**3GPP TSG- Meeting #C3-253543**

**Gothenburg, Sweden, 25 -29 August, 2025**

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| *CR-Form-v12.3* |
| **CHANGE REQUEST** |
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|  |  | **CR** | **1087** | **rev** | **1** | **Current version:** |  |  |
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| *For* [***HELP***](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** |

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|  |
| ***Title:***  | VFL Training on MLModelProvision |
|  |  |
| ***Source to WG:*** |  |
| ***Source to TSG:*** |  |
|  |  |
| ***Work item code:*** | AIML\_CN |  | ***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-17 (Release 17)Rel-18 (Release 18)Rel-19 (Release 19) Rel-20 (Release 20)* |
|  |  |
| ***Reason for change:*** | TS 23.288 specifies on clause 6.2H.2.3.1 the Training Procedure for Vertical Federated Learning when NWDAF or trusted AF is acting as VFL server Several scenarios are covered with different impacts on the MLModelProvision\_Subscribe response:* Case A (AF acts as VFL server): The NWDAF containing MTLF may either send in the service subscription response that no ML model identifier will be made available due to VFL model to be used and that training is ongoing, or alternatively, the NWDAF containing the MTLF just indicates that no ML model identifier will be made available and training is completed together with the NF ID of the VFL server.
* Case B (AF acts as VFL server): the MTLF sends in the service subscription response an indication that no ML model is available due to VFL model to be used and that the subscription is terminated (i.e. as new cause code) and may also provide VFL server ID.
* Case C (NWDAF acts as VFL server): NWDAF sends a response to the AnLF that no Model is available due to VFL used and that the subscription is terminated (i.e. as new cause code), and may also provide VFL server ID and/or an estimated time when the training is complete.

TS 23.288 also specifies on clause 6.2A.2 the contents of ML Model Provisioning:* Indication whether training is ongoing or training is complete as part of ML Model Information.
* Clarification about content of the ML Model identifier when VFL is used. In this case the ML Model identifier contains a non-relevant value.
* Clarification about the content of ML model provider information. The identification of the VFL server is provisioned using ML Model provider information. The NF Instance Identifier identifies the FL server. For example, if an AF is serving as VFL server the ML Model provider information identifies the VFL server, not the MTLF.

Hence, it is needed to extend the response of MLModelProvision\_Subscribe and the MLModelProvision\_Notify to include all these data. |
|  |  |
| ***Summary of change:*** | MLModelProvision API is extended to allow the inclusion of VFL training information in MLModelProvision\_Subscribe response.* MLEventSubscription data type is extended with "vflInfo" attribute to allow returning VFL training information in MLModelProvision\_Subscribe response per subscribed event. It covers Case A by allowing returning as part of the VFL information the VFL training status and optionally VFL Server.
* FailureEventInfoForMLModel data type is extended with "vflInfo" attribute to allow returning VFL training information in MLModelProvision\_Subscribe response per subscribed event. It covers Cases B and C by allowing sending as part of VFL information the VFL server ID and/or the estimated time when the VFL training is expected to be complete.
* New VflInfo data type is added containing the VFL training status, the VFL server identity and the estimated time when the VFL training is expected to be complete.
* FailureCode data type is extended to add as possible code that VFL model is going to be used (for cases B and C)
* New VflTrainingStatus data type is added with the indication about whether VFL training is ongoing or terminated (for case A).

MLModelProvision API is extended to allow the inclusion of VFL training information in MLModelProvision\_Notify:* MLEventNotif data type is extended with VFL training status so that NWDAF can notify the consumer that VFL training has terminated.
* It is clarified that when VFL training applies "modelProviderId" attribute in MLEventNotif data type will contain the VFL server identity.
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| ***Consequences if not approved:*** | No support of stage 2 requirements on VFL training on MLModelProvision. |
|  |  |
| ***Clauses affected:*** | 4.5.1.1, 4.5.2.2, 4.5.2.2.3, 4.5.2.4.2, 5.4.6.1, 5.4.6.2.3, 5.4.6.2.6, 5.4.6.2.7, 5.4.6.2.18 (New), 5.4.6.3.3, 5.4.6.3.5 (New), 5.4.7.3, 5.4.8, A.5 |
|  |  |
|  | **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 a backwards compatible feature to the following API: TS29520\_Nwdaf\_MLModelProvision.yaml. |
|  |  |
| ***This CR's revision history:*** |  |

**Additional discussion(if needed):**

**Proposed changes:**

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

#### 4.5.1.1 Overview

The Nnwdaf\_MLModelProvision service as defined in 3GPP TS 23.501 [2] and 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 analytics events;

- allows MTLF-based ML Model Accuracy monitoring procedure between the AnLF and MTLF; and

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

The types of analytics events supported by this service are the same as defined in clause 4.2.1.1.

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

#### 4.5.2.2.2 Subscription for event notifications

Figure 4.5.2.2.2-1 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 4.5.2.2.2-1: NF service consumer subscribes to notifications

The NF service consumer shall invoke the Nnwdaf\_MLModelProvision\_Subscribe service operation to subscribe to event notification(s). The NF service consumer shall send an HTTP POST request with "{apiRoot}/nnwdaf-mlmodelprovision/<apiVersion>/subscriptions" as Resource URI representing the "NWDAF ML Model Provision Subscriptions", as shown in figure 4.5.2.2.2-1, step 1, to create a subscription for an "Individual NWDAF ML Model Provision Subscription" according to the information in message body.

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

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

- 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; and

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

 and may include:

1) an identification of target UE information as the "tgtUe" attribute;

2) a time interval for which the ML model for the analytics is requested as the "mLTargetPeriod" attribute;

3) the time when the subscription expired as the "expiryTime" attribute;

4) the ML event reporting condition as the "mlEvRepCon" if the "FederatedLearning" feature or the "ModelProvisionExt" feature is supported;

5) the ML Model Interoperability Information as the "modelInterInfo" attribute if the "ModelSharing" feature is supported;

6) NF consumer information as the "nfConsumerInfo" attributed if the "ModelSharing" feature is supported;

7) use case context as "useCaseCxt" attribute, if the "ENAExt" feature is supported;

NOTE 1: The NWDAF containing MTLF can use the "useCaseCxt" attribute to select the most relevant ML model, when several ML models are available for the requested Analytics ID(s). The values of this parameter are not standardized.

8) extended parameters for ML model provisioning as the "modelProvExt" attribute, if the feature "ModelProvisionExt" is supported;

9) UTC time indicating the time when the ML model is needed as the "timeModelNeeded" attribute;

10) the inference data stored in ADRF which can be used by MTLF as the "inferDataForModel" attribute, if the feature "ModelProvisionExt" is supported; and

The NwdafMLModelProvSubsc data structure provided in the request body may include:

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

- the reporting requirement information of the subscription as the "eventReq" attribute.

For different event types, the filter information in "mLEventFilter" attribute within the MLEventSubscription data type is the same as described in clause 4.3.2.2.2 for the filter information contained in "event-filter" attribute.

NOTE 2: The features described in clause 4.3.2.2.2 has no impact on this service, i.e. the features defined for the EventFilter data type will possibly not have corresponding features in this service. The result is that when the releases of which the NF service consumer and the NWDAF containing MTLF are different, the NF service consumer will possibly not know whether the NWDAF containing MTLF has considered all the filter information provided in the request message.

Upon the reception of an HTTP POST request with: "{apiRoot}/nnwdaf-mlmodelprovision/<apiVersion>/subscriptions" as Resource URI and NwdafMLModelProvSubsc 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 Provision Subscription" resource, the NWDAF shall respond with "201 Created" with the message body containing a representation of the created subscription, as shown in figure 4.5.2.2.2-1, 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-mlmodelprovision/<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 "mLEventNotifs" 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 no subscription is created in NWDAF because VFL training model is going to be used for all required events, then the NWDAF which contains MTLF shall send a "403 Forbidden" status code to the NF service consumer which contains the corresponding failure reason via a "problemDetails" attribute with the "cause" attribute set to "VFL\_MODEL\_TO\_BE\_USED".

If there is no associated ML model 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\_FOR\_ALLEVENTS".

If other errors occur when processing the HTTP POST request, the NWDAF shall send an HTTP error response as specified in clause 5.4.7.

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

##### 4.5.2.2.3 Update subscription for event notifications

Figure 4.5.2.2.3-1 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 4.5.2.2.3-1: Modification of events subscription information using HTTP PUT

The NF service consumer shall invoke the Nnwdaf\_MLModelProvision\_Subscribe service operation to modify an existing ML Model subscription. The NF service consumer shall send an HTTP PUT request with: "{apiRoot}/nnwdaf-mlmodelprovision/<apiVersion>/subscriptions/{subscriptionId}" as Resource URI, where "{subscriptionId}" is the event subscription identifier of the existing subscription to be modified, to update an "Individual NWDAF ML Model Provision Subscription" according to the information in the message body. The NwdafMLModelProvSubsc data structure provided in the request body shall include the same contents as described in clause 4.5.2.2.2.

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

- modify the concerned subscription; and

- store the subscription.

NOTE: The "notifUri" attribute within the NwdafMLModelProvSubsc data structure can be modified to request that subsequent notifications are sent to a new NF service consumer.

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

- HTTP "204 No Content" response (as shown in figure 4.5.2.2.3-1, step 2a); or

- HTTP "200 OK" response (as shown in figure 4.5.2.2.3-1, step 2b) with a response body containing a representation of the updated subscription in the NwdafMLModelProvSubsc 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 no subscription is created in NWDAF because VFL training model is going to be used for all required events, then the NWDAF which contains MTLF shall send a "403 Forbidden" status code to the NF service consumer which contains the corresponding failure reason via a "problemDetails" attribute with the "cause" attribute set to "VFL\_MODEL\_TO\_BE\_USED".If other errors occur when processing the HTTP PUT request, the NWDAF shall send an HTTP error response as specified in clause 5.4.7.

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].

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

##### 4.5.2.4.2 Notification about subscribed event

Figure 4.5.2.4.2-1 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 4.5.2.4.2-1: NWDAF notifies the subscribed event

The NWDAF shall invoke the Nnwdaf\_MLModelProvision\_Notify service operation to notify the subscribed event. The NWDAF shall send an HTTP POST request with "{notifUri}" received in the Nnwdaf\_MLModelProvision\_Subscribe service operation as Resource URI, as shown in figure 4.5.2.2.2-1, step 1. The NwdafMLModelProvNotif data structure provided in the request body that shall include:

- an event subscription identifier as "subscriptionId" attribute; and

- description of the notified event as "eventNotifs" attribute, that for each event, the MLEventNotif 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 or if the "ModelProvisionExt"feature is supported, the ADRF (Set) information of the ML Model as the "mLModelAdrf" addtribute and an unique identifier for the ML model as "modelUniqueId" attribute; and

the MLEventNotif data type may include:

* a notification correlation identifier as "notifCorreId" 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
* if the feature "ModelProvisionExt" is supported, the additional ML model information as "addModelInfo" attribute; and
* if the feature "ModelProvisionExt" is supported, the filtering information of the ML Model as the "mLEventFilter" attribute;
* if the "EnModelProvision" feature is supported, the NF Instance Identifer to identify the ML Model provider as the "modelProviderId" attribute;
* if the "EnModelProvision" feature is supported, the indication that indicates the ML model is updated (e.g., re-trained) as the "modelUpdateInd" attribute; and
* if the feature "ModelProvisionExt" is supported, the target UEs of the ML Model as the "tgtUe" attribute.
* if the feature "VerticalFederatedLearning" is supported, the VFL training status as the "vflTrainStatus" 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 receives the ADRF ID as the "adrfId" attribute or the ADRF Set ID as the "adrfSetId" attribute in the NwdafMLModelProvNotif data structure of the HTTP POST request, it may invoke Nadrf\_MLModelManagement\_RetrievalRequest service operation to retrieve ML Model from the ADRF (Set) as specified in 3GPP TS 29.575 [27].

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 NF service consumer shall send an HTTP error response as specified in clause 5.4.7.

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

#### 5.4.6.1 General

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

Table 5.4.6.1-1 specifies the data types defined for the Nnwdaf\_MLModelProvision service based interface protocol.

Table 5.4.6.1-1: Nnwdaf\_MLModelProvision specific Data Types

|  |  |  |  |
| --- | --- | --- | --- |
| Data type | Section defined | Description | Applicability |
| AdditionalMLModelInformation | 5.4.6.2.14 | Represents the additional ML Model Information | ModelProvisionExt |
| FailureCode | 5.4.6.3.3 | Represents Failure Code. |  |
| FailureEventInfoForMLModel | 5.4.6.2.7 | Contains Failure Event Information for the ML Model. |  |
| InputDataInfo | 5.4.6.2.12 | Represents the metrics of the input data. | ModelProvisionExt |
| InferenceDataForModelTrain | 5.4.6.2.17 | Indicates the inference data stored in ADRF. | ModelProvisionExt |
| MLEventNotif | 5.4.6.2.6 | Represents notification on ML Event information. |  |
| MLEventSubscription | 5.4.6.2.3 | Represents ML Event Subscription. |  |
| MLModelAddr | 5.4.6.2.8 | Represents the address of the ML Model file. |  |
| MLModelAdrf | 5.4.6.2.15 | Represents the ADRF (Set) information of ML Model. | ModelProvisionExt |
| MLModelMetric | 5.4.6.3.4 | Represents the metric of the ML model. | FederatedLearningModelProvisionExt |
| MLRepEventCondition | 5.4.6.2.11 | Indicates the ML event reporting condition. | FederatedLearningModelProvisionExt |
| ModelProvisionParamsExt | 5.4.6.2.13 | Represents extended model provision parameters. | ModelProvisionExt |
| NwdafMLModelProvNotif | 5.4.6.2.5 | Represents notification on ML Model event(s) that occurred. |  |
| NwdafMLModelProvSubsc | 5.4.6.2.2 | Represents ML Model event(s) subscription. |  |
| TrainInputDataInfo | 5.4.6.2.16 | Represents training input data information. | ModelProvisionExt |
| VflInfo | 5.4.6.2.18 | Represents VFL training information. | VerticalFederatedLearning |
| VflTrainingStatus | 5.4.6.3.5 | Represents VFL training status. | VerticalFederatedLearning |

Table 5.4.6.1-2 specifies data types re-used by the Nnwdaf\_MLModelProvision 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\_MLModelProvision service based interface.

Table 5.4.6.1-2: Nnwdaf\_MLModelProvision re-used Data Types

|  |  |  |  |
| --- | --- | --- | --- |
| Data type | Reference | Comments | Applicability |
| Accuracy | 5.1.6.3.5 | Represents accuracy levels of interest for ML models | ModelProvisionExt |
| DataSetTag | 3GPP TS 29.575 [27] | Contains an identifier and a description of associated data or analytics records. | ModelProvisionExt |
| DateTime | 3GPP TS 29.571 [8] | Identifies the time. |  |
| DccfEvent | 3GPP TS 29.574 [26] | Identifies the input data event. | ModelProvisionExt |
| DurationSec | 3GPP TS 29.571 [8] | Represents the duration time in second(s). | VerticalFederatedLearning |
| EventFilter | 5.2.6.2.3 | Identifies the filter for the subscribed event. |  |
| NetworkAreaInfo | 3GPP TS 29.554 [18] | Identifies the network area. |  |
| NwdafEvent | 5.1.6.3.4 | Describes the NWDAF Events. |  |
| NfInstanceId | 3GPP TS 29.571 [8] | Identifies an NF instance. | ModelProvisionExt |
| NfSetId | 3GPP TS 29.571 [8] | Identifies an NF Set. | ModelProvisionExt |
| RedirectResponse | 3GPP TS 29.571 [8] | Represents redirection related information. |  |
| ReportingInformation | 3GPP TS 29.523 [20] | Represents the requirements of reporting the subscription. |  |
| SupportedFeatures | 3GPP TS 29.571 [8] | Used to negotiate the applicability of the optional features defined in table 5.4.8-1. |  |
| TargetUeInformation | 5.1.6.2.8 | Identifies the target UE information. |  |
| TimeWindow | 3GPP TS 29.122 [19] | Represents a time window. |  |
| Uinteger | 3GPP TS 29.571 [8] | Unsigned Integer, i.e. only value 0 and integers above 0 are permissible. | ModelProvisionExt |
| Uri | 3GPP TS 29.571 [8] | Represents a URI. |  |
| VendorId | 3GPP TS 29.510 [12] | Represents the Vendor ID. | ModelSharing |

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

##### 5.4.6.2.3 Type MLEventSubscription

Table 5.4.6.2.3-1: Definition of type MLEventSubscription

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Attribute name | Data type | P | Cardinality | Description | Applicability |
| mLEvent | NwdafEvent | M | 1 | Identifies the subscribed event. |  |
| mLEventFilter | EventFilter | M | 1 | Identifies the analytics filter for the subscribed event. |  |
| tgtUe | TargetUeInformation | O | 0..1 | Identifies target UE information |  |
| mLTargetPeriod | TimeWindow | O | 0..1 | Indicates the time interval for which the ML model for the analytics is requested. |  |
| timeModelNeeded | DateTime | O | 0..1 | UTC time indicating the time when the ML model is needed. | ModelProvisionExtFederatedLearningVerticalFederatedLearning |
| expiryTime | DateTime | O | 0..1 | Indicates the time when the subscription expired. |  |
| mlEvRepCon | MLRepEventCondition | O | 0..1 | Indicates the ML event reporting condition. This attribute can be provided when the "notifMethod" attribute within the ReportingInformation structure is set to "ON\_EVENT\_DETECTION" in the "eventReq" attribute within the NwdafMLModelProvSubsc data type. | FederatedLearningModelProvisionExt |
| modelInterInfo | String | O | 0..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.(NOTE) | ModelSharing |
| nfConsumerInfo | VendorId | O | 0..1 | Identifies a vendor. Vendor ID of the NF Service Consumer instance, according to the IANA-assigned "SMI Network Management Private Enterprise Codes" [31]. | ModelSharing |
| modelProvExt | ModelProvisionParamsExt | O | 0..1 | Extended ML model provisioning parameters. | ModelProvisionExt |
| useCaseCxt | String | O | 0..1 | Indicates the context of usage of the analytics.The value and format of this parameter are not standardized. | ENAExt |
| inferDataForModel | InferenceDataForModelTrain | O | 0..1 | Indicates the inference data stored in ADRF which can be used by MTLF to retrain or reprovision of the ML model. | ModelProvisionExt |
| modelId | Uinteger | O | 0..1 | The ML model Identifier. This attribute may be included when the consumer knows which model it wants to request, e.g., due to Analytics Context Transfer. | EnAnaCtxTransfer |
| vflInfo | VflInfo | O | 0..1 | Represents the VFL training information.May only be present in the response to a subscription and only when VFL training model is to be used. | VerticalFederatedLearning |
| NOTE: If both the "modelInterInfo" attribute and "modelInterInfo" attribute within the ModelProvisionParamsExt data type were provided, the "modelInterInfo" attribute takes precedence over the "modelInterInfo" attribute within the ModelProvisionParamsExt data type. |

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

##### 5.4.6.2.6 Type MLEventNotif

Table 5.4.6.2.6-1: Definition of type MLEventNotif

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Attribute name | Data type | P | Cardinality | Description | Applicability |
| event | NwdafEvent | M | 1 | Identifies the subscribed event. |  |
| notifCorreId | string | O | 0..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 NwdafMLModelProvSubsc data type. |  |
| mlFile | string | O | 0..1 | Indicates the ML model file. The format of its value is out of 3GPP scope.This attribute is not applicable in the Nnwdaf\_MLModelProvision API. |  |
| mLFileAddr | MLModelAddr | C | 0..1 | Indicates the address (e.g. a URL or an FQDN) of the ML model file.(NOTE 1, NOTE 2) |  |
| mLModelAdrf | MLModelAdrf | C | 0..1 | Indicates the ADRF (Set) information of the ML Model.(NOTE 2) | ModelProvisionExt |
| modelUpdateInd | boolean | O | 0..1 | Set to "true" to indicate that the ML model is updated. Set to "false" to indicate the ML model is not updated. Default value is "false" if omitted.(NOTE 1) | EnModelProvision |
| modelUniqueId | Uinteger | C | 0..1 | Unique identifier for an ML model. The identifier shall be unique within 5GC scope.It shall be provided only if the ModelProvisionExt feature is supported. | ModelProvisionExt |
| modelProviderId | NfInstanceId | O | 0..1 | The NF Instance Identifer to identify the ML Model provider.(NOTE 1) (NOTE 4) | EnModelProvisionVerticalFederatedLearning |
| validityPeriod | TimeWindow | O | 0..1 | Indicates the time period when the provided ML model applies.(NOTE 1) |  |
| spatialValidity | NetworkAreaInfo | O | 0..1 | Indicates the area where the provided ML model applies.(NOTE 1) |  |
| addModelInfo | array(AdditionalMLModelInformation) | O | 1..N | Indicates the additional ML Model Information.(NOTE 1) | ModelProvisionExt |
| useCaseCxt | string | O | 0..1 | Indicates the context of the ML model.The value and format of this parameter are not standardized.This attribute is not applicable in the Nnwdaf\_MLModelProvision API. | ENAExt |
| mLEventFilter | EventFilter | O | 0..1 | Identifies the analytics filter for the subscribed event.May be present if multiple ML Models with the same analytics ID are provided in the notification.(NOTE 3) | ModelProvisionExt |
| tgtUe | TargetUeInformation | O | 0..1 | Identifies target UE information. May be present if multiple ML Models with the same analytics ID are provided in the notification.(NOTE 3) | ModelProvisionExt |
| vflTrainStatus | VflTrainingStatus | O | 0..1 | Indicates VFL training status. If present it shall be set to "TERMINATED" value. | VerticalFederatedLearning |
| NOTE 1: If the "addModelInfo" attribute is provided, then the attributes "validityPeriod", "spatialValidity", "modelUpdateInd" and "modelProviderId" shall not be provided and the value of the "mLFileAddr" attribute and "mLModelAdrf" attribute and "modelUniqueId" attribute of the MLEventNotif data type shall be ignored.NOTE 2: If the "ModelProvisionExt" feature is supported, one of the "mLFileAddr" or "mLModelAdrf" attribute shall be provided, otherwise "mLFileAddr" attribute shall be provided.NOTE 3: The "mLEventFilter" and/or "tgtUe" attributes may be present when the ML Model provisioning request includes the same Analytics ID but with different ML Model filter information and/or different targets of ML Model reporting.NOTE 4: When training is done using VFL, this attribute contains the identification of the VFL server. |

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

##### 5.4.6.2.7 Type FailureEventInfoForMLModel

Table 5.4.6.2.7-1: Definition of type FailureEventInfoForMLModel

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Attribute name | Data type | P | Cardinality | Description | Applicability |
| event | NwdafEvent | M | 1 | Event that is subscribed. |  |
| failureCode | FailureCode | M | 1 | Identifies the failure reason. |  |
| vflInfo | VflInfo | O | 0..1 | Represents the VFL training information. | VerticalFederatedLearning |

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

##### 5.4.6.2.18 Type VflInfo

Table 5.4.6.2.18-1: Definition of type VflInfo

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Attribute name | Data type | P | Cardinality | Description | Applicability |
| vflServer | NfInstanceId | O | 0..1 | VFL server instance ID. |  |
| vflTrainStatus | VflTrainingStatus | O | 0..1 | VFL training status. |  |
| expCompTime | DurationSec | O | 0..1 | Indicates the expected remaining VFL training time.May only be provided if "vflTrainStatus" attribute is set to "ONGOING". |  |

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

##### 5.4.6.3.3 Enumeration: FailureCode

Table 5.4.6.3.3-1: Enumeration FailureCode

|  |  |  |
| --- | --- | --- |
| Enumeration value | Description | Applicability |
| UNAVAILABLE\_ML\_MODEL | Indicates the requested ML model for the event is unavailable. |  |
| VFL\_MODEL\_TO\_BE\_USED | Indicates the requested ML model for the event is not going to be made available due to VFL model to be used. | VerticalFederatedLearning |

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

##### 5.4.6.3.5 Enumeration: VflTrainingStatus

Table 5.4.6.3.5-1: Enumeration VflTrainingStatus

|  |  |  |
| --- | --- | --- |
| Enumeration value | Description | Applicability |
| ONGOING | Indicates VFL training is ongoing. |  |
| TERMINATED | Indicates VFL training is terminated |  |

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

#### 5.4.7.3 Application Errors

The application errors defined for the Nnwdaf\_MLModelProvision API are listed in table 5.4.7.3-1.

Table 5.4.7.3-1: Application errors

|  |  |  |
| --- | --- | --- |
| Application Error | HTTP status code | Description |
| UNAVAILABLE\_ML\_MODEL\_FOR\_ALLEVENTS | 500 Internal Server Error | Indicates the requested all events ML model is unavailable. |
| VFL\_MODEL\_TO\_BE\_USED\_FOR\_ALL\_EVENTS | 403 Forbidden | NWDAF rejects the creation of the MLModelProvision subscription because the requested ML model for the event(s) is not going to be made available due to VFL model to be used. |
| NOTE: Including a "ProblemDetails" data structure with the "cause" attribute in the HTTP response is optional unless explicitly mandated in the service operation clauses. |

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

### 5.4.8 Feature negotiation

The optional features in table 5.4.8-1 are defined for the Nnwdaf\_MLModelProvision API. They shall be negotiated using the extensibility mechanism defined in clause 6.6 of 3GPP TS 29.500 [6].

Table 5.4.8-1: Supported Features

|  |  |  |
| --- | --- | --- |
| Feature number | Feature Name | Description |
| 1 | FederatedLearning | Indicates the support of Federated Learning. |
| 2 | ModelSharing | This feature indicates the support of ML model sharing. |
| 3 | ENAExt | This feature indicates support for the general enhancements of network data analytics requirements, including support for use case context sent by the NF service consumer to the NWDAF. |
| 4 | ModelProvisionExt | This feature indicates support for the Model Provision Extension, including support for provisioning the ML model file address (e.g. URL or FQDN) or ADRF (Set) ID and additional ML Model Information to the NF service consumer. |
| 5 | EnModelProvision | This feature indicates the enhancements on the ML model provisioning service, including:* provisioning the ML Model update indicator in the notification;

provisioning the NF Instance identifier of the ML Model provider. |
| 6 | VerticalFederatedLearning | Indicates the support of Vertical Federated Learning. |

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

# A.5 Nnwdaf\_MLModelProvision API

openapi: 3.0.0

info:

 title: Nnwdaf\_MLModelProvision

 version: 1.2.0-alpha.3

 description: |

 Nnwdaf\_MLModelProvision API Service.

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externalDocs:

 description: 3GPP TS 29.520 V19.3.0; 5G System; Network Data Analytics Services.

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

servers:

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

 variables:

 apiRoot:

 default: https://example.com

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

security:

 - {}

 - oAuth2ClientCredentials:

 - nnwdaf-mlmodelprovision

paths:

 /subscriptions:

 post:

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

 operationId: CreateNWDAFMLModelProvisionSubcription

 tags:

 - Subscriptions (Collection)

 requestBody:

 required: true

 content:

 application/json:

 schema:

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

 responses:

 '201':

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

 content:

 application/json:

 schema:

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

 headers:

 Location:

 description: >

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

 {apiRoot}/nnwdaf-mlmodelprovision/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/NwdafMLModelProvNotif'

 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 Provision Subscription

 operationId: UpdateNWDAFMLModelProvisionSubcription

 tags:

 - Individual NWDAF ML Model Provision Subscription (Document)

 requestBody:

 required: true

 content:

 application/json:

 schema:

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

 parameters:

 - name: subscriptionId

 in: path

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

 required: true

 schema:

 type: string

 responses:

 '200':

 description: >

 The Individual NWDAF ML Model Provision Subscription resource was modified successfully

 and a representation of that resource is returned.

 content:

 application/json:

 schema:

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

 '204':

 description: >

 The Individual NWDAF ML Model Provision 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'

 delete:

 summary: Delete an existing Individual NWDAF ML Model Provision Subscription.

 operationId: DeleteNWDAFMLModelProvisionSubcription

 tags:

 - Individual NWDAF ML Model Provision Subscription (Document)

 parameters:

 - name: subscriptionId

 in: path

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

 required: true

 schema:

 type: string

 responses:

 '204':

 description: >

 No Content. The Individual NWDAF ML Model Provision 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-mlmodelprovision: Access to the Nnwdaf\_MLModelProvision API

 schemas:

 NwdafMLModelProvSubsc:

 description: Represents NWDAF Event Subscription resources.

 type: object

 properties:

 mLEventSubscs:

 type: array

 items:

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

 minItems: 1

 description: Subscribed events

 notifUri:

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

 mLEventNotifs:

 type: array

 items:

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

 minItems: 1

 description: >

 Notifications about Individual Events.Shall only be present if the immediate reporting

 indication in the "immRep" attribute within the "eventReq" attribute sets to true in the

 event subscription, and the reports are available.

 suppFeats:

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

 notifCorreId:

 type: string

 eventReq:

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

 failEventReports:

 type: array

 items:

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

 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).

 required:

 - mLEventSubscs

 - notifUri

 ModelProvisionParamsExt:

 description: >

 Extended parameters for ML model provisioning which can optionally be set by a service

 consuumer NF.

 type: object

 properties:

 modelInterInfo:

 type: string

 description: String representing the ML Model Interoperability Information.

 reqRepRatio:

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

 inferInpDataInfos:

 type: array

 items:

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

 minItems: 1

 description: >

 Inference information that is used by NWDAF containing AnLF during inference.

 multModelsInd:

 type: boolean

 description: Indicates if the NF service consumer supports multiple models.

 numModels:

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

 accuLevels:

 type: array

 items:

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

 minItems: 1

 description: >

 Provided accuracy levels of interest for ML models.

 InputDataInfo:

 description: Contains information about inference that is used by NWDAF containing AnLF.

 type: object

 properties:

 ratio:

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

 maxNumSamples:

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

 maxTimeInterval:

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

 inpEvent:

 $ref: 'TS29574\_Ndccf\_DataManagement.yaml#/components/schemas/DccfEvent'

 nfInstanceIds:

 type: array

 items:

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

 minItems: 1

 nfSetIds:

 type: array

 items:

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

 minItems: 1

 required:

 - inpEvent

 MLEventSubscription:

 description: Represents a subscription to a single event.

 type: object

 properties:

 mLEvent:

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

 mLEventFilter:

 $ref: 'TS29520\_Nnwdaf\_AnalyticsInfo.yaml#/components/schemas/EventFilter'

 tgtUe:

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

 mLTargetPeriod:

 $ref: 'TS29122\_CommonData.yaml#/components/schemas/TimeWindow'

 expiryTime:

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

 timeModelNeeded:

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

 mlEvRepCon:

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

 modelInterInfo:

 type: string

 description: String representing the ML Model Interoperability Information.

 nfConsumerInfo:

 $ref: 'TS29510\_Nnrf\_NFManagement.yaml#/components/schemas/VendorId'

 modelProvExt:

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

 useCaseCxt:

 type: string

 description: >

 Indicates the context of usage of the analytics. The value and format of this parameter

 are not standardized.

 inferDataForModel:

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

 modelId:

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

 vflInfo:

 $ref: '#/components/schemas/VflInfo' required:

 - mLEvent

 - mLEventFilter

 NwdafMLModelProvNotif:

 description: Represents notifications on events that occurred.

 type: object

 properties:

 eventNotifs:

 type: array

 items:

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

 minItems: 1

 description: Notifications about Individual Events.

 subscriptionId:

 type: string

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

 required:

 - eventNotifs

 - subscriptionId

 MLEventNotif:

 description: Represents a notification related to a single event that occurred.

 type: object

 properties:

 event:

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

 notifCorreId:

 type: string

 description: >

 Contains 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 NwdafMLModelProvSubsc data type.

 mlFile:

 type: string

 description: Contains the ML model file.

 mLFileAddr:

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

 mLModelAdrf:

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

 validityPeriod:

 $ref: 'TS29122\_CommonData.yaml#/components/schemas/TimeWindow'

 spatialValidity:

 $ref: 'TS29554\_Npcf\_BDTPolicyControl.yaml#/components/schemas/NetworkAreaInfo'

 addModelInfo:

 type: array

 items:

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

 minItems: 1

 description: Contains the additional ML Model Information besides the ML Model Address

 modelUniqueId:

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

 modelProviderId:

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

 useCaseCxt:

 type: string

 description: >

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

 parameter are not standardized.

 mLEventFilter:

 $ref: 'TS29520\_Nnwdaf\_AnalyticsInfo.yaml#/components/schemas/EventFilter'

 tgtUe:

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

 modelUpdateInd:

 type: boolean

 description: >

 Set to "true" to indicate that the ML model is updated. Set to "false" to indicate the

 ML model is not updated. Default value is "false" if omitted.

 vflTrainStatus:

 $ref: #/components/schemas/VflTrainingStatus'

 allOf:

 - required: [event]

 - oneOf:

 - required: [mLFileAddr]

 - required: [mLModelAdrf]

 FailureEventInfoForMLModel:

 description: >

 Represents the event(s) that the subscription is not successful including the failure

 reason(s).

 type: object

 properties:

 event:

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

 failureCode:

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

 vflInfo:

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

 required:

 - event

 - failureCode

 MLModelAddr:

 description: Addresses of ML model files.

 type: object

 properties:

 mLModelUrl:

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

 mlFileFqdn:

 type: string

 description: The FQDN of the ML Model file.

 oneOf:

 - required: [mLModelUrl]

 - required: [mlFileFqdn]

 MLRepEventCondition:

 description: Indicates the ML event reporting condition.

 type: object

 properties:

 mlTrainRound:

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

 mlTrainRepTime:

 $ref: 'TS29122\_CommonData.yaml#/components/schemas/TimeWindow'

 mlAccuracyThreshold:

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

 modelMetric:

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

 AdditionalMLModelInformation:

 description: Represents the additional ML Model Information.

 type: object

 properties:

 mLFileAddr:

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

 mLModelAdrf:

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

 validityPeriod:

 $ref: 'TS29122\_CommonData.yaml#/components/schemas/TimeWindow'

 spatialValidity:

 $ref: 'TS29554\_Npcf\_BDTPolicyControl.yaml#/components/schemas/NetworkAreaInfo'

 modelUniqueId:

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

 modelRepRatio:

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

 mlDegradInd:

 type: boolean

 description: >

 Set to "true" to indicate support degration of an ML model. Set to "false" to indicate

 not support degration of an ML model. Default value is "false" if omitted.

 trainInpInfos:

 type: array

 items:

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

 minItems: 1

 description: >

 Training information that is used by NWDAF containing MTLF during training.

 modelMetric:

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

 accMLModel:

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

 modelUpdateInd:

 type: boolean

 description: >

 Set to "true" to indicate that the ML model is updated. Set to "false" to indicate the

 ML model is not updated. Default value is "false" if omitted.

 modelProviderId:

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

 oneOf:

 - required: [mLFileAddr]

 - required: [mLModelAdrf]

 required:

 - modelUniqueId

 MLModelAdrf:

 description: ADRF (Set) information of the ML Model.

 type: object

 properties:

 adrfId:

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

 adrfSetId:

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

 storTransId:

 type: string

 description: String identifying a Storage Transaction ID.

 oneOf:

 - required: [adrfId]

 - required: [adrfSetId]

 TrainInputDataInfo:

 description: Contains Training input data information that is used by NWDAF containing MTLF.

 type: object

 properties:

 dataInfo:

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

 time:

 $ref: 'TS29122\_CommonData.yaml#/components/schemas/TimeWindow'

 dataStatisticsInfos:

 type: string

 InferenceDataForModelTrain:

 description: >

 Indicates the inference data stored in ADRF which can be used by MTLF to retrain or

 reprovision of the ML model.

 type: object

 properties:

 adrfId:

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

 adrfSetId:

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

 dataSetTag:

 $ref: 'TS29575\_Nadrf\_DataManagement.yaml#/components/schemas/DataSetTag'

 modelId:

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

 oneOf:

 - required: [adrfId]

 - required: [adrfSetId]

 VflInfo:

 description: >

 Represents the VFL training information.

 type: object

 properties:

 vflServer:

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

 vflTrainStatus:

 $ref: #/components/schemas/VflTrainingStatus'

 expCompTime:

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

#

# ENUMERATIONS DATA TYPES

#

 FailureCode:

 anyOf:

 - type: string

 enum:

 - UNAVAILABLE\_ML\_MODEL

 - VFL\_MODEL\_TO\_BE\_USED

 - 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: |

 Represents the failure code.

 Possible values are:

 - UNAVAILABLE\_ML\_MODEL: Indicates the requested ML model for the event is unavailable.

 - VFL\_MODEL\_TO\_BE\_USED: Indicates the requested ML model for the event is not going to

 be made available due to VFL model to be used.

 MLModelMetric:

 anyOf:

 - type: string

 enum:

 - ACCURACY

 - 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: |

 Represents the metric of the ML model.

 Possible values are:

 - ACCURACY: ML Model Accuracy metric.

 VflTrainingStatus:

 anyOf:

 - type: string

 enum:

 - ONGOING

 - TERMINATED

 - 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: |

 Represents VFL training status.

 Possible values are:

 - ONGOING: Indicates VFL training is ongoing.

 - TERMINATED: Indicates VFL training is terminated.

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