**SA WG2 Meeting #161 S2-2402990r02**

**February 26 – March 1, 2024, Athens, Greece**

**Source: InterDigital Inc.**

**Title: New use case for Vertical Federated Learning**

**Document for: Approval**

**Agenda Item: 19.15**

**Work Item / Release: FS\_AIML\_CN / Rel-19**

*Abstract of the contribution:* *This paper proposes a new use case on WT#2 for Vertical Federated Learning.*

# 1 Discussion

Based on the last SA#102 Plenary meeting of the approved R19 FS\_AIML\_CN (SP-231800), this paper proposes a use case related to WT2.

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| * WT2: Study whether and what potential enhancements are needed to enable 5G system to assist in collaborative AI/ML operation involving 5GC/NWDAF and/or AF for “Vertical Federated Learning (VFL)”. **The work will be based only on and limited to the scope of justified use cases.**
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# 2. Proposal

It is proposed to adopt the following text in TR 23.700-84.

 **\* \* \* \* Start of Changes (All new text) \* \* \* \***

## 5.1.X Use Case #X: Vertical Federated Learning for Member UE Selection Assistance.

### 5.1.X.1 Description

In Release 18, the 5GC supports a new service for member UE selection assistance to help Application Functions (AF) with determining candidate UEs based on filtering criteria provided by the AF. The procedure is described in detail in clause 4.15.13in TS 23.502.

Figure 1 illustrates some aspects of the member UE selection procedure.

The AF provides UE1-UE7 as the target UEs, along with some filtering criteria to the 5GC.

The 5GC uses the filtering criteria to determine a list of candidate UEs that can be potentially used by the application function. In the example, 5GC determines that candidate UEs are UE1-UE5.

In this UC, it is assumed that the NEF may use ML models to infer the member UE candidates to be provided to the requesting AF. E.g., the 5GC and one or more AFs may collaborative train ML models used to infer member UE selection, to improve the performance of these models, in particular when sensitive data cannot be shared. An example is provided where ML models may be trained for specific sample, e.g., an S-NSSAI, and the 5GC and AF may collect local training data using distinct Member UE selection operations.



Figure 1. Example 1 of Member UE Selection Assistance by 5GC.

The 5GC may benefit from intermediate results from the ML Models run at the AF with local data,. and use this information to further refine the member UE selection assistance procedure. The 5GC (e.g., a NEF) may build a ML model to infer member UE selection candidates, and request NWDAF to train this ML model using intermediate results from the AF.

Note: As per note 7, within S2-2401624, “Solutions based on interactions between the application client and 5GS are out of scope”, this UC thus focuses on new VFL mechanisms to enable training of ML Models for member UE selection functionality, supported in current Rel.18 specifications.

In a second example shown in Figure 2, two application functions use the member UE selection assistance service with the 5GC to help select UEs for their application traffic.



Figure 2. Example 2 of member UE selection assistance by 5GC.

The application functions AF1 and AF2 request from the 5GC to assist with member UE selection, providing each an AoI, an S-NSSAI and one or more filtering criteria. AF1 and AF2 may have a subset of UEs from the two target UE lists, that are common in both member UE selection assistance requests. In the example, UE5, UE6 and UE7 are common UEs provided in the requests from AF1 and AF2.

In this case, the 5GC may provide these common UEs in the candidate UE list, which can be selected by both Application functions afterwards. It may be that the resources required from the common UEs (UE5-UE7 in the example) to exchange traffic related to AF1 and AF2 cannot be fulfilled together or are not optimal. In this scenario, the 5GC may benefit from intermediate results from AF1 and AF2, and use these intermediate results to be able to provide a more educated recommendation for member UE selection assistance for both AF1 and AF2, e.g., if/when AFs modify a filtering parameter in the current subscription, as described in TS 23.502, clause 4.15.13.0.

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