**3GPP TSG-WG SA2 Meeting #161 *S2-2402063***

**Athens, Greece, 26 February – 1 March, 2024 (revision of S2-2400804)**

**Source: Huawei, HiSilicon**

**Title: New Use Case for WT#2: VFL between NWDAFs**

**Document for: Approval**

**Agenda Item: 9.15**

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*Abstract: Propose a use case for using VFL among NWDAFs for improving the accuracy and effectiveness of analytics when NWDAFs are not allowed to share their ML Models.*

# 1. Introduction

In an attempt to expand the possible collaborations for training processes in NWDAF architecture, the TR 23.700-84 defined the KI#2 to investigate the scenarios that can benefit from joint collaborative training based on Vertical Federated Learning principles as well as the associated mechanisms to support such processes.

# 2. Discussion

This contribution identifies the scenario where analytics aggregation with NWDAFs from different vendors without interoperability cannot use current HFL for the generation of the aggregated analytics output based on the collaborative training of ML models, therefore, aligned ML models. In such scenario the ML models of the multiple vendor NWDAFs cannot be shared, preventing the HFL mechanisms to be used.

Therefore, VFL among NWDAFs is proposed.

# 3. Text Proposal

It is proposed to capture the following changes vs. TR 23.700-84.

\* \* \* \* First change \* \* \* \*

### 5.1.y Use Case #y: Vertical Federated Learning among NWDAFs

This use case is related to the KI#2 on studying the support for Vertical Federated Learning with focus on the identification of the scenario where VFL is relevant for the joint ML model training among NWDAFs.

when multiple NWDAFs instances are deployed in a mobile network, it is possible that one single NWDAF instance cannot generate the required analytics output, e.g. for different area of interest or PLMNs. In details:

On roaming scenarios, e.g., when VPLMN aggregates its own generated analytics (i.e, H-analytics output) with the requested analytics from V-RE-NWDAF (V-analytics output) as specified in TS 23.288 Clause 6.1.5.3. Or, the NWDAF from different vendors cannot share the model for the same samples (e.g. AoIs) during analytic aggregation.

When analytics aggregation is used within the same mobile network, Examples of such analytics ID are:

- Slice load analytics (Clause 6.3);

- Service experience (Clause 6.4): for slice, for application, for an Edge Application over a UP path, for an Edge Application over a UP path

- User data congestion (Clause 6.8)

- QoS Sustainability (Clause 6.9)

- Dispersion analytics (Clause 6.10)

- DN Performance Analytics (Clause 6.14)

if the ML Models supporting the generation of the aggregated analytics ID in each NWDAF instance are not collaboratively trained, the final single output will have a low accuracy. .

Besides, different NWDAF vendors without interoperability support may be involved in the analytics generation. In this case, such different vendors may use different features as some of the input data may not be available or the models from the different vendors for the same analytics ID may use some additional data that is not standardized. This means that NWDAFs from different vendors may have different features for the same analytics ID.

The alternative for supporting proper analytics aggregation as mentioned above, when NWDAFs cannot share their ML models, is to use VFL as the collaborative joint ML technique.

The value of VFL for this UC is to enable the joint ML training to align ML models (i.e., be able to capture in one model characteristics perceived by a different model), without ML model sharing nor input data sharing. In this sense, this use case considers completely different feature space (such as in the roaming case) as well as some level of overlap in the feature space (e.g., in case of aggregation).

NOTE 1: The VFL between roaming scenario will be studied in the context of this use case based on the architecture defined in TS 23.288 clause 6.1.5.2 and 6.1.5.3, if it does not require different mechanism as non-roaming.

NOTE 2: The VFL sample alignment supporting analytics aggregation scenarios (e.g., using slice or application identifiers) will be studied in the context of this use case.

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