**3GPP TSG-CT WG3 Meeting #128 C3-232474**

**Bratislava, Slovakia, 22nd - 26th May, 2023 (Revision of C3-232226)**

|  |
| --- |
| *CR-Form-v12.2* |
| **CHANGE REQUEST** |
|  |
|  | **29.520** | **CR** | **0699** | **rev** | **3** | **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)*.* |
|  |

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

|  |
| --- |
|  |
| ***Title:***  | Update to support extended parameters for ML model provisioning |
|  |  |
| ***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:*** | TS 23.288 in clauses 6.2A.1-6.2A.3 add extended parameters for ML model provisioning such as indication for support for multiple ML models, accuracy levels of ML models, etc. All these parameters need to be added to TS 29.520. This CR also updates relevant parameters in the Nnwdaf\_MLModelProvision service API.Meanwhile TS 23.288 CR 0730 (S2-2304031) was agreed adding degradation information for an ML model in notification as model information also the other attributes to be included in model information to support multiple ML model information, hence also need to be added in this specification accordingly. |
|  |  |
| ***Summary of change:*** | New feature support additional parameters that need to be submitted by service consumer for ML model provision subscription and new parameters in notification to the service consumer. |
|  |  |
| ***Consequences if not approved:*** | Not aligned with stage 2. The APIs for ML model provisioning will not support extended parameters that are introduced in TS 23.288. |
|  |  |
| ***Clauses affected:*** | 4.5.2.2.2, 4.5.2.4.2, 5.4.6.1, 5.4.6.2.3, 5.4.6.2.6, 5.4.6.2.9 (New), 5.4.6.2.10 (New), 5.4.6.2.11 (New), A.5. |
|  |  |
|  | **Y** | **N** |  |  |
| ***Other specs*** | **X** |  |  Other core specifications  | TS 23.288 CR 0730 |
| ***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 into OpenAPI file for Nnwdaf\_MLModelProvision API. |
|  |  |
| ***This CR's revision history:*** | **Revision of C3-231457:**- Updates in the OpenAPI file to correct some errors.- adding ML degradation indicator and restruct the data model for ML model information according to the agreed TS 23.288 CR 0730. |

**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" attirbute.

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" attirbute;

3) the time when the subscription expired as the "expiryTime" attirbute; and

4) extended parameters for ML model provisioning as the "modelProvExt" 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 "mLEventFilter" attribute within the MLEventSubscription data type:

- if the event is "SLICE\_LOAD\_LEVEL", shall provide:

1) the S-NSSAI as the "snssais" attribute; and/or

2) the identification(s) of Network Slice instance as the "nsiIdInfos" attribute;

and may provide:

1) an optional list of analytics subsets as the "listOfAnaSubsets" attribute;

- if the event is "SERVICE\_EXPERIENCE", may provide:

1) the identification of the application as the "appIds" attribute;

2) the S-NSSAI as the "snssais" attribute;

3) the identification(s) of Network Slice instance as the "nsiIdInfos" attribute;

4) the Area of Interest (AOI) as the "networkArea" attribute;

5) the identification of DNN as the "dnns" attribute;

6) identification of user plane access to DN(s) which the subscription applies as the "dnais" attribute; and

7) identification(s) of RAT type(s) and/or frequency(ies) of UE's serving cell(s) which the subscription applies by "ratFreqs" attribute;

- if the event is "UE\_MOBILITY", may provide:

1) Area of Interest (AOI) as the "networkArea" attribute; and

- if the feature "UeMobilityExt" is supported and the event is "UE\_MOBILITY", may provide:

1) Visited Area(s) of Interest as the "visitedAreas" attirbute;

- if the event is "UE\_COMM", may provide:

1) the S-NSSAI as the "snssais" attribute;

2) the identification of DNN as the "dnns" attribute;

3) the identification of the application as the "appIds" attribute;

4) the Area of Interest (AOI) as the "networkArea" attribute; and

5) an optional list of analytics subsets as the "listOfAnaSubsets" attribute.

- if he event is "QOS\_SUSTAINABILITY", shall provide:

1) The QoS requirements via "qosRequ" attribute; and

2) Location information as "networkArea" attribute;

 and may provide:

1) identification of network slice(s) by "snssais" attirbute;

- if the event is "ABNORMAL\_BEHAVIOUR", may provide:

1) the S-NSSAI as the "snssais" attribute;

2) the identification of DNN as the "dnns" attribute;

3) the identification of the application as the "appIds" attribute;

4) the Area of Interest (AOI) as the "networkArea" attribute;

5) expected UE behaviour via "exptUeBehav" attribute; and

6) either the expected analytics type via "exptAnaType" attribute or a list of exception Ids with the associated thresholds via "excepRequs" attirbute;

- if the event is "USER\_DATA\_CONGESTION", shall provide:

1) the Area of Interest (AOI) as the "networkArea" attribute;

2) an optional list of analytics subsets as the "listOfAnaSubsets" attribute; and

3) the S-NSSAI as the "snssais" attirbute;

- if the event is "NF\_LOAD", may provide:

1) the S-NSSAI as the "snssais" attribute;

2) either list of NF instance IDs in the "nfInstanceIds" attribute or list of NF set IDs in the "nfSetIds" attribute;

3) list of NF instance types in the "nfTypes" attribute;

4) the Area of Interest (AOI) as the "networkArea" attribute; and

5) an optional list of analytics subsets as the "listOfAnaSubsets" attirbute;

- if the event is "NETWORK\_PERFORMANCE", may provide:

1) Area of Interest (AOI) as the "networkArea" attribute; and

2) an optional list of analytics subsets as the "listOfAnaSubsets" attirbute;

- if the event is "NSI\_LOAD\_LEVEL", shall provide:

1) the S-NSSAI as the "snssais" attribute; and/or

2) the identification(s) of Network Slice instance as the "nsiIdInfos" attribute;

 and may provide:

1) an optional list of analytics subsets as the "listOfAnaSubsets" attirbute;

- if the event is "SM\_CONGESTION", shall provide:

1) the S-NSSAI as the "snssais" attribute; and/or

2) the identification of DNN as the "dnns" attribute;

 and may provide:

1) an optional list of analytics subsets as the "listOfAnaSubsets" attirbute;

- if the event is "REDUNDANT\_TRANSMISSION", may provide:

1) the Area of Interest (AOI) as the "networkArea" attribute;

2) the S-NSSAI as the "snssais" attribute; and

3) the identification of DNN as the "dnns" attirbute;

- if the event is "WLAN\_PERFORMANCE", may provide:

1) the Area of Interest (AOI) as the "networkArea" attribute;

2) the SSID(s) and BSSID(s) as "wlanReqs" attribute; and

3) an optional list of analytics subsets as the "listOfAnaSubsets" attirbute;

- if the event is "DN\_PERFORMANCE", may provide:

1) the identification of the application as the "appIds" attribute;

2) the S-NSSAI as the "snssais" attribute;

3) the identification(s) of Network Slice instance as the "nsiIdInfos" attribute;

4) the Area of Interest (AOI) as the "networkArea" attribute;

5) the identification of the UPF as the "upfInfo" attribute;

6) the identification of DNN as the "dnns" attribute;

7) identification of user plane access to DN(s) which the subscription applies as the "dnais" attribute;

8) IP address(s)/FQDN(s) of the Application Server(s) as the "appServerAddrs" attribute;

9) an optional list of analytics subsets as the "listOfAnaSubsets" attirbute;

- if the event is "DISPERSION", may provide:

1) the Area of Interest (AOI) as the "networkArea" attribute;

2) the S-NSSAI as the "snssais" attribute;

3) the identification of the application as the "appIds" attribute;

4) dispersion analytics requirements in "disperReqs" attribute;

5) an optional list of analytics subsets as the "listOfAnaSubsets" attirbute;

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".

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.

\*\*\* 2nd 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 4.2.2.4.2-1, step 1. The NwdafMLModelProvNotif data structure provided in the request body that shall include:

- an event subscriptionId 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, and 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. If the feature "ModelProvisionExt" is supported, may also include additional ML model information as "addModelInfo" attribute.

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

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

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

\*\*\* 3rd 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 |
| FailureEventInfoForMLModel | 5.4.6.2.7 |  |  |
| TrainInputInfo | 5.4.6.2.9 | Represents training input data information. | ModelProvisionExt |
| AdditionalMLModelInformation | 5.4.6.2.12 | Represnets the additional ML Model Information | ModelProvisionExt |
| MLEventNotif | 5.4.6.2.6 |  |  |
| MLEventSubscription | 5.4.6.2.3 |  |  |
| MLModelAddr | 5.4.6.2.8 |  |  |
| ModelProvisionParamsExt | 5.4.6.2.11 | Represents extended model provision parameters. | ModelProvisionExt |
| MultipleModelsInfo | 5.4.6.2.10 | Represents multiple models information. | ModelProvisionExt |
| NwdafMLModelProvNotif | 5.4.6.2.5 |  |  |
| NwdafMLModelProvSubsc | 5.4.6.2.2 |  |  |

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] |  |  |

\*\*\* 4th 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. |  |
| modelProvExt | ModelProvisionParamsExt | O | 0..1 | Extended ML model provisioning parameters. | ModelProvisionExt |

\*\*\* 5th 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. |  |
| mLFileAddr | MLModelAddr | M | 1 | Indicates the address (e.g. a URL or an FQDN) of the ML model file. |  |
| validityPeriod | TimeWindow | O | 0..1 | Indicates the time period when the provided ML model applies. |  |
| spatialValidity | NetworkAreaInfo | O | 0..1 | Indicates the area where the provided ML model applies. |  |
| addModelInfo | array(AdditionalMLModelInformation) | O | 1..N | Indicates the additional ML Model Information besides the ML Model Address | ModelProvisionExt |
| NOTE: If the "addModelInfo" attribute is provided, then the attributes "validityPeriod" and "spatialValidity" shall not be provided and the value of the "mLFileAddr" attribute of the MLEventNotif data type shall be ignored. |

\*\*\* 6th Change \*\*\*

##### 5.4.6.2.9 Type TrainInputInfo

Table 5.4.6.2.9-1: Definition of type TrainInputInfo

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Attribute name | Data type | P | Cardinality | Description | Applicability |
| inpEvent | DccfEvent | O | 0..1 | Identifies the input data event. |  |
| maxNumSamples | Uinteger | O | 0..1 | Maximum number of samples that have been taken to train an ML model. |  |
| maxTimeInterval | Uinteger | O | 0..1 | Maximum time interval between samples that are used to train an ML model. |  |
| nfInstanceIds | array(NfInstanceId) | O | 1..N | NF instance identifiers of the used data sources. |  |
| nfSetIds | array(NfSetId) | O | 1..N | NF set identifiers of the used data sources. |  |
| ratio | Uinteger | O | 0..1 | Sampling ratio, indicates the percentage of the available data values that are used by this ML model (for training or inference).Minimum = 0. Maximum = 100. |  |

\*\*\* 7th Change \*\*\*

##### 5.4.6.2.10 Type ModelProvisionParamsExt

Table 5.4.6.2.10-1: Definition of type ModelProvisionParamsExt

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Attribute name** | **Data type** | **P** | **Cardinality** | **Description** | **Applicability** |
| 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. |  |
| reqRepRatio | Uinteger | O | 0..1 | Minimum percentage of UEs whose data is used for training an ML model when the target of ML model reporting is a group of UEs. |  |
| inferInpDataInfos | array(TrainInputInfo) | O | 1..N | Inference information that is used by NWDAF containing AnLF during inference |  |
| multModelsInd | boolean | O | 0..1 | If provided and set to "true", it indicates that the NF service consumer supports receiving multiple ML models. If omitted or set to "false" the NF service consumer does not support multiple ML models. The default value is false. |  |
| numModels | Uinteger | O | 0..1 | Maximum number of ML models that the consumer supports to receive for a specific analytics ID. It may only be provided if the "multModelInd" attribute is provided and set to "true". |  |
| accuLevels | array(Accuracy) | O | 1..N | Provided accuracy levels of interest for ML models. |  |

\*\*\* 8th Change \*\*\*

##### 5.4.6.2.11 Type AdditionalMLModelInformation

Table 5.4.6.2.11-1: Definition of type AdditionalMLModelInformation

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Attribute name | Data type | P | Cardinality | Description | Applicability |
| mLFileAddr | MLModelAddr | M | 1 | Indicates the address (e.g. a URL or an FQDN) of the ML model file. (NOTE) |  |
| validityPeriod | TimeWindow | O | 0..1 | Indicates the time period when the provided ML model applies. (NOTE) |  |
| spatialValidity | NetworkAreaInfo | O | 0..1 | Indicates the area where the provided ML model applies. (NOTE) |  |
| modelUniqueId | Uinteger | O | 0..1 | Unique identifier for an ML model. The identified shall be unique within 5GC scope. |  |
| modelRepRatio | Uinteger | O | 0..1 | Indicating the percentage of UEs in the group that is used to train an ML model when target of ML model reporting is a group of UEs. |  |
| mlDegradInd | boolean | O | 0..1 | 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 | array(TrainInputInfo) | O | 1..N | Training input data information that is used by NWDAF containing MTLF during training. |  |

\*\*\* 9th Change \*\*\*

# A.5 Nnwdaf\_MLModelProvision API

openapi: 3.0.0

info:

 title: Nnwdaf\_MLModelProvision

 version: 1.1.0-alpha.2

 description: |

 Nnwdaf\_MLModelProvision API Service.

 © 2023, 3GPP Organizational Partners (ARIB, ATIS, CCSA, ETSI, TSDSI, TTA, TTC).

 All rights reserved.

externalDocs:

 description: 3GPP TS 29.520 V18.1.0; 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

 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'

 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.

 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'

 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]

 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.

 required:

 - mLFileAddr

#

# 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 \*\*\*