the HTTP DELETE request, the NWDAF shall send an HTTP error response as specified in clause 5.5.7.

#### 4.6.2.4 Nnwdaf\_MLModelTraining\_Notify service operation

##### 4.6.2.4.1 General

The Nnwdaf\_MLModelTraining\_Notify service operation is used by an NWDAF to notify NF consumers about subscribed events.

##### 4.6.2.4.2 Notification about subscribed event

Figure 4.6.2.4.2-1 shows a scenario where the NWDAF sends a request to the NF Service Consumer to notify for event notifications (see also 3GPP TS 23.288 [17]).



Figure 4.6.2.4.2-1: NWDAF notifies the subscribed event

The NWDAF shall invoke the Nnwdaf\_MLModelTraining\_Notify service operation to notify the subscribed event. The NWDAF shall send an HTTP POST request with "{notifUri}" received in the Nnwdaf\_MLModelTraining\_Subscribe service operation as Resource URI, as shown in figure 4.6.2.4.2-1, step 1. The NwdafMLModelTrainNotif data structure provided in the request body that shall include:

- a notification correlation identifier as "notifCorreId" attribute;

- and description of the notified event as "mLModelInfos" attribute, that for each event, the MLModelInfo data type shall include an event identifier as the "event" attribute, an address (e.g. a URL or an FQDN) of the ML model file as the "mLFileAddr" attribute, and may include a unique identifier for an ML model as the "modelUniqueId" attribute and a accuracy level of the ML model as the "accMLModel" attribute and a time period when the provided ML model applies as the "validityPeriod" attribute and an area where the provided ML model applies as the "spatialValidity" attribute;

and may include:

- an identification of the Machine Learning procedure for training the ML model as "mLCorreId" attribute when the service is for Federated Learning;

- an identification of the round number of the training in a multi-round training process as "roundInd" attribute;

- an indication that the subscription is requested to be terminated, i.e. no further notifications related to this subscription will be provided, as "termTrainReq";

- an indication of the use case context of the ML model as "uCaseCont".

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 [6].

If errors occur when processing the HTTP POST request, the NWDAF shall send an HTTP error response as specified in clause 5.5.7.

\*\*\* 3rd Change (new) \*\*\*

## 5.5 Nnwdaf\_MLModelTraining Service API

### 5.5.1 Introduction

The Nnwdaf\_MLModelTraining service shall use the Nnwdaf\_MLModelTraining API.

The API URI of the Nnwdaf\_MLModelTraining API shall be:

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

The request URIs used in each HTTP requests from the NF service consumer towards the NWDAF shall have the Resource URI structure defined in clause 4.4.1 of 3GPP TS 29.501 [7], i.e.:

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

with the following components:

- The {apiRoot} shall be set as described in 3GPP TS 29.501 [7].

- The<apiName>shall be "nnwdaf-mlmodeltraining".

- The <apiVersion> shall be "v1".

- The <apiSpecificResourceUriPart> shall be set as described in clause 5.5.3.

### 5.5.2 Usage of HTTP

#### 5.5.2.1 General

HTTP/2, IETF RFC 7540 [9], shall be used as specified in clause 5 of 3GPP TS 29.500 [6].

HTTP/2 shall be transported as specified in clause 5.3 of 3GPP TS 29.500 [6].

The OpenAPI [11] specification of HTTP messages and content bodies for the Nnwdaf\_MLModelTraining is contained in Annex A.

#### 5.5.2.2 HTTP standard headers

##### 5.5.2.2.1 General

See clause 5.2.2 of 3GPP TS 29.500 [6] for the usage of HTTP standard headers.

##### 5.5.2.2.2 Content type

JSON, IETF RFC 8259 [10], 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 [6]. The use of the JSON format shall be signalled by the content type "application/json".

"Problem Details" JSON object shall be used to indicate additional details of the error in a HTTP response body and shall be signalled by the content type "application/problem+json", as defined in IETF RFC 7807 [15].

#### 5.5.2.3 HTTP custom headers

The Nnwdaf\_MLModelTraining service API shall support mandatory HTTP custom header fields specified in clause 5.2.3.2 of 3GPP TS 29.500 [6] and may support HTTP custom header fields specified in clause 5.2.3.3 of 3GPP TS 29.500 [6].

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

### 5.5.3 Resources

#### 5.5.3.1 Resource Structure

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

Figure 5.5.3.1-1 depicts the resource URIs structure for the Nnwdaf\_MLModelTraining API.



Figure 5.5.3.1-1: Resource URI structure of the Nnwdaf\_MLModelTraining API

Table 5.5.3.1-1 provides an overview of the resources and applicable HTTP methods.

Table 5.5.3.1-1: Resources and methods overview

|  |  |  |  |
| --- | --- | --- | --- |
| Resource name | Resource URI | HTTP method or custom operation | Description |
| NWDAF ML Model Training Subscriptions | /subscriptions | POST | Creates a new Individual NWDAF ML Model Training Subscription resource. |
| Individual NWDAF ML Model Training Subscription | /subscriptions/{subscriptionId} | DELETE | Deletes an Individual NWDAF ML Model Training Subscription identified by subresource {subscriptionId}. |
| PUT | Modifies an existing Individual NWDAF ML Model Training Subscription identified by subresource {subscriptionId}. |
| PATCH | Partial update of an existing Individual NWDAF ML Model Training Subscription identified by subresource {subscriptionId}. |

#### 5.5.3.2 Resource: NWDAF ML Model Training Subscriptions

##### 5.5.3.2.1 Description

The NWDAF ML Model Training Subscriptions resource represents all subscriptions to the Nnwdaf\_MLModelTraining service at a given NWDAF. The resource allows an NF service consumer to create a new Individual NWDAF ML Model Training Subscription resource.

##### 5.5.3.2.2 Resource definition

Resource URI: **{apiRoot}/nnwdaf-mlmodeltraining/<apiVersion>/subscriptions**

This resource shall support the resource URI variables defined in table 5.5.3.2.2-1.

Table 5.5.3.2.2-1: Resource URI variables for this resource

|  |  |  |
| --- | --- | --- |
| Name | Data type | Definition |
| apiRoot | string | See clause 5.5.1 |

##### 5.5.3.2.3 Resource Standard Methods

###### 5.5.3.2.3.1 POST

This method shall support the URI query parameters specified in table 5.5.3.2.3.1-1.

Table 5.5.3.2.3.1-1: URI query parameters supported by the POST method on this resource

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Name | Data type | P | Cardinality | Description |
| n/a |  |  |  |  |

This method shall support the request data structures specified in table 5.5.3.2.3.1-2 and the response data structures and response codes specified in table 5.5.3.2.3.1-3.

Table 5.5.3.2.3.1-2: Data structures supported by the POST Request Body on this resource

|  |  |  |  |
| --- | --- | --- | --- |
| Data type | P | Cardinality | Description |
| NwdafMLModelTrainSubsc | M | 1 | Creates a new Individual NWDAF ML Model Training Subscription resource. |

Table 5.5.3.2.3.1-3: Data structures supported by the POST Response Body on this resource

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Data type | P | Cardinality | Responsecodes | Description |
| NwdafMLModelTrainSubsc | M | 1 | 201 Created | The creation of an Individual NWDAF ML Model Training Subscription resource is confirmed and a representation of that resource is returned. |
| ProblemDetails | O | 0..1 | 500 Internal Server Error | (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 [6] also apply.NOTE 2: Failure causes are described in subclause 5.5.7.3. |

Table 5.5.3.2.3.1-4: Headers supported by the 201 Response Code on this resource

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

##### 5.5.3.2.4 Resource Custom Operations

None in this release of the specification.

#### 5.5.3.3 Resource: Individual NWDAF ML Model Training Subscription

##### 5.5.3.3.1 Description

The Individual NWDAF ML Model Training Subscription resource represents a single subscription to the Nnwdaf\_MLModelTraining service at a given NWDAF.

##### 5.5.3.3.2 Resource definition

Resource URI: **{apiRoot}/nnwdaf-mlmodeltraining/<apiVersion>/subscriptions/{subscriptionId}**

The <apiVersion> shall be set as described in clause 5.5.1.

This resource shall support the resource URI variables defined in table 5.5.3.3.2-1.

Table 5.5.3.3.2-1: Resource URI variables for this resource

|  |  |  |
| --- | --- | --- |
| Name | Data type | Definition |
| apiRoot | string | See clause 5.5.1. |
| subscriptionId | string | Identifies a subscription to the Nnwdaf\_MLModelTraining service. |

##### 5.5.3.3.3 Resource Standard Methods

###### 5.5.3.3.3.1 PUT

This method shall support the URI query parameters specified in table 5.5.3.3.3.1-1.

Table 5.5.3.3.3.1-1: 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 5.5.3.3.3.1-2 and the response data structures and response codes specified in table 5.5.3.3.3.1-3.

Table 5.5.3.3.3.1-2: Data structures supported by the PUT Request Body on this resource

|  |  |  |  |
| --- | --- | --- | --- |
| Data type | P | Cardinality | Description |
| NwdafMLModelTrainSubsc | M | 1 | Parameters to replace a subscription to NWDAF ML Model Training Subscription resource. |

Table 5.5.3.3.3.1-3: Data structures supported by the PUT Response Body on this resource

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Data type | P | Cardinality | Response codes | Description |
| NwdafMLModelTrainSubsc | M | 1 | 200 OK | The Individual NWDAF ML Model Training Subscription resource was modified successfully, and a representation of that resource is returned. |
| n/a |  |  | 204 No Content | The Individual NWDAF ML Model Training Subscription resource was modified successfully. |
| RedirectResponse | O | 0..1 | 307 Temporary Redirect | Temporary redirection, during Individual NWDAF ML Model Training Subscription modification. The response shall include a Location header field containing an alternative URI of the resource located in an alternative NWDAF (service) instance. |
| RedirectResponse | O | 0..1 | 308 Permanent Redirect | Permanent redirection, during Individual NWDAF ML Model Trainin Subscription modification. The response shall include a Location header field containing an alternative URI of the resource located in an alternative NWDAF (service) instance. |
| ProblemDetails | O | 0..1 | 500 Internal Server Error | (NOTE 2) |
| NOTE 1: The mandatory HTTP error status codes for the PUT method listed in table 5.2.7.1-1 of 3GPP TS 29.500 [6] also apply.NOTE 2: Failure causes are described in subclause 5.5.7.3. |

Table 5.5.3.3.3.1-4: Headers supported by the 307 Response Code on this resource

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Name | Data type | P | Cardinality | Description |
| Location | string | M | 1 | An alternative URI of the resource located in an alternative NWDAF (service) instance. |
| 3gpp-Sbi-Target-Nf-Id | string | O | 0..1 | Identifier of the target NF (service) instance towards which the request is redirected |

Table 5.5.3.3.3.1-5: Headers supported by the 308 Response Code on this resource

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Name | Data type | P | Cardinality | Description |
| Location | string | M | 1 | An alternative URI of the resource located in an alternative NWDAF (service) instance. |
| 3gpp-Sbi-Target-Nf-Id | string | O | 0..1 | Identifier of the target NF (service) instance towards which the request is redirected |

###### 5.5.3.3.3.2 PATCH

This method shall support the URI query parameters specified in table 5.5.3.3.3.2-1.

Table 5.5.3.3.3.2-1: 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 5.5.3.3.3.2-2 and the response data structures and response codes specified in table 5.5.3.3.3.2-3.

Table 5.5.3.3.3.2-2: Data structures supported by the PATCH Request Body on this resource

|  |  |  |  |
| --- | --- | --- | --- |
| Data type | P | Cardinality | Description |
| NwdafMLModelTrainSubscPatch | M | 1 | Partial update of parameters to a subscription to NWDAF ML Model Training Subscription resource. |

Table 5.5.3.3.3.2-3: Data structures supported by the PATCH Response Body on this resource

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Data type | P | Cardinality | Response codes | Description |
| NwdafMLModelTrainSubsc | M | 1 | 200 OK | The Individual NWDAF ML Model Training Subscription resource was partial modified successfully and a representation of that resource is returned. |
| n/a |  |  | 204 No Content | The Individual NWDAF ML Model Training Subscription resource was partial modified successfully. |
| RedirectResponse | O | 0..1 | 307 Temporary Redirect | Temporary redirection, during Individual NWDAF ML Model Training Subscription modification. The response shall include a Location header field containing an alternative URI of the resource located in an alternative NWDAF (service) instance. |
| RedirectResponse | O | 0..1 | 308 Permanent Redirect | Permanent redirection, during Individual NWDAF ML Model Trainin Subscription modification. The response shall include a Location header field containing an alternative URI of the resource located in an alternative NWDAF (service) instance. |
| ProblemDetails | O | 0..1 | 500 Internal Server Error | (NOTE 2) |
| NOTE 1: The mandatory HTTP error status codes for the PUT method listed in table 5.2.7.1-1 of 3GPP TS 29.500 [6] also apply.NOTE 2: Failure causes are described in subclause 5.5.7.3. |

Table 5.5.3.3.3.2-4: Headers supported by the 307 Response Code on this resource

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Name | Data type | P | Cardinality | Description |
| Location | string | M | 1 | An alternative URI of the resource located in an alternative NWDAF (service) instance. |
| 3gpp-Sbi-Target-Nf-Id | string | O | 0..1 | Identifier of the target NF (service) instance towards which the request is redirected |

Table 5.5.3.3.3.2-5: Headers supported by the 308 Response Code on this resource

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Name | Data type | P | Cardinality | Description |
| Location | string | M | 1 | An alternative URI of the resource located in an alternative NWDAF (service) instance. |
| 3gpp-Sbi-Target-Nf-Id | string | O | 0..1 | Identifier of the target NF (service) instance towards which the request is redirected |

###### 5.5.3.3.3.3 DELETE

This method shall support the URI query parameters specified in table 5.5.3.3.3.3-1.

Table 5.5.3.3.3.3-1: URI query parameters supported by the DELETE method on this resource

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Name | Data type | P | Cardinality | Description |
| n/a |  |  |  |  |

This method shall support the request data structures specified in table 5.5.3.3.3.3-2 and the response data structures and response codes specified in table 5.5.3.3.3.3-3.

Table 5.5.3.3.3.2-2: Data structures supported by the DELETE Request Body on this resource

|  |  |  |  |
| --- | --- | --- | --- |
| Data type | P | Cardinality | Description |
|  |  |  |  |

Table 5.5.3.3.3.3-3: Data structures supported by the DELETE Response Body on this resource

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Data type | P | Cardinality | Responsecodes | Description |
| n/a |  |  | 204 No Content | Successful case: The Individual NWDAF ML Model Training Subscription resource matching the subscriptionId was deleted. |
| RedirectResponse | O | 0..1 | 307 Temporary Redirect | Temporary redirection, during Individual NWDAF ML Model Training Subscription deletion. The response shall include a Location header field containing an alternative URI of the resource located in an alternative NWDAF (service) instance. |
| RedirectResponse | O | 0..1 | 308 Permanent Redirect | Permanent redirection, during Individual NWDAF ML Model Training Subscription deletion. The response shall include a Location header field containing an alternative URI of the resource located in an alternative NWDAF (service) instance. |
| NOTE: The mandatory HTTP error status codes for the DELETE method listed in table 5.2.7.1-1 of 3GPP TS 29.500 [6] also apply. |

Table 5.5.3.3.3.3-4: Headers supported by the 307 Response Code on this resource

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Name | Data type | P | Cardinality | Description |
| Location | string | M | 1 | An alternative URI of the resource located in an alternative NWDAF (service) instance. |
| 3gpp-Sbi-Target-Nf-Id | string | O | 0..1 | Identifier of the target NF (service) instance towards which the request is redirected |

Table 5.5.3.3.3.3-5: Headers supported by the 308 Response Code on this resource

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Name | Data type | P | Cardinality | Description |
| Location | string | M | 1 | An alternative URI of the resource located in an alternative NWDAF (service) instance. |
| 3gpp-Sbi-Target-Nf-Id | string | O | 0..1 | Identifier of the target NF (service) instance towards which the request is redirected |

##### 5.5.3.3.4 Resource Custom Operations

None in this release of the specification.

### 5.5.4 Custom Operations without associated resources

None in this release of the specification.

### 5.5.5 Notifications

#### 5.5.5.1 General

Notifications shall comply with clause 6.2 of 3GPP TS 29.500 [6] and clause 4.6.2.3 of 3GPP TS 29.501 [7].

Table 5.5.3.4.1-1: Notifications overview

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

#### 5.5.5.2 Event Notification

##### 5.5.5.2.1 Description

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

##### 5.5.5.2.2 Operation Definition

Callback URI: **{notifUri}**

The operation shall support the callback URI variables defined in table 5.5.5.2.2-1, the request data structures specified in table 5.5.5.2.2-2 and the response data structure and response codes specified in table 5.5.5.2.2-3.

Table 5.5.5.2.2-1: Callback URI variables

|  |  |  |
| --- | --- | --- |
| Name | Data type | Definition |
| notifUri | Uri | The Notification Uri as assigned within the Individual NWDAF ML Model Training Subscription and described within the NwdafMLModelTrainSubsc type (see table 5.5.6.2.2-1). |

Table 5.5.5.2.2-2: Data structures supported by the POST Request Body on this resource

|  |  |  |  |
| --- | --- | --- | --- |
| Data type | P | Cardinality | Description |
| array(NwdafMLModelTrainNotif) | M | 1..N | Provides Information about observed events. |

Table 5.5.5.2.2-3: 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, during the event notification. The response shall include a Location header field containing an alternative URI representing the end point of an alternative NF consumer (service) instance where the notification should be sent. |
| RedirectResponse | O | 0..1 | 308 Permanent Redirect | Permanent redirection, during the event notification. The response shall include a Location header field containing an alternative URI representing the end point of an alternative NF consumer (service) instance where the notification should be sent. |
| NOTE: The mandatory HTTP error status codes for the POST method listed in table 5.2.7.1-1 of 3GPP TS 29.500 [6] also apply. |

Table 5.5.5.2.2-4: Headers supported by the 307 Response Code on this resource

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Name | Data type | P | Cardinality | Description |
| Location | string | M | 1 | An alternative URI representing the end point of an alternative NF consumer (service) instance towards which the notification should be redirected. |
| 3gpp-Sbi-Target-Nf-Id | string | O | 0..1 | Identifier of the target NF (service) instance towards which the notification request is redirected. |

Table 5.5.5.2.2-5: Headers supported by the 308 Response Code on this resource

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Name | Data type | P | Cardinality | Description |
| Location | string | M | 1 | An alternative URI representing the end point of an alternative NF consumer (service) instance towards which the notification should be redirected. |
| 3gpp-Sbi-Target-Nf-Id | string | O | 0..1 | Identifier of the target NF (service) instance towards which the notification request is redirected |

### 5.5.6 Data Model

#### 5.5.6.1 General

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

Table 5.5.6.1-1 specifies the data types defined for the Nnwdaf\_MLModelTraining service-based interface protocol.

Table 5.5.6.1-1: Nnwdaf\_MLModelTraining specific Data Types

|  |  |  |  |
| --- | --- | --- | --- |
| Data type | Section defined | Description | Applicability |
| FailureCodeTrain | 5.5.6.3.3 | Identifies the failure reason. |  |
| FailureEventInfoForMLModelTrain | 5.5.6.2.7 | Represents the failure event informaiton for a ML Model Training subscription. |  |
| NwdafMLModelTrainSubsc | 5.5.6.2.2 | Represents a ML Model Training subscription. |  |
| NwdafMLModelTrainSubscPatch | 5.5.6.2.3 | Represents parameters to request the modification of a ML Model Training subscription. |  |
| MLModelInfo | 5.5.6.2.4 | Represents the ML Model information. |  |
| MLModelTrainInfo | 5.5.6.2.5 | Represents the ML Model training informaiton, include requirement on data availability and time availability, training filter information. |  |
| NwdafMLModelTrainNotif | 5.5.6.2.8 | Represents notification of a ML Model Training subscription. |  |
| MLTrainReportInfo | 5.5.6.2.6 | Indicates the training reporting information. |  |
| TermMLModelTrainInfo | 5.5.6.2.9 | Indicates that the subscription is requested to be terminated, contain the reasons. |  |
| TermTrainCause | 5.5.6.3.4 | Represents the reasons that the ML Model Training to be terminated. |  |

Table 5.5.6.1-2 specifies data types re-used by the Nnwdaf\_MLModelTraining 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 Nnwdaf\_MLModelTraining service-based interface.

Table 5.5.6.1-2: Nnwdaf\_MLModelTraining re-used Data Types

|  |  |  |  |
| --- | --- | --- | --- |
| Data type | Reference | Comments | Applicability |
| Accuracy | 5.1.6.3.5 | Represents the accuracy level of the ML model. |  |
| Dnn | 3GPP TS 29.571 [8] | Identifies the DNN. |  |
| DurationSec | 3GPP TS 29.571 [8] | Represents the duration time in second(s). |  |
| MLEventSubscription | 5.4.6.2.3 | Represents an Individual NWDAF Event Subscription resource. |  |
| MLEventNotif | 5.4.6.2.6 | Represents notifications about Individual Events. |  |
| NwdafEvent | 5.1.6.3.4 | Describes the NWDAF Events. |  |
| RedirectResponse | 3GPP TS 29.571 [8] |  |  |
| ReportingInformation | 3GPP TS 29.523 [20] | Represents the requirements of reporting the subscription. |  |
| Snssai | 3GPP TS 29.571 [8] | Identifies the S-NSSAI (Single Network Slice Selection Assistance Information). |  |
| SupportedFeatures | 3GPP TS 29.571 [8] |  |  |
| TargetUeInformation | 5.1.6.2.8 | Identifies the target UE information. |  |
| Uri | 3GPP TS 29.571 [8] |  |  |

#### 5.5.6.2 Structured data types

##### 5.5.6.2.1 Introduction

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

##### 5.5.6.2.2 Type NwdafMLModelTrainSubsc

Table 5.5.6.2.2-1: Definition of type NwdafMLModelTrainSubsc

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Attribute name | Data type | P | Cardinality | Description | Applicability |
| eventReq | ReportingInformation | O | 0..1 | Reporting requirement information of the subscription.If omitted, the default values within the ReportingInformation data type apply. |  |
| failEventReports | array(FailureEventInfoForMLModelTrain) | O | 1..N | Supplied by the NWDAF containing MTLF when available, shall contain the event(s) that the subscription is not successful including the failure reason(s).  |  |
| mLCorreId | string | C | 0..1 | Identifies the Machine Learning procedure for training the ML model.It shall be present when the service is for Federated Learning. |  |
| mLEventSubscs | array(MLEventSubscription) | M | 1..N | Each element identifies the subscription for each event. |  |
| mLModelInfos | array(MLModelInfo) | O | 1..N | Each element represents the ML Model information for each event. |  |
| mLModelTrainInfos | array(MLModelTrainInfo) | O | 1..N | Each element represents the ML Model training informaiton for each event, include requirement on data availability and time availability. |  |
| mLPreFlag | boolean | C | 0..1 | Indicates whether the subscription is for preparation of ML Model training. Set to "true" if it is for ML training preparation, otherwise set to "false".Default value is "false" if omitted.It shall be present when the service is for preparation of Federated Learning. |  |
| mLAccChkFlg | boolean | O | 0..1 | Indicates whether request using the local training data as the testing dataset to calculate the Model Accuracy of the global ML model provided by the consumer. Set to "true" if it is requested, otherwise set to "false".Default value is "false" if omitted. |  |
| mLTrainRepInfo | MLTrainReportInfo | O | 0..1 | Indicates the training reporting information.This attribute can be provided when the "notifMethod" attribute within the ReportingInformation structure is set to "ON\_EVENT\_DETECTION" in the "eventReq" attribute. |  |
| modelInterInfo | string | M | 1 | Represents the ML Model Interoperability Information. This is vendor-specific information and is agreed between vendors, if necessary for sharing purposes.The format of value is out of 3GPP. |  |
| 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. |  |
| roundInd | Uinteger | O | 0..1 | Indicates the round number of the training in a multi-round training process. |  |
| suppFeats | SupportedFeatures | C | 0..1 | List of Supported features used as described in clause 5.5.8.It shall be supplied by NF service consumer in the POST requests that request the creation of an NWDAF ML Model Training Subscriptions resource and shall be supplied by the NWDAF in the reply of corresponding request. |  |
| tgtRepUe | TargetUeInformation | O | 0..1 | Indicates the UE(s) information for which data for ML model training is requested. |  |
| uCaseCont | string | O | 0..1 | Indicates the use case context of the ML model. The value and format of this parameter are not standardized. |  |

Editor’s Note: Whether need the "roundInd" attribute is FFS and will align with stage 2 requirements.

##### 5.5.6.2.3 Type NwdafMLModelTrainSubscPatch

Table 5.5.6.2.3-1: Definition of type NwdafMLModelTrainSubscPatch

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Attribute name | Data type | P | Cardinality | Description | Applicability |
| eventReq | ReportingInformation | O | 0..1 | Reporting requirement information of the subscription.If omitted, the default values within the ReportingInformation data type apply. |  |
| failEventReports | array(FailureEventInfoForMLModelTrain) | O | 1..N | Supplied by the NWDAF containing MTLF when available, shall contain the event(s) that the subscription is not successful including the failure reason(s).  |  |
| mLModelInfo | MLModelInfo | O | 0..1 | Represents the ML Model information. |  |
| mLModelTrainInfo | MLModelTrainInfo | O | 0..1 | Represents the ML Model training informaiton, include requirement on data availability and time availability, training filter information. |  |
| mLPreFlag | boolean | O | 0..1 | Indicates whether the subscription is for preparation of ML Model training. Set to "true" if it is for ML training preparation, otherwise set to "false". |  |
| mLAccChkFlg | boolean | O | 0..1 | Indicates whether request using the local training data as the testing dataset to calculate the Model Accuracy of the global ML model provided by the consumer. Set to "true" if it is requested, otherwise set to "false". |  |
| mLTrainRepInfo | MLTrainReportInfo | O | 0..1 | Indicates the training reporting information.This attribute can be provided when the "notifMethod" attribute within the ReportingInformation structure is set to "ON\_EVENT\_DETECTION" in the "eventReq" attribute. |  |
| modelInterInfo | string | O | 1 | Represents the ML Model Interoperability Information. This is vendor-specific information and is agreed between vendors, if necessary for sharing purposes.The format of value is out of 3GPP. |  |
| notifUri | Uri | O | 1 | URI at which the NF service consumer requests to receive notifications. |  |
| roundInd | Uinteger | O | 0..1 | Indicates the round number of the training in a multi-round training process. |  |
| tgtRepUe | TargetUeInformation | O | 0..1 | Indicates the UE(s) information for which data for ML model training is requested. |  |
| uCaseCont | string | O | 0..1 | Indicates the use case context of the ML model. The value and format of this parameter are not standardized. |  |

Editor’s Note: Whether need the "roundInd" attribute is FFS and will align with stage 2 requirements.

##### 5.5.6.2.4 Type MLModelInfo

Table 5.5.6.2.4-1: Definition of type MLModelInfo

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Attribute name | Data type | P | Cardinality | Description | Applicability |
| accMLModel | Accuracy | O | 0..1 | Represents the accuracy level of ML model.  |  |
| eventNotif | MLEventNotif | M | 1 | Notifications about Individual Event. |  |
| modelUniqueId | Uinteger | O | 0..1 | Unique identifier for an ML model. The identified shall be unique within 5GC scope. |  |

##### 5.5.6.2.5 Type MLModelTrainInfo

Table 5.5.6.2.5-1: Definition of type MLModelTrainInfo

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Attribute name | Data type | P | Cardinality | Description | Applicability |
| dataAvReq | string | C | 0..1 | Represents the requirement on available data for the ML model training. Shall be provided when the "mlPreFlag" attribute in data type "NwdafMLModelTrainSubsc" is set to "true". |  |
| timeAvReq | string | C | 0..1 | Represents the requirement on available time for the ML model training.Shall be provided when the "mlPreFlag" attribute in data type "NwdafMLModelTrainSubsc" is set to "true". |  |

Editor’s Note: The details of available data requirement is FFS and will align with stage 2 requirements.

##### 5.5.6.2.6 Type MLTrainReportInfo

Table 5.5.6.2.6-1: Definition of type MLTrainReportInfo

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Attribute name | Data type | P | Cardinality | Description | Applicability |
| maxResTime | DurationSec | O | 0..1 | Indicates the maximum time for waiting notifications. |  |

##### 5.5.6.2.7 Type FailureEventInfoForMLModelTrain

Table 5.5.6.2.7-1: Definition of type FailureEventInfoForMLModelTrain

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Attribute name | Data type | P | Cardinality | Description | Applicability |
| mLTrainEvent | NwdafEvent | M | 1 | Event that is subscribed. |  |
| failureCodeTrain | FailureCodeTrain | M | 1 | Identifies the failure reason. |  |

##### 5.5.6.2.8 Type NwdafMLModelTrainNotif

Table 5.5.6.2.8-1: Definition of type NwdafMLModelTrainNotif

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Attribute name | Data type | P | Cardinality | Description | Applicability |
| mLCorreId | string | C | 0..1 | Identifies the Machine Learning procedure for training the ML model.It shall be present when the service is for Federated Learning. |  |
| mLModelInfos | array(MLModelInfo) | M | 1..N | Each element represents the ML Model information for each event. |  |
| notifCorreId | string | M | 1 | Notification correlation ID used to identify the subscription to which the notification relates. It shall be set to the same value as the "notifCorreId" attribute of NwdafMLModelTrainSubsc data type. |  |
| roundInd | Uinteger | O | 0..1 | Indicates the round number of the training in a multi-round training process. |  |
| termTrainReq | TermMLModelTrainInfo | O | 0..1 | Indicates that the subscription is requested to be terminated, i.e. no further notifications related to this subscription will be provided.Supplied by the NWDAF containing MTLF when available, shall contain the reasons that the subscription is requested to be terminated. |  |
| uCaseCont | string | O | 0..1 | Indicates the use case context of the ML model. The value and format of this parameter are not standardized. |  |

Editor’s Note: Whether need the "roundInd" attribute is FFS and will align with stage 2 requirements.

##### 5.5.6.2.9 Type TermMLModelTrainInfo

Table 5.5.6.2.9-1: Definition of type TermMLModelTrainInfo

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Attribute name | Data type | P | Cardinality | Description | Applicability |
| terminationTrainReq | boolean | M | 1 | If provided and set to "true", it indicates that the subscription is requested to be terminated, i.e. no further notifications related to this subscription will be provided. Otherwise set to "false" The default value is "true". |  |
| termTrainCause | TermTrainCause | O | 0..1 | Represents the reasons for which the ML Model Training to terminate. |  |

#### 5.5.6.3 Simple data types and enumerations

##### 5.5.6.3.1 Introduction

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

##### 5.5.6.3.2 Simple data types

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

Table 5.5.6.3.2-1: Simple data types

|  |  |  |  |
| --- | --- | --- | --- |
| Type Name | Type Definition | Description | Applicability |
|  |  |  |  |

##### 5.5.6.3.3 Enumeration: FailureCodeTrain

Table 5.5.6.3.3-1: Enumeration FailureCodeTrain

|  |  |  |
| --- | --- | --- |
| Enumeration value | Description | Applicability |
| UNAVAILABLE\_ML\_MODEL\_TRAIN | Indicates the requested ML model training is unavailable. |  |

##### 5.5.6.3.4 Enumeration: TermTrainCause

Table 5.5.6.3.4-1: Enumeration TermTrainCause

|  |  |  |
| --- | --- | --- |
| Enumeration value | Description | Applicability |
| NWDAF\_OVERLOAD | Indicates the NWDAF is overload, e.g. in compuatation and/or communication capability, for the ML model training. |  |
| NOT\_AVAILABLE\_ML\_TRAIN | Indicates the ML model training process is not available anymore. |  |
| OTHERS | Indicates other cause. |  |

### 5.5.7 Error handling

#### 5.5.7.1 General

HTTP error handling shall be supported as specified in clause 5.2.4 of 3GPP TS 29.500 [6].

For the Nnwdaf\_MLModelTraining API, HTTP error responses shall be supported as specified in clause 4.8 of 3GPP TS 29.501 [7].

Protocol errors and application errors specified in table 5.2.7.2-1 of 3GPP TS 29.500 [6] 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 [6].

Protocol errors and application errors specified in table 5.2.7.2-1 of 3GPP TS 29.500 [6] for HTTP redirections shall be supported.

In addition, the requirements in the following clauses shall apply.

#### 5.5.7.2 Protocol Errors

In this Release of the specification, there are no additional protocol errors applicable for the Nnwdaf\_MLModelTraining API.

#### 5.5.7.3 Application Errors

The application errors defined for the Nnwdaf\_MLModelTraining API are listed in table 5.5.7.3-1.

Table 5.5.7.3-1: Application errors

|  |  |  |
| --- | --- | --- |
| Application Error | HTTP status code | Description |
| UNAVAILABLE\_ML\_MODEL\_TRAINING\_FOR\_ALLEVENTS | 500 Internal Server Error | Indicates the requested all events ML model training is unavailable. |
| NOTE: Including a "ProblemDetails" data structure with the "cause" attribute in the HTTP response is optional unless explicitly mandated in the service operation clauses. |

### 5.5.8 Feature negotiation

The optional features in table 5.5.8-1 are defined for the Nnwdaf\_MLModelTraining API. They shall be negotiated using the extensibility mechanism defined in clause 6.6 of 3GPP TS 29.500 [6].

Table 5.5.8-1: Supported Features

|  |  |  |
| --- | --- | --- |
| Feature number | Feature Name | Description |
|  |  |  |

### 5.5.9 Security

As indicated in 3GPP TS 33.501 [13] and 3GPP TS 29.500 [6], the access to the Nnwdaf\_MLModelTraining API may be authorized by means of the OAuth2 protocol (see IETF RFC 6749 [14]), based on local configuration, using the "Client Credentials" authorization grant, where the NRF (see 3GPP TS 29.510 [12]) plays the role of the authorization server.

If OAuth2 is used, a n NF Service Consumer, prior to consuming services offered by the Nnwdaf\_MLModelTraining API, shall obtain a "token" from the authorization server, by invoking the Access Token Request service, as described in 3GPP TS 29.510 [12], clause 5.4.2.2.

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

The Nnwdaf\_MLModelTraining API defines a single scope "nnwdaf-mlmodeltraining" for the entire service, and it does not define any additional scopes at resource or operation level.

\*\*\* 4th Change \*\*\*

# A.1 General

The present Annex contains an OpenAPI [11] specification of HTTP messages and content bodies used by the Nnwdaf\_EventsSubscription, the Nnwdaf\_AnalyticsInfo, Nnwdaf\_DataManagement, Nnwdaf\_MLModelProvision, and Nnwdaf\_MLModelTraining APIs.

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

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

Informative copies of the OpenAPI specification files contained in this 3GPP Technical Specification are available on a Git-based repository, that uses the GitLab software version control system (see clause 5B of the 3GPP TR 21.900 [16] and clause 5.3.1 of the 3GPP TS 29.501 [7] for further information).

\*\*\* 5th Change (new) \*\*\*

# A.6 Nnwdaf\_MLModelTraining API

openapi: 3.0.0

info:

 title: Nnwdaf\_MLModelTraining

 version: 1.0.0-alpha.1

 description: |

 Nnwdaf\_MLModelTraining API Service.

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externalDocs:

 description: 3GPP TS 29.520 V18.2.0; 5G System; Network Data Analytics Services.

 url: https://www.3gpp.org/ftp/Specs/archive/29\_series/29.520/

servers:

 - url: '{apiRoot}/nnwdaf-mlmodeltraining/v1'

 variables:

 apiRoot:

 default: https://example.com

 description: apiRoot as defined in clause 4.4 of 3GPP TS 29.501

security:

 - {}

 - oAuth2ClientCredentials:

 - nnwdaf-mlmodeltraining

paths:

 /subscriptions:

 post:

 summary: Create a new Individual NWDAF ML Model Training Subscription resource.

 operationId: CreateNWDAFMLModelTrainingSubcription

 tags:

 - Subscriptions (Collection)

 requestBody:

 required: true

 content:

 application/json:

 schema:

 $ref: '#/components/schemas/NwdafMLModelTrainSubsc'

 responses:

 '201':

 description: Create a new Individual NWDAF ML Model Training Subscription resource.

 content:

 application/json:

 schema:

 $ref: '#/components/schemas/NwdafMLModelTrainSubsc'

 headers:

 Location:

 description: >

 Contains the URI of the newly created resource, according to the structure

 {apiRoot}/nnwdaf-mlmodeltraining/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:

 type: array

 items:

 $ref: '#/components/schemas/NwdafMLModelTrainNotif'

 minItems: 1

 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}:

 put:

 summary: update an existing Individual NWDAF ML Model Training Subscription

 operationId: UpdateNWDAFMLModelTrainingSubcription

 tags:

 - Individual NWDAF ML Model Training Subscription (Document)

 requestBody:

 required: true

 content:

 application/json:

 schema:

 $ref: '#/components/schemas/NwdafMLModelTrainSubsc'

 parameters:

 - name: subscriptionId

 in: path

 description: String identifying a subscription to the Nnwdaf\_MLModelTraining Service.

 required: true

 schema:

 type: string

 responses:

 '200':

 description: >

 The Individual NWDAF ML Model Training Subscription resource was modified successfully

 and a representation of that resource is returned.

 content:

 application/json:

 schema:

 $ref: '#/components/schemas/NwdafMLModelTrainSubsc'

 '204':

 description: >

 The Individual NWDAF ML Model Training 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 NWDAF ML Model Training Subscription

 operationId: PartialUpdateNWDAFMLModelTrainingSubcription

 tags:

 - Individual NWDAF ML Model Training Subscription (Document)

 requestBody:

 required: true

 content:

 application/merge-patch+json:

 schema:

 $ref: '#/components/schemas/NwdafMLModelTrainSubscPatch'

 parameters:

 - name: subscriptionId

 in: path

 description: String identifying a subscription to the Nnwdaf\_MLModelTraining Service.

 required: true

 schema:

 type: string

 responses:

 '200':

 description: >

 The Individual NWDAF ML Model Training Subscription resource was partial modified

 successfully and a representation of that resource is returned.

 content:

 application/json:

 schema:

 $ref: '#/components/schemas/NwdafMLModelTrainSubsc'

 '204':

 description: >

 The Individual NWDAF ML Model Training 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 NWDAF ML Model Training Subscription.

 operationId: DeleteNWDAFMLModelTrainingSubcription

 tags:

 - Individual NWDAF ML Model Training Subscription (Document)

 parameters:

 - name: subscriptionId

 in: path

 description: String identifying a subscription to the Nnwdaf\_MLModelTraining Service.

 required: true

 schema:

 type: string

 responses:

 '204':

 description: >

 No Content. The Individual NWDAF ML Model Training 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:

 nnwdaf-mlmodeltraining: Access to the Nnwdaf\_MLModelTraining API

 schemas:

 NwdafMLModelTrainSubsc:

 description: Represents a ML Model Training subscription..

 type: object

 properties:

 mLEventSubscs:

 type: array

 items:

 $ref: 'TS29520\_Nnwdaf\_MLModelProvision.yaml#/components/schemas/MLEventSubscription'

 minItems: 1

 description: Subscribed events

 notifUri:

 $ref: 'TS29571\_CommonData.yaml#/components/schemas/Uri'

 suppFeats:

 $ref: 'TS29571\_CommonData.yaml#/components/schemas/SupportedFeatures'

 eventReq:

 $ref: 'TS29523\_Npcf\_EventExposure.yaml#/components/schemas/ReportingInformation'

 failEventReports:

 type: array

 items:

 $ref: '#/components/schemas/FailureEventInfoForMLModelTrain'

 minItems: 1

 description: >

 Supplied by the NWDAF containing MTLF when available, shall contain the event(s) that

 the subscription is not successful including the failure reason(s).

 mLCorreId:

 type: string

 description: String identifying the subscription is for a Federated Learning procedure.

 mLModelInfos:

 type: array

 items:

 $ref: '#/components/schemas/MLModelInfo'

 minItems: 1

 description: Represents the ML Model information.

 mLModelTrainInfos:

 type: array

 items:

 $ref: '#/components/schemas/MLModelTrainInfo'

 minItems: 1

 description: Represents the ML Model training information.

 mLPreFlag:

 type: boolean

 description: >

 Indicates whether the subscription is for preparation of ML Model training. Set to

 "true" if it is for ML training preparation, otherwise set to "false".

 mLAccChkFlg:

 type: boolean

 description: >

 Indicates whether request using the local training data as the testing dataset to

 calculate the Model Accuracy of the global ML model provided by the consumer. Set to

 "true" if it is requested, otherwise set to "false".

 mLTrainRepInfo:

 $ref: '#/components/schemas/MLTrainReportInfo'

 modelInterInfo:

 type: string

 description: >

 String identifying the ML Model Interoperability Information. This is vendor-specific

 information and is agreed between vendors, if necessary for sharing purposes.

 notifCorreId:

 type: string

 description: >

 String identifying the Notification Correlation ID in the corresponding notification.

 roundInd:

 $ref: 'TS29571\_CommonData.yaml#/components/schemas/Uinteger'

 tgtRepUe:

 $ref: 'TS29520\_Nnwdaf\_EventsSubscription.yaml#/components/schemas/TargetUeInformation'

 uCaseCont:

 type: string

 description: >

 String identifying the use case context of the ML model. The value and format of this

 parameter are not standardized.

 required:

 - mLEventSubscs

 - modelInterInfo

 - notifUri

 - notifCorreId

 NwdafMLModelTrainSubscPatch:

 description: Represents parameters to request the modification of a ML Model Training

 subscription.

 type: object

 properties:

 notifUri:

 $ref: 'TS29571\_CommonData.yaml#/components/schemas/Uri'

 eventReq:

 $ref: 'TS29523\_Npcf\_EventExposure.yaml#/components/schemas/ReportingInformation'

 failEventReports:

 type: array

 items:

 $ref: '#/components/schemas/FailureEventInfoForMLModelTrain'

 minItems: 1

 description: >

 Supplied by the NWDAF containing MTLF when available, shall contain the event(s) that

 the subscription is not successful including the failure reason(s).

 mLModelInfo:

 $ref: '#/components/schemas/MLModelInfo'

 mLModelTrainInfo:

 $ref: '#/components/schemas/MLModelTrainInfo'

 mLPreFlag:

 type: boolean

 description: >

 Indicates whether the subscription is for preparation of ML Model training. Set to

 "true" if it is for ML training preparation, otherwise set to "false".

 mLAccChkFlg:

 type: boolean

 description: >

 Indicates whether request using the local training data as the testing dataset to

 Calculate the Model Accuracy of the global ML model provided by the consumer. Set to

 "true" if it is requested, otherwise set to "false".

 mLTrainRepInfo:

 $ref: '#/components/schemas/MLTrainReportInfo'

 modelInterInfo:

 type: string

 description: >

 String identifying the ML Model Interoperability Information. This is vendor-

 specific information and is agreed between vendors, if necessary for sharing

 purposes. roundInd:

 $ref: 'TS29571\_CommonData.yaml#/components/schemas/Uinteger'

 tgtRepUe:

 $ref: 'TS29520\_Nnwdaf\_EventsSubscription.yaml#/components/schemas/TargetUeInformation'

 uCaseCont:

 type: string

 description: >

 String identifying the use case context of the ML model. The value and format of this

 parameter are not standardized.

 NwdafMLModelTrainNotif:

 description: Represents notifications on events that occurred.

 type: object

 properties:

 mLCorreId:

 type: string

 description: String identifying the subscription is for a Federated Learning procedure.

 mLModelInfos:

 type: array

 items:

 $ref: '#/components/schemas/MLModelInfo'

 minItems: 1

 description: Represents the ML Model information.

 notifCorreId:

 type: string

 description: >

 String identifying the Notification Correlation ID in the corresponding notification.

 roundInd:

 $ref: 'TS29571\_CommonData.yaml#/components/schemas/Uinteger'

 termTrainReq:

 $ref: '#/components/schemas/TermMLModelTrainInfo'

 uCaseCont:

 type: string

 description: >

 String identifying the context of use of ML model. The value and format of this

 parameter are not standardized.

 required:

 - mLModelInfos

 - notifCorreId

 MLModelInfo:

 description: Represents the ML Model information.

 type: object

 properties:

 accMLModel:

 $ref: 'TS29520\_Nnwdaf\_EventsSubscription.yaml#/components/schemas/Accuracy'

 eventNotif:

 $ref: 'TS29520\_Nnwdaf\_MLModelProvision.yaml#/components/schemas/MLEventNotif'

 modelUniqueId:

 $ref: 'TS29571\_CommonData.yaml#/components/schemas/Uinteger'

 MLModelTrainInfo:

 description: Represents the ML Model training informaiton, include requirement on data availability and time availability, training filter information.

 type: object

 properties:

 dataAvReq:

 type: string

 description: >

 String representing the requirement on available data for the ML model training.

 timeAvReq:

 type: string

 description: >

 String representing the requirement on available time for the ML model training.

 MLTrainReportInfo:

 description: Represents the ML Model training reporting information.

 type: object

 properties:

 maxResTime:

 $ref: 'TS29571\_CommonData.yaml#/components/schemas/DurationSec'

 FailureEventInfoForMLModelTrain:

 description: Represents the failure event informaiton for a ML Model Training subscription.

 type: object

 properties:

 mLTrainEvent:

 $ref: 'TS29520\_Nnwdaf\_EventsSubscription.yaml#/components/schemas/NwdafEvent'

 failureCodeTrain:

 $ref: '#/components/schemas/FailureCodeTrain'

 required:

 - mLTrainEvent

 - failureCodeTrain

 TermMLModelTrainInfo:

 description: Indicating that the subscription is requested to be terminated.

 type: object

 properties:

 terminationTrainReq:

 type: boolean

 description: >

 Indication that the subscription is requested to be terminated if set to "true", i.e. no

 further notifications related to this subscription will be provided. Otherwise set to

 "false". The default value is "true".

 termTrainCause:

 $ref: '#/components/schemas/TermTrainCause'

 required:

 - terminationTrainReq

#

# ENUMERATIONS DATA TYPES

#

 FailureCodeTrain:

 anyOf:

 - type: string

 enum:

 - UNAVAILABLE\_ML\_MODEL\_TRAIN

 - type: string

 description: >

 This string provides forward-compatibility with future extensions to the enumeration but

 is not used to encode content defined in the present version of this API.

 description: |

 Possible values are:

 - UNAVAILABLE\_ML\_MODEL\_TRAIN: The ML model training is unavailable.

 TermTrainCause:

 anyOf:

 - type: string

 enum:

 - NWDAF\_OVERLOAD

 - NOT\_AVAILABLE\_ML\_TRAIN

 - OTHERS

 - type: string

 description: >

 This string provides forward-compatibility with future extensions to the enumeration but

 is not used to encode content defined in the present version of this API.

 description: |

 Possible values are:

 - NWDAF\_OVERLOAD: The NWDAF is overloaded for the ML model training.

 - NOT\_AVAILABLE\_ML\_TRAIN: The ML model training process is not available.

 - OTHERS: Other cause.

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