A Handover Scheme for Service Continuity in VMR-aided Hierarchical Federated Learning

Scenario:

The VRMs serve as the second aggregator in the two-tier hierarchical federated learning architecture:

First layer: VMR --- UEs, one VMR aggregation --- > k_I UE iterations: $w_{ij}^{k+1} \leftarrow w_{ij}^k - \alpha \frac{\partial L}{\partial w_{ij}^k}$

Second layer: gNB --- VMRs, one gNB (global) aggregation --- > k_2 relay aggregations

Problem:



Standard impact:

1. T_1, T_2, t_1, t_2 are new signalings, need to upload to gNB as handover decision at gNB,

2. The choice of k_1 and k_2 have impact on service continuity

Solution:

T_remain --- estimated VMR *i* stay time;

T_1 --- The time for gNB to finish global aggregation in this round, i.e., we have $(k'_1 < k_1)$ relay aggregations left

T_2 --- The time for gNB to finish global aggregation in next round (k_1 relay aggregations) **T_train** = T_1 +T_2

- a) If T_remain > T_train, no handover;
- b) If **T_1 < T_remain < T_train**, handover after global aggregation in this round is finished

Note \div all VMRs ,UEs and the gNB share the same global model at handover.

If T_remain < T_1,

t_1 --- The time for VMR to finish relay aggregation in this round, i.e., we have $(k'_2 < k_2)$ UE iterations left

t_2 --- The time for VMR to finish k_2 UE iterations in next round **t_train** = t_1 +t_2

c) T_remain > t_train, no handover

- d) **t_1** < **T_remain** < **t_train**, handover after relay aggregation is finished in this round, VMR *i* send local Model to VMR *j* to finish the rest.
- e) **T_remain** < **t_1**, VMR *i* force an aggregation and handover to VMR *j*, then it does what is in d)

SP 211648 FS_AIMLsys: WT#1.1 c. Enhancements **of external parameter provisioning to 5GC** (e.g. expected UE activity behaviors, expected UE mobility, etc.) based on Application AI/ML operation.

SP 211636 FS_VMR: WT#1. efficient mobility and service continuity for UE or a group of UEs to efficiently deliver data during different mobility scenarios (including mobility of the mobile base station relays).

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