**3GPP SA WG2 Meeting #154** **S2-2210900r01**

**Toulouse, FR, November 14 – 18, 2022**

**Source: Nokia, Nokia Shanghai Bell**

**Title:** **KI#1: Updates of Conclusions**

**Document for:** **Approval**

**Agenda Item: 9.23.1**

**Work Item / Release: FS\_eNA\_PH3/Rel-18**

*Abstract of the contribution: This paper proposes updates to the conclusions section for KI#1 in TR* 23*.700-81.*

# Discussion

In general, the ability for a service consumer to use a performance score to select an NWDAF Analytics and/or ML model may help such service consumer to obtain the desired level of correctness. Solution #7 proposes to associate a score attribute to NWDAF Analytics and ML models, which can be used in the selection of NWDAF Analytics and ML models. Such score attribute may be limited to an accuracy rating, as per current understanding at this point of the study or can be extended to metrics defined by the Analytics provider (i.e., AnLF) for what concerns rating analytics IDs, and by the ML model provider (i.e., MTLF) for what concerns ML models. The score is attributed by service consumers and should be visible to service consumers during the NWDAF discovery procedure.

The score attribute can be used by the Analytics ID/ML model provider as feedback from service consumer about the service delivered. Based on implementations, it can be used to trigger improvements of the services, and/or compared against the accuracy (and possibly other metrics) computed by the service provider itself.

The score can be attributed only by the true consumers of the service, and a token-based mechanism can be used to ensure that only such entities rate the service.

To improve correctness of analytics, MTLF needs to provide the most suitable ML model to AnLF. In order for MLTF to accomplish the task, AnLF can send information about what data and which data granularity are used as input to the inference. Similarly, to assist the AnLF in selecting the appropriate ML model for inference, the ML model provisioning response includes information about the data (parameters and data sources) that have been actually used for the training of the ML model. The new parameters are described in table 6.36.1-1.

# Proposal

It is proposed to add the following to TR 23.700-81.

\*\*\* Start of changes \*\*\*

## 8.1 Key Issue #1: How to improve correctness of NWDAF

For KI#1, it proposes the following principles:

**General aspects:**

- Analytics consumers and AnLF may indicate a "Use case context" when subscribing to or requesting analytics or ML model(s), respectively. The values of this parameter will not be standardized. The actions of the NWDAF based on the use case context are out of scope of 3GPP/implementation specific.

- NWDAF has the accuracy checking capability of analytics IDs and/or ML models, where NWDAF can store for a period of time the necessary information to determine the analytics IDs and/or ML model accuracy and provide the accuracy information to consumers when requested or use it for its internal processes.

- An NWDAF containing AnLF NWDAF with accuracy checking capability is able to provide or notify the accuracy information of Analytics IDs to the consumers of such service.

- An NWDAF containing MTLF NWDAF with accuracy checking capability is able to provide or notify the ML model accuracy degradation to the consumers of such service.

- A service consumer of NWDAF analytics services can provide information about the accuracy of the consumed Analytics ID. The accuracy information collected should be visible by other service consumers during the AnLF discovery and selection procedures (e.g., stored at NRF). The accuracy information can be attributed only by true service consumers.

**Input of accuracy check:**

- ML Model accuracy improvement can be achieved by comparing prediction using the current trained ML model and its corresponding ground truth data i.e. the corresponding true observed events.

- The MTLF is to reselect a new ML model or retrain the existing ML model that provided to the AnLF when it determines ML model degradation by either:

- MTLF determining ML model degradation by collecting new test data (including input data, ground truth data and the corresponding inference) and testing the ML model accuracy. MTLF can compute accuracy by comparing the predictions and the corresponding ground truth data.

NOTE 1: Input data is the necessary data which is collected by AnLF to perform inference to generate prediction and the ground truth data is the actual measured data which corresponds toa prediction.

- MTLF can collect data for monitoring purposes from AnLF, ADRF or other NF. When ADRF is used, the MTLF can retrieve the data by specifying in the request the DataSetTag.

NOTE 2: The DataSetTag is defined from the conclusions of KI#4.

- MTLF subscribes to AnLF, that is registered in MTLF with its accuracy monitoring for a model provided by that MTLF, for getting notifications of the accuracy degradation of the analytics generated by the model, where the AnLF determines accuracy information based on any of the following:

Editor's note: The analytics consumer NF making some decision may change the trend indicated by the prediction output. The analytics consumer NF may provide a unified feedback related to the effect of an analytics on the changes in network status after the consumption of analytics. How to define such unified feedback and based on which logic is FFS.

- Comparing predictions and its corresponding ground truth data.

NOTE 3: The ground truth data and the corresponding prediction is to be defined per Analytics ID.

- Comparing changes in internal configuration for the analytics ID generation (e.g. data collection parameters).

- Previous existent records of analytics accuracy information.

- AnLF/MTLF can evaluate the quality of the data from the 3rd party data sources for input data selection.

- An AnLF can provide information about the accuracy of the consumed ML model. The accuracy information collected should be visible by other AnLF during the MTLF discovery and selection procedures. The feedback can be attributed only by true service consumers.

**Triggers of performance check:**

- MTLF with accuracy checking capability of ML models can trigger the analytics accuracy checking based on its internal logic or configuration which may require to subscribe events, i.e. a change in the policy and/or a change in the subscription data for Target of ML Model Reporting, etc.

- When requesting an ML model via the MLModelProvision service, the AnLF can specify in the request the additional parameters indicating the need for ML model accuracy check.

- When MTLF provides an ML model to an AnLF, the MTLF requests/subscribes AnLF to determine accuracy of the analytics generated from that model by comparing predictions and its corresponding ground truth data, if the AnLF indicates it can provide accuracy feedback.

- An analytics consumer may request or subscribe to accuracy information about Analytics ID(s) from the AnLF with the performance checking capabilities. Accuracy information can be included in an accuracy report, scoped in the same way as Analytics requests are scoped, i.e. per Analytics ID, for a specific area, slice, (group of) UEs, in a given time window, etc. Such request or subscription triggers the monitoring and check of Analytics ID(s) and generation of analytics accuracy information.

**Actions after accuracy check:**

- When accuracy information includes an indication that the accuracy of the analytics does not meet the consumer's requirements, the analytics consumer may stop using analytics for a period of time or obtain new analytics.

In addition, accuracy information may also include updated analytics for the provided analytics ID, if the updated analytics is able to be generated within the correction time period.

- When accuracy information includes indications for the NF to stop or pause the consumption of the analytics, the NF may unsubscribe to the analytics ID, or provide an indication to AnLF that it is pausing an existing subscription of the analytics ID. Once AnLF determines the accuracy of the analytics is improved to meet the consumer's requirements for an analytics ID, the AnLF may notify the NF consumer with an indication for resuming consumption of analytics ID.

- NF consumers of Analytics ID(s) upon receiving an accuracy information from an AnLF may request a pause or resume of notification from existing subscriptions.

- NWDAF can rate 3rd party data sources based on data source performance monitoring and reporting. Monitoring can be performed by NWDAF containing MTLF considering the data distribution or data drift, (i.e., between predictions and ground truth data) or alternatively by the NWDAF containing AnLF considering either the data drift or the evaluation feedback provided by service consumer. As possible input to allow NWDAF rate data sources, an AF can explicitly indicate the accuracy of a data source by introducing a weight.

**Other aspects:**

- In order to improve correctness of NWDAF Service Experience analytics, the AF may provide "Service Experience Contribution Weights" to the NWDAF as described in Solution #2.

- Providing Multiple ML models to AnLF may help improve Analytics accuracy. In this case, each ML model shall indicate the providing MTLF and is assigned a unique ML Model identifier (i.e. unique within a PLMN) by the providing MTLF.

NOTE 4: The structure and format of the ML Model identifier and its uniqueness are up to stage 3.

- When requesting an ML model via the MLModelProvision service, the AnLF can specify in the request the information about input data type and their granularity to assist MTLF in the ML model selection. Similarly, to assist the AnLF in selecting the appropriate ML model for inference, the ML model provisioning response includes information about the input data sources and their granularity that have been actually used for the training of the ML model.

- In order to enable AnLF to know if a model can represent the group of UEs which are Target of ML Model Reporting, Representative Ratio may be provided from MTLF to AnLF as part of the model information. AnLF may provide a threshold of Representative ratio as part of the input parameters in the Model Provisioning request.

\*\*\* End of changes \*\*\*