**3GPP TSG-SA5 Meeting #143-e S5-223380rev1**

**e-meeting, 9 - 17 May 2022**

**Source: Huawei**

**Title: pCR TS 28.105 Add AI/ML training information in case of AI/ML training initiated by producer**

**Document for: Approve**

**Agenda Item: 6.6.5**

# 1 Decision/action requested

***In this box give a very clear / short /concise statement of what is wanted.***

# 2 References

[1] 3GPP TS 28.105-110 “Management and orchestration; AI/ML management”.

# 3 Rationale

TS 28.105 [1] defines the use case of AI/ML training initiated by producer. This use case describes that the AI/ML training may be initiated by the AIMLT MnS producer when new training data describing the new network status/events are available. Therefore, it is necessary for the consumer to know whether the training data is based on new training data so as to determine the availability of the model.

In addition, in the use case of AI/ML training initiated by producer, the producer can initiated model training based on conditions specified by the consumer. This ensures the timeliness of the model and avoids frequent triggering of the model.

This contribution is proposed to update the attributes of AIMLTrainingReport and add request training condition datatype in draft TS 28.105 [1].

# 4 Detailed proposal

It is proposed to add the following chapter in TS 28.105 [1].

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| **1st modified section** |

#### 6.2.2.2 AI/ML training initiated by producer

The AI/ML training may be initiated by the AIMLT MnS producer, for instance as result of evaluation of performance of the AI/ML model, based on the feedback or training condition or new training data received from the consumer, or when new training data which are not from the consumer describing the new network status/events are available.

When the AIMLT MnS producer decides to start the AI/ML training, the producer

- selects the training data,

- trains the AI/ML Entity using the selected training data, and

- provides the training result (including the location of the trained AI/ML Entity, etc) to the AIMLT MnS consumer(s) who have subscribed to receive the AI/ML training results.

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### 7.3.2 AIMLTrainingRequest

#### 7.3.2.1 Definition

The IOC AIMLTrainingRequest represents the AI/ML model training request that is created by the MnS consumer.

The AIMLTrainingRequest MOI is contained under one AIMLTrainingFunction MOI. Each AIMLTrainingRequest is associated to at least one AIMLEntity.

The AIMLTrainingRequest may have a source to identify where it is coming from and which may be used to prioritize the resources for different sources. The sources may be for example the network functions, operator roles, or other functional differentiations.

Each AIMLTrainingRequest may indicate the expectedRunTimeContext that describes the specific conditions for which the AIMLEntity (either AIML Model or AIML-enabled function) should be trained for.

In case the request is accepted, the MnS producer decides when to start the AI/ML training. Once the MnS producer decides to start the training based on the request, the MnS producer instantiates one or more AI/MLTrainingProcess MOI(s) that are responsible to:

- collects (more) data for training, if the training data are not available or the data are available but not sufficient for the training,

- prepares and selects the training data, with consideration of the consumer provided candidate training data if any. The MnS producer may examine the consumer provided candidate training data and select none, some or all of them for training. In addition, the MnS producer may select some other training data that are available,

- trains the AIMLEntity using the selected and prepared training data.

The AIMLTrainingRequest may have a requestStatus field to represent the status of the specific AIMLTrainingRequest:

- The attribute values are "NOT\_STARTED", "TRAINING\_IN\_PROGRESS", "SUSPENDED", "FINISHED", and "CANCELLED".

- When value turns to "TrainingInProcess", the MnS producer instantiates one or more AIMLTrainingProcess MOI(s) representing the training process(es) being performed per the request and notifies the MnS consumer(s) who subscribed the notification.

The AIMLTrainingRequest may have a requestTrainingCondition attribute to indicate the conditions in case of AI/ML training initiated by producer.

When all of the training process associated to this request are completed, the value turns to "FINISHED.

#### 7.3.2.2 Attributes

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Attribute name | Support Qualifier | isReadable | isWritable | isInvariant | isNotifyable |
| aIMLEntityId | M | T | T | F | T |
| candidateTraingDataSource | O | T | T | F | T |
| trainingRequestSource | CM | T | T | F | T |
| requestStatus | CM | T | T | F | T |
| expectedRuntimeContext |  |  |  |  |  |
| peformanceRequirements | CM | T | T | F | T |
| cancelRequest | CO | T | T | F | T |
| suspendRequest | CO | T | T | F | T |
| requestTrainingCondition | CO | T | T | F | T |
| **Attribute related to role** |  |  |  |  |  |
|  |  |  |  |  |  |

#### 7.3.2.3 Attribute constraints

|  |  |
| --- | --- |
| Name | Definition |
| trainingRequestSource | The condition is use case " AI/ML training initiated by consumer" is supported. |
| requestStatus | The condition is use case " AI/ML training initiated by consumer" is supported. |
| peformanceRequirements | The condition is use case " AI/ML training initiated by consumer" is supported. |
| cancelRequest | The condition is use case " AI/ML training initiated by consumer" is supported. |
| suspendRequest | The condition is use case " AI/ML training initiated by consumer" is supported. |
| requestTrainingCondition | The condition is use case " AI/ML training initiated by producer" is supported. |

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### 7.3.4 AIMLTrainingReport

#### 7.3.4.1 Definition

The IOC AIMLTrainingReport represents the AI/ML model training report that is provided by the MnS producer.

The AIMLTrainingReport MOI is contained under one AIMLTrainingReports MOI.

#### 7.3.4.2 Attributes

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Attribute name | Support Qualifier | isReadable | isWritable | isInvariant | isNotifyable |
| aIMLEntityId | M | T | F | F | T |
| areConsumerTrainingDataUsed | M | T | F | F | T |
| usedConsumerTrainingData | CM | T | F | F | T |
| confidenceIndication | O | T | F | F | T |
| modelPeformanceTraining | CM | T | F | F | T |
| areNewTrainingDataUsed | CO | T | F | F | T |
| **Attribute related to role** |  |  |  |  |  |
| trainingRequestRef | CM | T | F | F | T |
| trainingProcessRef | M | T | F | F | T |
| lastTrainingRef | CM | T | F | F | T |

#### 7.3.4.3 Attribute constraints

|  |  |
| --- | --- |
| Name | Definition |
| usedConsumerTrainingData Support Qualifier | Condition: The value of areConsumerTrainingDataUsed attribute is ALL or PARTIALLY. |
| trainingRequestRef Support Qualifier | Condition: The AIMLTrainingReport MOI represents the report for the AI/ML model training that was requested by the MnS consumer (via AIMLTrainingRequest MOI). |
| lastTrainingRef Support Qualifier | Condition: The AIMLTrainingReport MOI represents the report for the AI/ML model training that was not initial training (i.e., the model has been trained before). |
| modelPeformanceTraining | The condition is use case " AI/ML training initiated by consumer" is supported. |
| areNewTrainingDataUsed | The condition is use case " AI/ML training initiated by producer" is supported. |

#### 7.3.4.4 Notifications

The common notifications defined in clause 7.6 are valid for this IOC, without exceptions or additions.

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### 7.4.X RequestTrainingCondition <<dataType>>

#### 7.4.X.1 Definition

This data type specifies the training condition of an AI/ML entity in case of AI/ML training initiated by producer.

#### 7.4.X.2 Attributes

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Attribute name | Support Qualifier | isReadable | isWritable | isInvariant | isNotifyable |
| loadCondition | M | T | T | F | T |
| coverageCondition | M | T | T | F | T |
| **Attribute related to role** |  |  |  |  |  |
|  |  |  |  |  |  |

#### 7.4.X.3 Attribute constraints

None.

#### 7.4.X.4 Notifications

The notifications specified for the IOC using this <<dataType>> for its attribute(s), shall be applicable.

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## 7.5 Attribute definitions

### 7.5.1 Attribute properties

| Attribute Name | Documentation and Allowed Values | Properties |
| --- | --- | --- |
| aIMLEntityId | It identifies the AI/ML entity.  It is unique in each MnS producer.  allowedValues: N/A. | type: String  multiplicity: 1  isOrdered: N/A  isUnique: N/A  defaultValue: None  isNullable: True |
| candidateTraingDataSource | It provides the address(es) of the candidate training data source provided by MnS consumer. The detailed training data format is vendor specific.  allowedValues: N/A. | type: String  multiplicity: \*  isOrdered: False  isUnique: True  defaultValue: None  isNullable: True |
| inferenceType | It indicates the type of inference that the AI/ML model supports.  allowedValues: the values of the MDA type (see TS 28.104 [2]), Analytics ID(s) of NWDAF (see TS 23.288 [3]), types of inference for RAN-intelligence, and vendor’s specific extensions. | type: String  multiplicity: 1  isOrdered: N/A  isUnique: N/A  defaultValue: None  isNullable: True |
| areConsumerTrainingDataUsed | It indicates whether the consumer provided training data have been used for the AI/ML model training.  allowedValues: ALL, PARTIALLY, NONE. | type: Enum  multiplicity: 1  isOrdered: N/A  isUnique: N/A  defaultValue: None  isNullable: True |
| usedConsumerTrainingData | It provides the address(es) where lists of the consumer-provided training data are located, which have been used for the AI/ML model training.  allowedValues: N/A. | type: String  multiplicity: \*  isOrdered: False  isUnique: True  defaultValue: None  isNullable: True |
| trainingRequestRef | It is the DN(s) of the related AIMLTrainingRequest MOI(s).  allowedValues: DN. | type: DN (see TS 32.156 [12])  multiplicity: \*  isOrdered: False  isUnique: True  defaultValue: None  isNullable: True |
| lastTrainingRef | It is the DN of the AIMLTrainingReport MOI that represents the reports for the last training of the AI/ML model.  allowedValues: DN. | type: DN (see TS 32.156 [12])  multiplicity: 1  isOrdered: N/A  isUnique: N/A  defaultValue: None  isNullable: True |
| confidenceIndication | It indicates the confidence (in unit of percentage) that the AI/ML model would perform for inference on the data with the same distribution as training data.  allowedValues: { 0..100 }. | type: integer  multiplicity: 1  isOrdered: N/A  isUnique: N/A  defaultValue: None  isNullable: False |
| aIMLEntityList | It describes the list of aIMLEntity. | type: AIMLEntity  multiplicity: \*  isOrdered: False  isUnique: N/True  defaultValue: None  isNullable: False |
| trainingRequestSource | It descriobes the entity that requested to instantiatethe AIMLTrainingRequest MOI. | type: integer  multiplicity: 1  isOrdered: N/A  isUnique: N/A  defaultValue: None  isNullable: False |
| requestStatus | It describes the status of a particular AI/ML training request. T.  allowedValues: NOT\_STARTED, TRAINING\_IN\_PROGRESS, CANCELLING, SUSPENDED, FINISHED, and CANCELLED. | type: Enum  multiplicity: 1  isOrdered: N/A  isUnique: N/A  defaultValue: None  isNullable: False |
| aIMLTrainingProcessId | It identifies the training process.  It is unique in each instantiated process in the MnS producer.  allowedValues: N/A. | type: String  multiplicity: 1  isOrdered: N/A  isUnique: N/A  defaultValue: None  isNullable: True |
| priority | It indicates the priority of the training process.  The priority may be used by the AI/ML training to schedule the training processes.  allowedValues: { 0..100 }. | type: ENUM  multiplicity: 1  isOrdered: N/A  isUnique: N/A  defaultValue: None  isNullable: False |
| terminationConditions | It indicates the conditions to be considered by the AIMLTraining to terminate a specific training process.  Editor's Note: The specific nature of the termination conditions is FFS  allowedValues: FFS. | type: FFS  multiplicity: 1  isOrdered: N/A  isUnique: N/A  defaultValue: None  isNullable: False |
| progressStatus | It indicates the status of the AI/ML training process.  allowedValues: N/A. | type: ProcessMonitor (see TS 28.622 [11])  multiplicity: 1  isOrdered: N/A  isUnique: N/A  defaultValue: None  isNullable: False |
| aIMLEntityVersion | It indicates the version number of the AI/ML entity.  allowedValues: N/A. | type: String  multiplicity: 1  isOrdered: N/A  isUnique: N/A  defaultValue: None  isNullable: False |
| performanceRequirements | It indicates the expected performance for a trained AI/ML entity when performing on the training data.  allowedValues: N/A. | type: ModelPeformance  multiplicity: \*  isOrdered: N/A  isUnique: N/A  defaultValue: None  isNullable: True |
| performanceTraining | It indicates the performance score of the AI/ML entity when performing on the training data.  allowedValues: N/A. | type: ModelPeformance  multiplicity: \*  isOrdered: N/A  isUnique: N/A  defaultValue: None  isNullable: False |
| AIMLTrainingProcess.progressStatus.progressStateInfo | It provides the following specialisation for the "progressStateInfo" attribute of the "ProcessMonitor" data type for the "AIMLTrainingProcess".  When the AI/ML training is in progress, and the "status" is equal to " RUNNING" it provides the more detailed progress information.  allowedValues for "status" = "RUNNING":  - COLLECTING\_DATA  - PREPARING\_TRAINING\_DATA  - TRAINING  The allowed values for "status" = "CANCELLED" are vendor specific. | Type: String  multiplicity: 0..1  isOrdered: N/A  isUnique: N/A  defaultValue: None  isNullable: False |
| inferenceOutputName | It indicates the name of an inference output of an AI/ML entity.  allowedValues: the name of the MDA output IEs (see TS 28.104 [2]), name of analytics output IEs of NWDAF (see TS 23.288 [3]), RAN-intelligence inference output IE name(s), and vendor’s specific extensions. | Type: String  multiplicity: 0..1  isOrdered: N/A  isUnique: N/A  defaultValue: None  isNullable: False |
| performanceScore | It indicates the performance score (in unit of percentage) of an AI/ML entity when performing inference on a specific data set (Note).  The performance metrics may be different for different kinds of AI/ML models depending on the nature of the model. For instance, for numeric prediction, the metric may be accuracy; for classification, the metric may be a combination of precision and recall, like the “F1 score”.  allowedValues: { 0..100 }. | Type: Real  multiplicity: 0..1  isOrdered: N/A  isUnique: N/A  defaultValue: None  isNullable: False |
| cancelRequest | It indicates whether the MnS consumer cancels the AI/ML training request.  Setting this attribute to "TRUE" cancels the AI/ML training request. Cancellation is possible when the requestStatus is the "NOT\_STARTED", " TRAINING\_IN\_PROGRESS", and "SUSPENDED" state. Setting the attribute to "FALSE" has no observable result.  Default value is set to "FALSE".  allowedValues: TRUE, FALSE. | Type: ENUM  multiplicity: 0..1  isOrdered: N/A  isUnique: N/A  defaultValue: FALSE  isNullable: False |
| suspendRequest | It indicates whether the MnS consumer suspends the AI/ML training request.  Setting this attribute to "TRUE" suspends the AI/ML training request. Suspension is possible when the requestStatus is the not “FINISHED" state. Setting the attribute to "FALSE" has no observable result.  Default value is set to "FALSE".  allowedValues: TRUE, FALSE. | Type: ENUM  multiplicity: 0..1  isOrdered: N/A  isUnique: N/A  defaultValue: FALSE  isNullable: False |
| cancelProcess | It indicates whether the MnS consumer cancels the AI/ML training process.  Setting this attribute to "TRUE" cancels the AI/ML training request. Cancellation is possible when the progressStateInfo is the not “FINISHED" state. Setting the attribute to "FALSE" has no observable result.  Default value is set to "FALSE".  allowedValues: TRUE, FALSE. | Type: ENUM  multiplicity: 0..1  isOrdered: N/A  isUnique: N/A  defaultValue: FALSE  isNullable: False |
| suspendProcess | It indicates whether the MnS consumer suspends the AI/ML training process.  Setting this attribute to "TRUE" suspends the AI/ML training request. Suspension is possible when the progressStateInfo is the not “FINISHED", “CANCELLING” or “CANCELLED” state. Setting the attribute to "FALSE" has no observable result.  Default value is set to "FALSE".  allowedValues: TRUE, FALSE. | Type: ENUM  multiplicity: 0..1  isOrdered: N/A  isUnique: N/A  defaultValue: FALSE  isNullable: False |
| managedEntityRef | It describes the entities that the MLApp is responsible for managing or optmimizing | Type: DN (see TS 32.156 [12])  multiplicity: \*  isOrdered: False  isUnique: True  defaultValue: None  isNullable: True |
| dataProviderRef | It describes the entities that have provided or should provide data needed by the MLApp, say for training or inference | Type: DN (see TS 32.156 [12])  multiplicity: \*  isOrdered: False  isUnique: True  defaultValue: None  isNullable: True |
| requestTrainingCondition | It indicates the condition for the AIMLT MnS producer to initiat AI/ML training.  allowedValues: N/A. | type: RequestTrainingCondition  multiplicity: \*  isOrdered: N/A  isUnique: N/A  defaultValue: None  isNullable: False |
| loadCondition | It indicates the load condition (in unit of percentage) for the AIMLT MnS producer to initiat AI/ML training. E.g. Percentage of PRB usage.  allowedValues: (0..100). | type: integer  multiplicity: 1  isOrdered: N/A  isUnique: N/A  defaultValue: None  isNullable: False |
| coverageCondition | It indicates the coverage condition (in unit of percentage) for the AIMLT MnS producer to initiat AI/ML training. E.g. Percentage of RSRP or SINR.  allowedValues: (0..100). | type: integer  multiplicity: 1  isOrdered: N/A  isUnique: N/A  defaultValue: None  isNullable: False |
| areNewTrainingDataUsed | It indicates whether the other new training data have been used for the AI/ML model training.  allowedValues: TRUE,FALSE. | type: Boolean  multiplicity: 1  isOrdered: N/A  isUnique: N/A  defaultValue: None  isNullable: False |
| NOTE: when the performanceScore is to indicate the performance score for AI/ML training, the data set is the training data set. | | |

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| **End of modified section** |