**3GPP TSG-CT WG3 Meeting #142C3-253556**

**25-29 August 2025, Goteborg, Sweden *(was\_C3-25xxxx)***

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| *CR-Form-v12.2* | | | | | | | | |
| **CHANGE REQUEST** | | | | | | | | |
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|  |  | **CR** | **0165** | **rev** | **-** | **Current version:** |  |  |
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| *For* [***HE******LP***](http://www.3gpp.org/3G_Specs/CRs.htm#_blank)*on using this form: comprehensive instructions can be found at* [*http://www.3gpp.org/Change-Requests*](http://www.3gpp.org/Change-Requests)*.* | | | | | | | | |
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| ***Proposed change affects:*** | UICC apps |  | ME |  | Radio Access Network |  | Core Network | **x** |

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| ***Title:*** | Support of VFL inference procedures | | | | | | | | | |
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| ***Source to WG:*** |  | | | | | | | | | |
| ***Source to TSG:*** |  | | | | | | | | | |
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| ***Work item code:*** | AIML\_CN | | | | |  | ***Date:*** | | | 2025-08-15 |
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| ***Category:*** | **B** |  | | | | | ***Release:*** | | | Rel-19 |
|  | *Use one of the following categories:* ***F*** *(correction)* ***A*** *(mirror corresponding to a change in an earlier release)* ***B*** *(addition of feature),* ***C*** *(functional modification of feature)* ***D*** *(editorial modification)*  Detailed explanations of the above categories can be found in 3GPP [TR 21.900](http://www.3gpp.org/ftp/Specs/html-info/21900.htm). | | | | | | | | *Use one of the following releases: Rel-8 (Release 8) Rel-9 (Release 9) Rel-10 (Release 10) Rel-11 (Release 11) … Rel-16 (Release 16) Rel-17 (Release 17) Rel-18 (Release 18) Rel-19 (Release 19)* | |
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| ***Reason for change:*** | | SA2 introduces VFL inference procedures in clause 6.2H.2.4 of TS 23.288 between VFL server and VFL clients. Current clause 5.10.3.4 is the placeholder for VFL inference procedures. Stage 3 needs to capture above procedures in the current specification. | | | | | | | | |
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| ***Summary of change:*** | | Add VFL inference procedures in TS 29.552 | | | | | | | | |
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| ***Consequences if not approved:*** | | Stage 2 requirements cannot be fulfilled. | | | | | | | | |
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| ***Clauses affected:*** | | 5.10.3.4, 5.10.3.4.1 (new), 5.10.3.4.2(new) | | | | | | | | |
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|  | | **Y** | **N** |  | | | |  | | |
| ***Other specs*** | |  | **x** | Other core specifications | | | | TS/TR ... CR ... | | |
| ***affected:*** | |  | **x** | Test specifications | | | | TS/TR ... CR ... | | |
| ***(show related CRs)*** | |  | **x** | O&M Specifications | | | | TS/TR ... CR ... | | |
|  | |  | | | | | | | | |
| ***Other comments:*** | | This CR does not impact the OpenAPI file. | | | | | | | | |
|  | |  | | | | | | | | |
| ***This CR's revision history:*** | |  | | | | | | | | |

\* \* \* First Change \* \* \* \*

#### 5.10.3.4 Inference procedures

##### 5.10.3.4.1 General

The inference procedures are triggered by NWDAF containing AnLF. The NWDAF containing AnLF determines the VFL server (i.e., NWDAF, trusted AF, or untrusted AF) based on the VFL server discovery procedure as described in the clause 4.4.52.2 of 3GPP TS 29.522 [10]. The VFL server generates and responses an aggregation result to NWDAF containing AnLF based on local inference results received from each VFL client(s).

The inference procedures in this clause include the following cases:

* subclause 5.10.3.4.2 specifies the inference procedure when NWDAF or trusted AF is acting as VFL server while VFL client(s) can be NWDAF, AF, and/or untrusted AF;

- subclause 5.10.3.4.3 specifies the inference procedure when untrusted AF is acting VFL server while VFL client(s) can be NWDAF.

##### 5.10.3.4.2 Inference procedure for vertical federated learning when NWDAF or Trusted AF is acting as VFL server

The inference procedure when trusted AF is acting as VFL server may be triggered by a request or subscription from a 5GC consumer NF or internal service logic of the AF acting as VFL server. This procedure is used by the NWDAF containing VFL Server to trigger inference procedure for Vertical Federated Learning among multiple NWDAF instances and/or AF containing VFL client.



Figure 5.10.3.4.2-1: General procedure for Vertical Federated Learning when NWDAF is acting as VFL server

0. To send a request for ML model analytics events, the NWDAF service consumer invokes the Nnwdaf\_EventsSubscription\_Subscribe service operation to NWDAF containing AnLF as described in clause 4.10.2.2 of 3GPP TS 29.520 [5], or the NWDAF service consumer invokes Nnwdaf\_AnalyticsInfo\_Request service operation to NWDAF containing AnLF to request the analytics information as described in clause 4.3.2.2 of 3GPP TS 29.520 [5].

1. The NWDAF containing AnLF determines the NWDAF or trusted AF acting as an VFL server. If NWDAF is selected as VFL server, the NWDAF containing AnLF invokes the Nnwdaf\_EventsSubscription\_Subscribe service operation to VFL server NWDAF as described in clause 4.10.2.2 of 3GPP TS 29.520 [5]. If the trusted AF is selected as VFL server, the NWDAF containing AnLF invokes Naf\_Inference\_Subscribe service operation to VFL server trusted AF to perform the VFL inference as described in clause 5.5.2.2.2 of 3GPP TS 29.530 [X].

2. The VFL server and VFL clients perform VFL training procedures as described in clause 5.10.3.3.

3. The NWDAF or trusted AF acting as VFL server sends the VFL inference request to each VFL client.

3a. If the VFL client is another instance of NWDAF, the NWDAF or trusted AF acting as VFL server invokes Nnwdaf\_VFLInference\_Subscribe service operation as described in clause 4.11.2.2.2 of 3GPP TS 29.520 [5]. If the Subscription is successfully processed and accepted, the VFL client sends Nnwdaf\_VFLInference\_Subscribe Response message as described in clause 4.11.2.2.2 of 3GPP TS 29.520 [5].

3b. If the VFL client is a trusted AF, the NWDAF or trusted AF acting as VFL server invokes Naf\_VFLInference\_Subscribe service operation as described in clause 5.5.2.2.2 of 3GPP TS 29.530 [X]. If the Subscription is successfully processed and accepted, VFL client sends Naf\_VFLInference\_Subscribe Response message as described in clause 5.5.2.2.2 of 3GPP TS 29.530 [X].

3c. If NWDAF VFL client is an untrusted AF, the NWDAF or trusted AF acting as VFL server invokes Nwdaf\_VFLInference\_Subscribe service operation through NEF. The NEF invokes Naf\_VFLInference\_Subscribe by sending an HTTP POST request as described in clause 5.5.2.2.2 of 3GPP TS 29.530 [X]. If the Subscription is successfully processed and accepted, VFL client sends Naf\_VFLInference\_Subscribe response message as described in clause 5.5.2.2.2 of 3GPP TS 29.530 [X]. The NEF sends Nwdaf\_VFLInference\_Subscribe response message to VFL server as described in clause 4.11.2.2.2 of 3GPP TS 29.520 [5].

NOTE 1: For the trusted AF is acting as VFL server, the VFL client can only be the NWDAF.

4. Each VFL client collects its local data. Based on the "notifCorrId" attribute received in step 1, each VFL Client determines the VFL local model to generate the intermediate local inference results.

5. Each VFL client sends the client intermediate local results to the VFL server.

5a. If the VFL client is another instance of NWDAF, then it sends the response to the VFL server by invoking Nnwdaf\_VFLInference\_Notify service operation as described in clause 4.11.2.4.2 of 3GPP TS 29.520 [5].

5b. If the VFL client is a trusted AF, then it sends the response to the VFL server by invoking Naf\_VFLInference\_Notify service operation as described in clause 5.3.2.4 of 3GPP TS 29.530 [X].

5c. If the VFL client is an untrusted AF, then it sends the response to the VFL server to NEF by invoking Naf\_VFLInference\_Notify service operation as described in clause 5.3.2.4 of 3GPP TS 29.530 [X]. For each untrusted AF VFL client, the NEF converts any external identifiers to internal identifiers and the NEF invoking Nnef\_VFLInference\_Notify service operation as described in clause 4.11.2.4.2 of 3GPP TS 29.522 [10].

6. The VFL server combines all the intermediate local results to generate the combined inference results.

7. If the NWDAF is the VFL server in step 1 and analytics notifications are to be sent, the VFL server NWDAF invokes Nnwdaf\_EventsSubscription\_Notify service operation to NWDAF containing AnLF as described in clause 4.2.2.4 of 3GPP TS 29.520 [5]. The NWDAF containing AnLF responds to the Nnwdaf\_EventsSubscription\_Notify service operation as described in clause 4.2.2.4 of 3GPP TS 29.520 [5].

If the trusted AF is VFL server in step 1 and analytics notifications are to be sent, the VFL server NWDAF invokes Naf\_Inference\_Notify service operation to NWDAF containing AnLF as described in clause 5.3.2.4 of 3GPP TS 29.530 [X]. The NWDAF containing AnLF responds to the Naf\_Inference\_Notify service operation as described in clause 5.3.2.4 of 3GPP TS 29.530 [X].

8. The NWDAF containing AnLF invokes the Nnwdaf\_EventsSubscription\_Notify service operation to the consumer as described in clause 4.2.2.4 of 3GPP TS 29.520 [5], or sends Nnwdaf\_AnalyticsInfo\_Request response message to the consumer as described in clause 4.3.2.2 of 3GPP TS 29.520 [5].

##### 5.10.3.4.3 Inference procedure for vertical federated inference when untrusted AF is acting as VFL server

This procedure is used by the NWDAF containing VFL Server to trigger inference procedure for Vertical Federated Learning among multiple NWDAF instances and/or AF containing VFL client.



Figure 5.10.3.4.3-1: Inference procedure for Vertical Federated Learning when untrusted AF is the VFL Server

0. Same as step 0 in clause 5.10.3.4.2.

1. The NWDAF containing AnLF determines the untrusted AF acting as an VFL server. The NWDAF containing AnLF invokes Nnef\_Inference\_Subscribe service operation to NEF as described in clause 4.4.50.2 of 3GPP TS 29.522 [10] and then NEF forwards the subscription to the VFL server untrusted AF using Naf\_Inference\_Subscribe service operation to perform the VFL inference as described in clause 5.5.2.2 of 3GPP TS 29.530 [X].

2. The VFL server and VFL clients perform VFL training procedures as described in clause 5.10.3.3.

3. The untrusted AF acting as VFL server sends a inference request to VFL clients by invoking Nnef\_VFLInference\_Subscribe service operation to all associated VFL clients i.e., NWDAF, as described in clause 4.4.50.2 of 3GPP TS 29.522 [10].

4. The NEF sends the inference request received from the untrusted AF acting as VFL server to VFL clients i.e., NWDAF instances. The NEF shall map the external NWDAF and GPSI(s) to the internal NWDAF and SUPI(s). The inference request will be sent through NEF by invoking Nnwdaf\_VFLInference\_Subscribe service operation as described in clause 4.11.2.2.2 of 3GPP TS 29.520 [5].

5. Same as step 2 in clause 5.10.3.4.2. Additionally, an NWDAF VFL client which is interacted with additional NWDAF VFL client(s) receives responses from each of those client(s) and then aggregates the intermediate result.

6. Each VFL client responses to NEF with the client intermediate local results by invoking the Nnwdaf\_VFLInference\_Notify service operation as described in clause 4.11.2.4.2 of 3GPP TS 29.520 [5].

7. The NEF maps the internal NWDAF and SUPI(s) to external NWDAF and GPSI(s) by invoking Nnef\_VFLInference\_Notify service operation to the untrusted AF acting as VFL server as described in clause 4.11.2.4.2 of 3GPP TS 29.522 [10].

The VFL server untrusted AF sends the notification of the inference result to NWDAF containing AnLF by invoking Nnef\_Inference\_Notify service operation to NEF as described in clause 4.4.50.2 of 3GPP TS 29.522 [10] and then NEF forwards the subscription to the NWDAF containing AnLF using Naf\_Inference\_Notify service operation as described in clause 5.3.2.4 of 3GPP TS 29.530 [X].

8. Same as step 8 in clause 5.10.3.4.2.

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