3GPP TSG SA Plenary #101 Tdoc SP-231137

**Bangalore, IN, 11th -15th September 2023**

**Source: Qualcomm (moderator)**

**Title: New SID on Core Network Enhanced Support for Artificial Intelligence (AI)/Machine Learning (ML) -- after post-SA2#158 CC**

**Document for: Approval**

**Agenda Item: 6.4.2**

3GPP™ Work Item Description

Information on Work Items can be found at <http://www.3gpp.org/Work-Items>   
See also the [3GPP Working Procedures](http://www.3gpp.org/specifications-groups/working-procedures), article 39 and the TSG Working Methods in [3GPP TR 21.900](http://www.3gpp.org/ftp/Specs/html-info/21900.htm)

Title: Study on Core Network Enhanced Support for Artificial Intelligence (AI)/Machine Learning (ML)

Acronym: FS\_AIML\_CN

Unique identifier:

Potential target Release: Rel-19

# 1 Impacts

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Affects: | UICC apps | ME | AN | CN | Others (specify) |
| Yes |  |  |  | X |  |
| No | X | X | X |  |  |
| Don’t know |  |  |  |  |  |

# 2 Classification of the Work Item and linked work items

## 2.1 Primary classification

### This work item is a …

|  |  |
| --- | --- |
| X | Study |
|  | Normative – Stage 1 |
|  | Normative – Stage 2 |
|  | Normative – Stage 3 |
|  | Normative – Other\* |

**\* Other = e.g. testing**

## 2.2 Parent Work Item

For a brand-new topic, use “N/A” in the table below. Otherwise indicate the parent Work Item.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Parent Work / Study Items | | | | | | | |
| Acronym | | Working Group | | Unique ID | | Title (as in 3GPP Work Plan) | |
| N/A | |  | |  | |  | |
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### 2.3 Other related Work Items and dependencies

|  |  |  |
| --- | --- | --- |
| Other related Work /Study Items (if any) | | |
| Unique ID | Title | Nature of relationship |
|  |  |  |
| 940073 | Study on Enablers for Network Automation for 5G - phase 3 | Related study for 5GC intelligence |
| 980019 | (Stage 2 for AIML) System Support for AI/ML-based Services | Related study for AIML |
|  |  |  |

# 3 Justification

The convergence of communication network and Artificial Intelligence (AI) technology is progressing based on work done in previous releases on AI-enabled network architecture and leveraging AI/Machine Learning (ML) to enable 5GC intelligence in terms of data collection, ML model training, analytics inference, and closed-loop procedures by consuming data analytics, etc. NWDAF mechanisms and enhancements have been defined in Rel. 16, Rel. 17, and Rel. 18. Moreover, Rel. 18 AIMLsys has introduced 5GC assistance capabilities to support AI/ML operations in the application layer specified in TS 22.261.

One main component i considered for Rel. 19:

* Architecture enhancement to support 5G Core intelligence.

This study item builds on Rel-18 work to support enhancements to 5GC intelligence, alignment and convergence between SA2 and RAN WG for UE data collection framework, and ML model sharing. Based on the work in previous release, there is a need to study how to leverage AI/ML technologies to enable 5GC by providing network automation and improving 5G system efficiency. This may include handling of signalling storms, 5GC NF operations (i.e. policy control and QoS) assisted by NWDAF.

There are widespread efforts and support for AI/ML across various 3GPP WGs, and thus work is required to study possible architectural and functional extensions for cross-domain AI/ML interworking and coordination (e.g., UE, RAN, Core, applications, etc.) to address the overall AI/ML framework. This includes studying whether and how Vertical Federated Learning (VFL) may support AI training and inference for verifying and/or predicting e.g. the application QoE performance, network energy saving, and mobility optimization, and to support the AI/ML related data or model sharing.

# 4 Objective

The aim of this study work is to investigate and identify potential architecture and system level enhancements to support AI/ML enhancements.

Specifically, the objectives include:

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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 for “Vertical Federated Learning (VFL)”. This includes use cases for service provisioning, functionality and dataset alignment/mapping.

NOTE F: RAN and UE aspects are out of scope. Interactions between the application client and 5GS are out of scope. The necessary communication between AF and UE application client to support the collaborative AI/ML operation is understood as no normative procedure impact. Horizontal FL procedure defined in R18 should be taken into account and reused whenever possible.

NOTE G: coordination with SA6 is required.

* WT3: Study enhancements to support NWDAF-assisted policy control and address network abnormal behaviour
* WT3.1 – Study whether and what additionally needs to be supported in order to enhance 5GC NF operations (i.e. policy control and QoS) assisted by NWDAF. The work will firstly identify the specific use cases to be considered, in order to identify the appropriate scope. The work will analyse the result impacts on NWDAF (e.g. the need to understand specific NF functionality), and the compatibility of new solutions wrt existing analytics, in order to determine the need and benefits of new solutions.
* WT3.2 - Study prediction, detection, prevention, and mitigation of network abnormal behaviours i.e. signalling storm with the assistance of NWDAF.

NOTE H: The study will focus primarily on existing enforcement mechanisms when available and identify new ones when no existing ones can be used.

NOTE I: The study will consider the study/work done by SA WG5 and CT WG4 in this regard already and collaborate with SA WG5/CT WG4 regarding the handling of abnormal network behaviours.

## TU estimates and dependencies

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Work Task ID** | **TU Estimate**  **(Study)** | **TU Estimate**  **(Normative)** | **RAN Dependency**  **(Yes/No/Maybe)** | **Inter Work Tasks Dependency** |
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|  |  |  |  |  |
| WT#2 | 2 | 2 | No |  |
| WT#3 | 2 | 2 | No |  |
| WT#3.1 | 1 | 1 |  |  |
| WT#3.2 | 1 | 1 |  |  |

**Total TU estimates for the study phase: 4**

**Total TU estimates for the normative phase: 4**

**Total TU estimates: 4**

# 5 Expected Output and Time scale

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| New specifications {One line per specification. Create/delete lines as needed} | | | | | |
| Type | TS/TR number | Title | For info  at TSG# | For approval at TSG# | Rapporteur |
| Internal TR | 23.xxx | Study on Core Network Enhanced Support for Artificial Intelligence (AI)/Machine Learning (ML) | TSG#103  June 2024 | TSG#104  June 2024 | TBD |

|  |  |  |  |
| --- | --- | --- | --- |
| Impacted existing TS/TR {One line per specification. Create/delete lines as needed} | | | |
| TS/TR No. | Description of change | Target completion plenary# | Remarks |
|  |  |  |  |
|  |  |  |  |

# 6 Work item Rapporteur(s)

TBD

# 7 Work item leadership

S2

# 8 Aspects that involve other WGs

The following aspects involving other WGs may arise related to this SID:

- Support for security and privacy aspects on data collection and model transfer/delivery to UE should be discussed in SA3.

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- SA4 for EVEX and AI4Media

- SA5 for MDAS

- CT4 for signalling storm aspects

- SA6 for application client related aspects

# 9 Supporting Individual Members

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| Supporting IM name |
| China Mobile |
| ETRI |
| Interdigital |
| Lenovo |
| KDDI |
| KPN |
| OPPO |
| Rakuten Mobile |
| Samsung |
| Vivo |
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