**3GPP TSG-CT WG3 Meeting #130C3-234068**

**Xiamen, China, 9 - 13 October, 2023 (revision of C3-233abc)**

|  |
| --- |
| *CR-Form-v12.2* |
| **CHANGE REQUEST** |
|  |
|  | **29.520** | **CR** | **0787** | **rev** |  | **Current version:** | **18.3.0** |  |
|  |
| *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)*.* |
|  |

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ***Proposed change affects:*** | UICC apps |  | ME |  | Radio Access Network |  | Core Network | **X** |

|  |
| --- |
|  |
| ***Title:***  | Support the consumer to provide the inference data stored in ADRF for model training |
|  |  |
| ***Source to WG:*** | Huawei, Nokia, Nokia Shanghai Bell |
| ***Source to TSG:*** | CT3 |
|  |  |
| ***Work item code:*** | eNA\_Ph3 |  | ***Date:*** | 2023-09-25 |
|  |  |  |  |  |
| ***Category:*** | **B** |  | ***Release:*** | Rel-18 |
|  | *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:*** | As indicated in 6.2A.2 of 23.288, the consumer may provide the inference data stored in ADRF which can be used the NWDAF containing MTLF to retrain the ML model. This CR proposes to enhance the ML model provisioning service to support the consumer to provide the inference data information.The ADRF instance ID and ADRF set ID can be provided together, the presence condition of "adrfId" and "adrfSetId" attributes in MLModelAdrf data type needs to be corrected. |
|  |  |
| ***Summary of change:*** | * Define new data type for the inference data.
* Correct the NOTE in MLModelAdrf data type.
 |
|  |  |
| ***Consequences if not approved:*** | Misalignment between stage 2 and stage 3. |
|  |  |
| ***Clauses affected:*** | 4.5.2.2.2, 5.4.6.1, 5.4.6.2.3, 5.4.6.2.15, 5.4.6.2.16, 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 backward compatible features to the OpenAPI of the Nnwdaf\_MLModelProvision API. |
|  |  |
| ***This CR's revision history:*** |  |

**Additional discussion(if needed):**

**Proposed changes:**

\*\*\* 1st 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 during which the ML model shall be reported as the "mLTargetPeriod" attribute;

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

4) the ML model metric as the "modelMetric" attribute if the "FederatedLearning" feature or the "ModelProvisionExt" feature is supported;

5) a pre-determined status for the ML model or training as the "preDetStatus" attribute if the "FederatedLearning" feature is supported; and

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

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

8) NF consumer information as the "nfConsumerInfo" attributed if the "ModelSharing" feature is supported.

9) 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.

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

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

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.

Editor’s Note: The type EventFilter includes attributes (and/or attributes within attributes) that have been introduced in Rel-18. For these attributes, the present API shall either define new features to indicate that the attributes are supported based on these features or it shall indicate that they are not applicable. This feature handing is FFS.

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 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".

When the "notifFlag" attribute within the "eventReq" attribute is included and set to "DEACTIVATE" in the request, the NWDAF shall mute the event notification and store the available events until the NF service consumer requests to retrieve them by setting the "notifFlag" attribute to "RETRIEVAL" or until a muting exception occurs (e.g. full buffer). When a muting exception occurs, if the EnhDataMgmt feature is supported, the NWDAF may consider the contents of the "notifFlagInstruct" attribute within the "eventReq" attribute (if provided) and/or local configuration to determine its actions.

If the EnhDataMgmt feature is supported and the NWDAF accepts the muting instructions provided in the "notifFlag" and/or the "notifFlagInstruct" attributes, it may indicate the applied muting notification settings within the "mutingSetting" attribute in the response. If the NWDAF does not accept the muting instructions provided in the "notifFlag" and/or the "notifFlagInstruct" attributes, it shall send an HTTP "403 Forbidden" error response including the "cause" attribute set to "MUTING\_INSTR\_NOT\_ACCEPTED".

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 \*\*\*

#### 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 | Represnets the additional ML Model Information | ModelProvisionExt |
| FailureEventInfoForMLModel | 5.4.6.2.7 |  |  |
| InferenceDataForModelTrain | 5.4.6.2.16 | Indicates the inference data stored in ADRF. | ModelProvisionExt |
| MLEventNotif | 5.4.6.2.6 |  |  |
| MLEventSubscription | 5.4.6.2.3 |  |  |
| MLModelAddr | 5.4.6.2.8 |  |  |
| MLModelAdrf | 5.4.6.2.15 | Represents the ADRF (Set) information of ML Model. | ModelProvisionExt |
| MLModelMetric | 5.4.6.2.9 | Indicates the ML model metric. | FederatedLearningModelProvisionExt |
| MLModelStatus | 5.4.6.2.10 | Indicates the pre-determined status of the ML model or training. | FederatedLearning |
| 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 |  |  |
| NwdafMLModelProvSubsc | 5.4.6.2.2 |  |  |
| TrainInputInfo | 5.4.6.2.12 | Represents training input data information. | ModelProvisionExt |

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 |
| DateTime | 3GPP TS 29.571 [8] | Identifies the time. |  |
| DccfEvent | 3GPP TS 29.574 [26] | Identifies the input data event. | ModelProvisionExt |
| 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 |  |  |
| 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] |  |  |
| ReportingInformation | 3GPP TS 29.523 [20] | Represents the requirements of reporting the subscription. |  |
| SupportedFeatures | 3GPP TS 29.571 [8] |  |  |
| TargetUeInformation | 5.1.6.2.8 |  |  |
| TimeWindow | 3GPP TS 29.122 [19] |  |  |
| 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] |  |  |
| 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 during which the ML model shall be reported. |  |
| expiryTime | DateTime | O | 0..1 | Indicates the time when the subscription expired. |  |
| modelMetric | MLModelMetric | O | 0..1 | Indicates the ML model metric. | FederatedLearningModelProvisionExt |
| 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 |
| preDetStatus | MLModelStatus | O | 0..1 | Indicates the pre-determined status of the ML model or training. | FederatedLearning |
| 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. | 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" [30]. | 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 |

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

##### 5.4.6.2.15 Type MLModelAdrf

Table 5.4.6.2.9-1: Definition of type MLModelAdrf

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Attribute name | Data type | P | Cardinality | Description | Applicability |
| adrfId | NfInstanceId | C | 0..1 | Identifier of the ADRF.(NOTE) |  |
| adrfSetId | NfSetId | C | 0..1 | Identifier of the ADRF Set.(NOTE) |  |
| storTransId | string | O | 0..1 | Indicates Storage Transaction ID, may be provided when "adrfId" or "adrfSetId" attribute is provisioned. |  |
| NOTE: One of "adrfId" and "adrfSetId" attributes shall be provided. |

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

##### 5.4.6.2.16 Type InferenceDataForModelTrain

Table 5.4.6.2.16-1: Definition of type InferenceDataForModelTrain

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Attribute name | Data type | P | Cardinality | Description | Applicability |
| adrfId | NfInstanceId | C | 0..1 | Identifier of the ADRF.(NOTE) |  |
| adrfSetId | NfSetId | C | 0..1 | Identifier of the ADRF Set.(NOTE) |  |
| dataSetTag | DataSetTag | O | 0..1 | Data set tag of the data stored in ADRF which can be used by MTLF. |  |
| modelId | Uinteger | O | 0..1 | ML model Identifier. Indicates the model that the data corresponding to the DataSetTag is related to. This attribute may present only in a subscription modification request. |  |
| NOTE: One of "adrfId" and "adrfSetId" attributes shall be provided. |

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

# A.5 Nnwdaf\_MLModelProvision API

openapi: 3.0.0

info:

 title: Nnwdaf\_MLModelProvision

 version: 1.1.0-alpha.4

 description: |

 Nnwdaf\_MLModelProvision API Service.

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externalDocs:

 description: 3GPP TS 29.520 V18.3.0; 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: >

 Vendor-specific information about the ML models.

 reqRepRatio:

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

 inferInpDataInfos:

 type: array

 items:

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

 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.

 TrainInputInfo:

 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'

 modelMetric:

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

 mlEvRepCon:

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

 preDetStatus:

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

 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'

 description: >

 Extended ML model parameters that a service consumer optionally sets when subscribing to

 an ML model to be provisioned.

 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'

 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

 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:

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

 required:

 - event

 - mLFileAddr

 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'

 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]

 MLModelMetric:

 description: Indicates the ML model metric.

 type: object

 properties:

 mlModelAcc:

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

 mlModelPre:

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

 mlModelRec:

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

 MLModelStatus:

 description: Indicates the pre-determined status of the ML model or training.

 type: object

 properties:

 mlReqAcc:

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

 mlTrainTime:

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

 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'

 AdditionalMLModelInformation:

 description: Represents the additional ML Model Information.

 type: object

 properties:

 mLFileAddr:

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

 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'

 description: Unique identifier for an ML model.

 modelRepRatio:

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

 description: >

 Minimum percentage of UEs whose data is used for training an ML model.

 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/TrainInputInfo'

 minItems: 1

 description: >

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

 modelMetric:

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

 accMLModel:

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

 required:

 - mLFileAddr

 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]

 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]

#

# ENUMERATIONS DATA TYPES

#

 FailureCode:

 anyOf:

 - type: string

 enum:

 - UNAVAILABLE\_ML\_MODEL

 - 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.

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