

NWM AI/ML Summary
Variant of SA2 Rel-19 23Q3 moderated discussion - AI/ML enhancements Version 0.0.1
SA2

<https://nwm-trial.etsi.org/#/documents/8578>

1 Introduction

In the SP-230759, a list of potential WTs for MED (starting point) was captured:

Table 1:

<p>AI/ML enhancements</p>	<ol style="list-style-type: none"> 1. Enhancements to NWDAF to support policy recommendations and online learning. 2. Generalized framework for UE data collection to support AI/ML use cases. 3. AI/ML alignment and convergence for Air interface and 5G Core network <ol style="list-style-type: none"> 1. Study trustworthiness for data used by MTLF (Model Training Logical Function) and AnLF (Analytics Logical Function) to provide ML models and analytics. 2. Study trustworthiness for ML models provided by MTLF. 3. Study trustworthiness for analytics provided by AnLF. <ol style="list-style-type: none"> 1. Architecture extensions for coordination of cross-domain AI/ML functionalities^{1,2,3,4,5}: i.e. support for 5GC-UE and 5GC-RAN AI/ML related exposure and collaboration, and MTLF-MDAS collaboration 2. Architectural and functional extensions to support AI/ML-based 5GC recommendation capabilities^{1,2} 3. Extensions for prediction, detection, prevention and mitigation of network misbehavior, e.g. abnormal NF behavior, performance degradation, signaling storm, operational conflict, etc. <ol style="list-style-type: none"> 1. Architecture extensions for coordination of cross-domain AI/ML functionalities. 2. 5G Core assistance for AIML related data exchange between UE and core network/OTT server 3. RAN AI-based Positioning 4. Detection/prevention/mitigation of signaling storm <p>** ADDED FROM RESILIENT CORE</p> <ol style="list-style-type: none"> 1. Operators has the ability to predict/recommend/mitigate NFs that are misbehaving and/or under signal storm. This could be based on NWDAF-assistance and related NF enhancements.
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A series of papers were submitted to the workshop that relate to AI/ML: SW-230007, SW-230009, SWS-230012, SWS-230013, SWS-230014, SW-230015, SWS-230016, SW-230017, SW-230018, SWS-230019, SWS-230020, SWS-230021, SWS-230025, SWS-230030, SWS-230032, SW-230033, SWS-230034, SWS-230035, SWS-230036, SWS-230038, SWS-230042, SWS-230045, SWS-230050, SWS-230054, SWS-230055, SWS-230056, SWS-230058, SWS-230061, SWS-230066, SWS-230068, SWS-230069, SWS-230073, SW-230078.

2 Scoping

2.1 Work Tasks based on input to and outcome of the Workshop

The initial set of Work Tasks for discussion, based on the input to the workshop and SP-230759, are as follows:

WT1: AI/ML alignment and convergence for air interface and 5GC (SWS-230012, SWS-230013, SWS-230014, SWS-230016, SWS-230019, SWS-230020, SWS-230021, SWS-230025, SWS-230030, SWS-230032, SWS-230034, SWS-230035, SWS-230038, SWS-230050, SWS-230054, SWS-230055, SWS-230056, SWS-230058, SWS-230061, SWS-230066, SWS-230068, SWS-230069, SWS-230073).

(Note: this relates to the RAN1/RAN2 effort)

- WT1.1: Whether and how to support a common 5GS AI/ML framework to enable AI/ML for radio interface. This includes studying 5GC/LMF extensions (e.g. UE selection, performance monitoring etc.) to enable AI/ML support for the RAN-1 AI/ML use cases;
- WT1.2: Whether and how to enhance UE data collection framework to meet requirements for RAN AI support for air interface operation (for RAN);
- WT1.3: Whether (and how) to support model transfer/delivery to the UE;
- WT1.4: Study support for security and privacy aspects on data collection and model transfer/delivery to UE (Authentication, Authorization, Subscription management);
- WT1.5: Study the Model ID alignment, Lifecycle management;
- WT1.6: Study QoS and policy control to support RAN model transfer and delivery (including data collection).

WT2: Interaction/coordination with RAN to support the AI enabled RAN framework AI (i.e. AI/ML for NG-RAN in Rel-18) (SWS-230035, SWS-230038, SWS-230042).

(Note: this relates to the RAN3 effort)

WT3: Study the following potential enhancements to enable 5G system to assist cross-domain (e.g. UE, 5G Core, application, OAM) application AI training and inference (so-called “Vertical Federated Learning (VFL)”) (SW-230007, SW-230009, SW-230016, SW-230018, SW-230019, SW-230021, SW-230032, SW-230035, SW-230054, SW-230058)

- WT3.1: How to support feature determination and alignment across domains when applying the VFL operation;
- WT3.2: How to identify/select the required NF(s) within the 5G Core domain corresponding to the local feature in order to collaborate on the VFL operation (i.e. training or inference);
- WT3.3: Whether and which policy configurations and enhancement are required in order to support VFL operation (i.e. training or inference);

- WT3.4: What is the proper transport mechanism to support cross-domain AI model training/inference data transfer.

WT4: Study 5GC extensions to support Transfer Learning in order to expedite the 5GC assistance for the model training or inference operation (SW-230007, SW-230009, SW-230017, SW-230018, SW-230025, SW-230030, SW-230033, SW-230038, SW-230050, SW-230054, SW-230058, SW-230066, SW-230078)

- WT4.1: Whether and what to extend in the existing Member UE selection in order to support Transfer Learning
- WT4.2: Whether and what to extend in the QoS & Policy control as well as in the service provisioning mechanisms in order to support Transfer Learning
- WT4.3: Whether and how to transfer AI model between the UEs via direct device connection

WT5: Study enhancements to NWDAF to support:

- WT5.1: NWDAF-assisted recommendations (SWS-230013, SWS-230014, SWS-230021, SWS-230045, SWS-230058, SWS-230068, SWS-230033, SWS-230034), including policy/QoS recommendations
- WT5.2: Signaling storm prediction, detection, prevention and mitigation (SWS-230013, SWS-230016, SWS-230034, SWS-230035, SWS-230050, SWS-230068)
- WT5.3: Misbehaving NF handling e.g. abnormal behaviour, performance degradation, operational conflict etc. prediction, detection, prevention and mitigation; study of the further information exchange with MDAF, etc. for specific operational use cases (SWS-230035, SWS-230058)
- WT5.4: Online learning (SWS-230014)
- WT5.5: Analytics and models trustworthiness, including input and output data (SWS-230036)
- WT5.6: NWDAF-assisted energy saving (SWS-230013, SWS-230019, SWS-230068)
- WT5.7: NWDAF assisted Sensing (SW-230015)
- WT5.8: NWDAF assisted 5G MBS and ProSe (SWS-230042, SWS-230055)

Feedback Form 1: Which of the above Work Tasks should be in scope of Rel-19?

1 – CATT

WT 1 and 2;

WT 3;

WT 4.3;

WT 5.1, 5.2, 5.3, 5.4, 5.6, 5.7 and 5.8

2 – DOCOMO Communications Lab.

- WT1 except WT1.4. *WT1.4 is excluded because security and privacy aspects can be covered by SA3.*
- WT2 as merged in WT1
- WT3
- *Due to the time constraint of Rel-19, We think WT4 which is mainly for D2D AI techniques can be postponed for the next releases.*
- WT5 except WT5.4. *WT5.4 is about online learning, to our understanding, it is an implementation issue. It depends on the implementation of NWDAF whether to use offline batched training or online training. These details are out of SA2's scope.*

3 – Guangdong OPPO Mobile Telecom.

Reply to comment#2 by Docomo lab: WT4 has its related SA1 requirements for R-19 (TR 22.876, section 6.2), hence it is important to study those in Rel-19 AIML, we believe.

4 – KDDI Corporation

Comment to docomo#2 and OPPO#3:

I have the same view as OPPO; WT#4 inherits SA1 requirements and is important for Rel-19.

5 – KDDI Corporation

I suggest prioritizing WT#5 at the sub-WT level, e.g., WT#5.1, WT#5.2, etc. Because WT#5 includes various and low correlated sub-WTs.

6 – ZTE Corporation.

WT#1 and WT#2 have RAN dependency. We prefer not to study in parallel. SA2 can do alignment after receiving input from RAN working groups.

7 – Nokia Germany

Some reduction is likely required to fit the time budget for a SID

Nokia support parts of WT1 (with reformulations and mergers as explained below), in particular **WT.1.1 and WT1.2**,

WT.1.3 needs to wait for RAN and **should be removed** for now

WT 1.5 seems **not required** as well as RAN is not discussing models ID. It is unclear what models are meant. Models in UE or RAN as in WT 1.3 would needs to wait for RAN anyway. And RAN will not have service based interfaces and thus leveraging model storage in 5GC for RAN models seems not realistic.

WT2is to be merged with WT1, NOK standalone.

WT4 should be dropped. This mainly relates to model transfer between UEs (WT 4.3), but before this is studied it should clear that we need models at the UE (See WT1.3 comments). Other sub WTs seem to overlap with WT3.

Nokia supports WT5.2, WT 5.3, WT 5.5

8 – Ericsson LM

Ericsson comments on WTs:

WT1: Ericsson agrees with Nokia that WT1.1, 1.2 and 1.3 cover areas that are not yet settled in RAN, so should be removed. WT1.4 seems to be SA3 responsibility, so shall also be removed. For WT1.5 sees no opportunity to align with RAN and shall therefore be removed.

WT2: Ericsson find it hard to distinguish between WT2 and WT1. Ericsson would like to remind the audience that the different groups in 3GPP differ in how they see the ML model LCM. So it will be hard to align from SA2, and to add, SA5 may study similar in Rel-18. An example of differences is that RAN cannot define FL which requires the model to be sent in clear between entities/NFs, since they have agreed that AI/ML algorithms and models are out of 3GPP scope. On top of this, the details of model performance feedback are also out of 3GPP scope in RAN. Ericsson finds it hard to agree to this WT.

WT3: Because of what is mentioned above for RAN. It needs to be clearly stated that RAN is out of scope. And to bridge cross domain we need to first agree on use cases.

WT3.4, intends to study what the proper transport mechanism is to support cross-domain AI model training/inference data transfer. Each domain has defined their own data transfer, which can be used for pre-sumable VFL. It is therefore suggested to be removed until it is clear why a new transfer is needed.

WT4: Ericsson agrees with Nokia and Docomo. Especially WT4.1 and 4.2 need to be questioned since we did similar work for FL over the top in Rel-18. What is expected to be new from that work?

WT5: WT5.1 seems to reflect a solution that has been up for discussion multiple times and been rejected because it has not been found useful compared to existing Analytics, and it would give two incompatible options for NF control. Also the NWDAF shall not have understanding of internals of NFs, making it impossible for NWDAF to recommend actions. Ericsson cannot agree to this WT.

For WT5.2 it would be good to state/limit the scope to use existing enforcements when available.

WT5.3 is an SA5 work task, so not acceptable to have in SA2.

Before WT5.4 is agreed it needs to be discussed how it may impact on the architecture, which we specify in SA2. Because it is believed to be possibly internal implementation in NWDAF.

Before WT5.5 is agreed it needs to be discussed whether this should be driven by SA2 or other group such as SA5.

Energy saving is an important area, but the use cases must be fully understood for WT5.6 before accepting it.

Remove WT5.7, because sensing is not clear. It is too early to assist something that is not even specified.

Before WT5.8 is agreed, it needs to be justified why this feature shall be assisted.

9 – Guangdong OPPO Mobile Telecom.

Response to #8 provided by Ericsson:

WT1: OPPO believes that whether and how RAN dependencies for WT#1.1, 1.2 and 1.3 should be addressed, is more a process discussion than a technical discussion and this process has not been clarified by SA/SA2 chairs yet. Furthermore, the RAN dependency related considerations are not unique to this study. It is more appropriate to have the working group level discussion instead of just simply removing legitimate WTs, especially that the upcoming SA and RAN groups Aug. meetings overlap and more progress is expected then.

As for WT#1.5, OPPO respectfully disagrees with Ericsson comments. Please refer to RAN2#121bis-e report for the agreement of the Model ID which shows very promising progress.

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- Model ID can be used to identify model or models for the following LCM purposes: model selection/activation/deactivation/switching (or identification, if that will be supported as a separate step), e.g. for so called “model ID based LCM”.

- If model transfer/delivery is supported, model ID can be used for model transfer/delivery LCM purpose

- How to achieve globality of the Model ID is FFS.

- Initial discussion in RAN2: the following global unique model ID definition directions can be considered as a starting point:

- o Direction1: Pre-defined/hard-coded global unique model ID

- o Direction3: Assigned global unique model ID via specific ID management node.

- o Note: Other global unique model ID definition is not precluded.

- Model ID structure, if any, is FFS

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Within the same 3GPP 5G system, there are no technical and compatibility reasons to define “different” Model IDs for different domains. Hence, SA2 which is responsible for system architecture, should take RAN AI requirements into account when defining a unified System Model ID.

WT2: Though Ericsson has provided its comments here, many of the comments are also targeting WT#1. Therefore, OPPO provides feedbacks here also related to WT#1 above.

First of all, OPPO agrees with Ericsson and many other companies that there is overlap between WT#1 and #2. OPPO supports to merge WT#1 and WT#2.

As for the specific comment from Ericsson, we are afraid that there must be some misunderstanding on the purpose of the WT#1.5. The LCM mentioned in WT#1 has nothing to do with the ML Model applicability to the 5GC domain, but rather, it is targeting the Model ID alignment. In fact, OPPO has already provided the clarifications in Feedback Form 3 comment#9 with the following:

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“WT1.5: Study the Model ID alignment to support the AI/ML model Lifecycle management as defined by RAN1.”

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Based on the moderated discussions, such clarifications for WT#1.5 receive general support among companies.

OPPO is concerned regarding Ericsson’s comment to keep the model performance monitoring out of scope of 3GPP. Without the model performance monitoring support over the 5GS for the RAN AI positioning coordinated with LMF, for example, how to ensure that the inference operation is useful and successful? It would be more helpful if Ericsson could provide more clarifications instead of just disagreeing something

without specific justifications. Even for the Rel-18 eNA and application AI/ML operation, the support for the performance monitoring provides important assistance to the AI/ML operation.

WT3: OPPO would be happy to provide more specific use cases and welcome other companies to do so when drafting the WTs/Objectives for this study. Specifically for WT3.4, OPPO would like to remind Ericsson that the purpose of WT#3 is to support Vertical Federated Learning (VFL). In VFL, depending on the type of VFL algorithm used, the passive parties from different domains may provide intermediate result exchanges to the active party. Such collaborative ML operation is not quite the same as what has been defined in Rel18 and therefore, some enhancements to the existing R18 mechanism must be studied.

WT4: OPPO disagrees with Ericsson to remove the WT#4.1 and 4.2 given that Transfer Learning is based on SA1 requirements. Transfer learning has specific characteristics and has not been supported in Rel18 and hence, extensions for Member UE selection and QoS/Policy enhancement are needed to be included in this WT.

10 – T-Mobile USA

- TMUS feels support of RAN functionality is very important (WT#1 and merging in WT#2).
- WT#1.4 should be dropped since security is out of scope of SA2.
- This is a huge study. Due to the time constraints of Rel-19, we suggest the following WTs to be postponed to the next release
 - o Postpone WT3.1, 3.2, 3.3. Keep 3.4. We need to support cross domain AI inference operations before supporting cross domain FL.
 - o Postpone WT4: 5GC extensions to support Transfer Learning
 - o Postpone WT5.5: Analytics and models trustworthiness, including input and output data
 - o Postpone WT5.8: NWDAF assisted 5G MBS and ProSe

11 – Guangdong OPPO Mobile Telecom.

Response to comment #10 provided by T-Mobile USA:

WT#3:

Let's put aside the AI training aspect and focus on the AI inference aspect. AI inference is the process of running data points into a ML model to derive the inference result. It is basically putting a ML model into production mode, assuming the AI training model for each domain is available (e.g. specific 5GC NF would have been configured with the required AI model to support the inference operation). When supporting the AI inference across domains, each domain (e.g. 5GC, UE etc.) is responsible for applying the ML model to the local data set which is NOT shared across domain due to the privacy concerns. This implies that there is a need to require cross domain Features determination and alignment. In other words, WT#3.4 has strong dependency on WT#3.1. This specific aspect is not specific to VFL, but generic for all cross-domain features.

As for WT#3.2, since the 5GC domain is involved in the cross domain inference support, it is necessary to identify the required 5GC NF which is involved to support the "local" inference operation. Hence, as a result, WT#3.4 also has the dependency on WT#3.2.

As for WT#3.3, it is necessary to support WT#3.1 and WT#3.2 so that the proper local data set and the proper 5GC NF can be determined to support the collaborative cross domain AI operation.

Meanwhile, VFL is an add-on to the overall cross domain inference operation to also enable the Model Training operation which relies on the similar support described in WT#3.1, 3.2 and 3.3., and to reuse the existing Member UE selection which has already been defined in Rel18.

WT#4:

For WT#4, as OPPO has responded to Ericsson's comment, there are existing SA1 requirements in place (which is not the case of e.g. several proposed sub-working tasks of WT#5). However, we believe that there could be a further consolidation between WT#3 and WT#4 to be more focused and hence, to optimize the TUs spent on these two WTs, and we welcome such consolidation discussion.

12 – Guangdong OPPO Mobile Telecom.

OPPO believes **WT1, WT3 and WT4 should be in scope of R-19**. Necessary merges and rewordings should be done as already commented by OPPO and others; WT1 coordination with RAN should be applied.

As commented, **we don't see a need in standalone WT2**.

Regarding **WT5**, OPPO has several concerns to include it, therefore, unless convincing arguments are provided for keeping the related sub-tasks, it **should not be included in the scope**, in our view.

Here is the list of our concerns, per WT5 sub-tasks:

WT5.1: NWDAF-assisted recommendations - in our view this significantly extends the scope of NWDAF functionality. Up until now, NWDAF provided analytics (statistics and predictions), and the corresponding NF (e.g. PCF etc.) could take it into account while making its decisions. Introducing NWDAF assisted recommendations significantly extends NWDAF scope in each area (e.g. introduces policy, mobility, etc. related logic), and we would like to better understand why it is needed and what is currently missing in the existing support by the corresponding NF.

WT5.2: Signaling storm prediction, detection, prevention and mitigation - We understand the demand in studying signaling storm scenarios, well described by S2-2306550, in order to support 5GC improvements for core network robustness and resiliency. However, as we understand, signaling storm overall handling may go far beyond NWDAF assisted support (e.g. as described by S2-2306550 "adding a new redundant signal path etc."), therefore indeed should be studied for overall 5GC robustness and resiliency improvements, not as a part of AI/ML SID specifically for NWDAF-assisted functionalities. And, as we know, Study on robust and resilient core was deprioritized during the workshop. Therefore, all-in-all, we propose to exclude it from R-19 AI/ML SID scope.

WT5.3: Misbehaving NF handling e.g. abnormal behavior, performance degradation, operational conflict etc. prediction, detection, prevention and mitigation; study of the further information exchange with MDAF, etc. for specific operational use cases - we believe operational use cases are widely handled by SA5 already, where it belongs. If there are any use cases which require information exchange with SA5 entities e.g. with MDAF, we would like to see and discuss those.

WT5.4: Online learning - the requirements are unclear as was already commented several times by OPPO and others

WT5.5: Analytics and models trustworthiness, including input and output data - we agree with a need to study trustworthiness, however we believe it needs SA1 related requirements and a wider discussion, in a collaboration with SA5. Therefore, we propose to postpone it.

WT5.6: NWDAF-assisted energy saving - firstly, basic Energy Efficiency mechanisms should be studied by the corresponding R-19 SID. Yet unclear, if analytics are in scope of R-19 Energy Efficiency SID.

WT5.7: NWDAF assisted Sensing - firstly basic Sensing mechanisms should be studied by the corresponding R-19 Sensing SID. Yet unclear, if analytics are in scope of the corresponding R-19 Sensing SID.

WT5.8: NWDAF assisted 5G MBS and ProSe - yet unclear, if analytics are in scope of the corresponding R-19 ProSe SID.

WT 5.9 Reinforcement learning - we believe we may need an overall bigger work task assessing different AI/ML training methods and their additional potential requirements, including reinforcement learning (e.g. supervised learning, unsupervised learning, reinforcement learning), and we should firstly get SA1 requirements instead of limiting such study to reinforcement learning only without having a deep SA1 study prior to that.

13 – MediaTek Inc.

In our view, WT1.1, WT1.2, WT1.3 and WT1.4 can be in scope of Rel-19 System Architecture enablers for AIML Radio.

WT1.5 is not in remit of SA2 and should be determined by RAN.

WT1.6 is not essential. This can be covered as part of WT1.1 / WT1.2.

WT2 seems to be in scope of RAN3. It is not clear if RAN3 has such a plan so we suggest to remove this for the time-being.

WT3.1, WT3.2, WT3.3, WT3.4 are not needed. It is not clear what is the scope of work to be done at SA2 assuming all these VFL operation could be part of application logic.

There are some merits for WT4.1, WT4.2 and WT4.3 given that they seem as organic continuation of AIMLsys from Rel-18 also considering new stage 1 requirements from SA1. However, the scope is quite orthogonal to WT1 and related sub-WTs.

WT5 and related sub-WTs seem to be in scope of eNA continuation. It is not clear why they are needed for Rel-19 AI/ML (they need to be considered in the context of a separate study item if any).

14 – vivo Communication Technology

WT#1:

In general, we think the support of RAN functionality is very important.

We fully understand the comment from Ericsson and agree that WT#1 has strong dependency with RAN. However, it is more a process discussion than a technical discussion, which is also not unique to this study. It looks that SA/SA2 chairs will give some guidance how to process it.

Therefore, at the moment, from SA side, it may look reasonable to focus on what kind of alignment is needed assuming that RAN will make progress in the upcoming August RAN meeting. In addition, we can add a NOTE, saying strong dependency with RAN and will be updated based on RAN progress.

In summary, in our view, WT1.1, WT1.2, WT1.3, WT1.4 and WT#1.5 can be in scope of Rel-19 AI/ML.

Regarding WT#1.5 Study the Model ID alignment, Lifecycle management, we understood that RAN is still under discussion e.g. Model ID or feature/FG report to network, which may take some time to have conclusion e.g. in or after August RAN meeting.

ML model performance belongs to Lifecycle management and we share the concern regarding Ericsson's comment to keep the model performance monitoring out of scope of 3GPP. If you look at R18 KI#1 for eNA_ph3, we had a very good discussion and defined Model/Analytics Accuracy for classification in TS23.288, which is the number of correct predictions out of all predictions.

In our view, RAN looks promising to also have a good discussion at least for RAN AI positioning otherwise how to measure the accuracy of RAN AI positioning as commented by OPPO.

Therefore in our view, regarding WT#1.5 Lifecycle management, it looks promising that RAN will make some progress soon and better to keep it at the moment.

Furthermore, in order to address the concern from Ericsson, maybe we can rephrase WT#1.5 to make it more general

WT1.5: Study the Model ID alignment, Lifecycle management alignment between SA2 and RAN e.g. in terms of Model performance and Model ID;

WT#2: we also support to merge WT#2 into WT#1 since WT#1.1 somehow already cover WT#2.

WT#3 we in general support to keep WT#3 in scope of Rel-19 AI/ML and however looks better to rephrase WT#3 (e.g. on the top of WT3.4) to make it simple and so far the sub-WT#3 looks like Key issue(s), which better to leave them in TR phase.

WT#5: so far, in our view, WT5.1, WT5.2, and WT5.5 can be in scope of Rel-19 AI/ML especially regarding WT#5.5, we do think it is time to study Analytics and models trustworthiness, including input and output data considering we already standardized Analytics and models in R16 eNA/R17 eNA_ph2/R18 eNA_ph3.

Regarding WT5.8: NWDAF assisted 5G MBS and ProSe, at the moment we would like to postpone study NWDAF assisted 5G MBS while are open with NWDAF assisted ProSe and would like to hear clarification first.

15 – Qualcomm Korea

We support WT1 and WT2 to be in the scope of Rel-19, but we do not support WT3, 4, 5 to be in the scope of Rel-19 with the following reasons:

WT3, requires cross-domain FL which belongs to different vendors (UE, RAN and CN), and we think it is not realistic to have coordination between the ASP, network vendor and UE vendor for FL since it requires to standardize the model itself which is not in scope of 3GPP. It is also not clear for us that why does 5GC need to be involved in the application AI training and inference.

For WT4, all the sub WTs were discussed in Rel-18 in AIMLsys study, we do not see the value for further enhancement in Rel-19.

For WT5, WT5.1 is already supported, WT5.2 and WT 5.3 are related to abnormal prediction, generally, the signalling storm, network abnormal behaviour are happened due to unpredictable event, e.g., earthquake, cannot be predicted by using historic data, so we do not believe WT5.2 and WT5.3 are valid use cases for using AI/ML models. It is not clear about the scope and impact in standard for WT 5.4 and WT5.5. WT5.6 and WT 5.7 are related to the other new SIDs proposed for Rel-19 and not clear what are the impacts / relation to AIML. The proposal for WT 5.8 is too broad and not clear what is the cope.

16 – Guangdong OPPO Mobile Telecom.

OPPO would like to respond to Qualcomm comment#15 specifically on WT#3 and #4.

WT3: OPPO would like to respond to QC’s concern on how the MNO coordinate with ASP to address the multi-vendor interoperability issues in order to support the cross-domain AI/ML operation, when there are different vendors’ product implementation and platforms within an MNO domain. The multi-vendor interoperability could make it difficult to have consistent training and inference outcomes. However, OPPO believes that the scenario for model identification in R18 eNA is very different from WT#3 because of the following:

- In VFL operation, the model for each domain is implemented by a “**common**” **model owner/implementor. With proper provisioning (via SBA) and NF selection (via NRF) of the required features, system conditions and datasets for the target NF(s) to map to the vendor specific information**, it is a more “manageable” than eNA scenario. In Rel18, the issue for different NWDAF/MTLFs to share their models among MTLFs from different vendors require a lot more complex handling for the interoperability because the model are from different sources and it is more complicate to align, manage the required features, system conditions and datasets.

It is very important to point out the benefits of the VFL technique which is considered as a more practical FL approach because VFL is focusing on multiple domains with different features corresponding to the **same set of users (i.e. UEs) to jointly train machine learning model(s) without exposing each domain’s local data or model parameters**. In fact, expecting to be able to identify different sets of users to support the “same” set of features is not always feasible as different users may have different variations of their respective conditions and requirements for the same features. Furthermore, VFL approach is generally considered more reliable and effective with much stronger privacy protection of the user’s local data and model parameters. Hence, in our view, it is essential for 5G advanced system to support VFL to provide the full suite of FL capability support in 5G Core in Rel-19.

WT4:

OPPO would like to emphasize that, WT#4 has well defined stage-1 requirements (see 22.261, clause 6.40) to support Model Transfer learning, as we already mentioned in our comments. Model Transfer learning is an “efficient” mechanism to expedite the AI/ML operation and to improve the energy efficiency for transferring a well-trained model to the neighbor UE using the direct communication. Hence, the neighbor UE does not require to go through a complete Model Training from scratch. Worth also to mention that, with the consideration of such significant benefits and, given that eProSe in Rel18 has already supported the secured direct communications between UEs, and the AI/ML training model itself has its own security protection, **the additional impact towards 5GS to support the WT#4 is insignificant when compared to other WTs to study the AI/ML enhancements.**

17 – SK Telecom

SK Telecom thinks that AI/ML enhancements study Work Tasks to be

WT1.1, WT1.2, WT1.3, WT2, WT5.1, WT5.2, WT5.3

18 – Futurewei

Response to #8 by Ericsson, #12 by Oppo, #15 by Qualcomm regarding work task 5.7;

There are two WTs under discussion for integrated sensing and communications related to sensing result calculation and Sensing result exposure. In our view, if sensing result calculation includes sensing analytics (statistics/predictions) calculation, this functionality should be at NWDAF and studied under AI/ML enhancements. Therefore, we suggest keeping WT 5.7 under AI/ML enhancements and wait for the outcome of integrated sensing and communications discussions, and then decide whether to study WT 5.7 in rel 19 or next phases of AIML enhancements.

19 – HuaWei Technologies Co.

Huawei comments on WT 1,2,3:

WT 1~3 should be not in the scope of R19 SID.

- WT 1 is related to RAN study, especially WT1.1, 1.2 and 1.3. This should be discussed only after RAN WGs have a conclusion. SA2 should not study it in parallel. Some other detailed comments
 - o It seems WT1.4 should be in the scope of SA3.
 - o WT1.5 is not required. Different WGs can have different terminology. If it is necessary, it can also be treated as alignment.
 - o WT 1.6 is solution oriented, assuming CN will transfer the model/data via user plane. Need to wait for WT 1.1~1.3 first.
- WT 2: Based on the conclusion of RAN3, there is no impact on CN. This WT is not needed for alignment. If there will be some new use cases, the discussion should be initiated by RAN3.
- WT 3: There is no use case requiring VFL. The VFL is a technology to avoid private data transferring, i.e. there is some data which is not able to be collected. For the current example on QoE, the application can generate the QoE based on SA4 mechanism or the mechanism without 3GPP standardization already, i.e. there is no limitation to retrieve the data.

20 – LG Electronics France

We support WT1.2 and WT1.3 to be in the scope of Rel-19 AI/ML enhancements.

21 – China Telecommunications

CT supports **WT4(*)**, **WT5.1**, **WT5.2**, **WT5.5**, **WT5.8**.

WT1 and WT2: In our understanding, there are several use cases in RAN side and they have not come to a conclusion which solution has high priority, considering each use case may have different impact on SA2, we think WT1 and WT2 should be postponed for now and we can consider them when RAN side has a stable conclusion.

WT3: We are open to this WT. Share the same view with vivo, WT3.4 seems more general, VLF is a sub-case to support cross-domain AI model training/inference data transfer. Before studying this WT, use case needs to be clarified, I only found QoE enhancement in S2-2306424 in that use case, it seems also refer to data collection and model transfer across the domains, not sure whether it is possible to use the same mechanism as WT1? If yes, we may not need to do some repetitive work.

WT4: As we mentioned below, transfer learning scenario for NWDAF-NWDAF is also important and we suggest to study in this WT or in WT5.

WT5.2: Respond to Qualcomm comment#15, in our view, signaling do not rise abruptly from the beginning of signaling storm, NWDAF may provide predictions of some key parameters instead of unpredictable events, and when the key parameters beyond normal range, operators can make some adjustments to the network to avoid signaling storm.

WT5.8: I would like to make a clarification on WT5.8. We can see some benefits of NWDAF assisted ProSe and we think it is worthy to be studied, I just give an example here. In proximity service, service experience of relay UE is easily affected by relay traffic and the frequent movement of relay UE may also affect the service experience of remote UE. The predictions like network performance, traffic characteristics and UE mobility can be provided by NWDAF to help select relay UE which is in a better network or in a relatively fixed position to give better service to remote UE.

22 – HuaWei Technologies Co.

Huawei comments on WT4 and WT5:

WT4:

The scope of WT4 should be clarified before agreeing to it. If Transfer Learning is for the model on application layer, then WT4.1 seems reasonable, but WT4.2 has been discussed in previous AIMLsys study, currently we do not see the technical gaps for further Rel-19 enhancements. For WT4.3, the AF may directly transfer the model to the target UE, we don't see the need to transfer AI model between the UEs via direct device connection. If Transfer Learning is for the model on NWDAF, since NWDAF can already fine-tune the model for a specific UE based on UE data, depending on the internal implementation of NWDAF, so it needs to be clarified what is the impact on NWDAF/5GC in this scenario.

WT5:

Huawei is interested in WT5.1, which could be in Rel-19 scope.

WT5.2 is interesting. SA2 can handle the cases within SA2 scope while SA3 already discussed some abnormal use cases.

For WT5.3 and WT5.5, Huawei suggests those items to be led by SA3. Those are the remit of SA3 and they have been discussing them.

Before agreeing WT5.4, the meaning of online learning and the impact on 5GC need to be clarified.

23 – Motorola Mobile Com Technology

Lenovo sees value in the following WT1 tasks: WT1.1, 1.2,1.3,1.6, However, the related work in RAN is still not finalised and there are still many open items (e.g. whether UE provides a model ID or functionality ID). Lenovo prefers to let RAN continue the discussion for one more meeting cycle in order to allow SA2 to have a clear understanding of the RAN requirements. Discussion on WT1 and WT2 should be postponed for now.

Lenovo supports WT3.1, WT3.2 but they need to be reworded (rewording proposal in Feedback Form 3. It is also important to clarify what a "domain" is. Examples are: Support VFL across 1) UEs and 5GC, 2) between 5GC of two PLMNs 3) between 5GC and edge.

Lenovo supports WT5.1 which has been also proposed during Release 18. We propose to limit the scope for R19 to

study framework and architecture enhancements to enable policy recommendations.

Lenovo also supports WT5.2, WT5.3, WT5.5 and WT5.6.

For WT5.3 the Lenovo proposal in SWS-230058 is to support a more general interaction between NWDAF and MDAS and ADAES. A rewording of WT5.3 is proposed in Feedback Form 3.

For WT5.6 this work task can also be part of the energy efficiency study.

24 – Rakuten Mobile

Rakuten Mobile supports the following to be in scope for Rel-19:

WT 1.1, WT 1.2, WT 1.3, WT 1.5, WT 1.6,

WT 2

WT 5.1, WT 5.2, WT 5.3, WT 5.6

The below could be considered if TU permits or part of a separate SID

WT 3, WT 4, WT 5.4, WT 5.5, WT 5.7, WT 5.8

25 – KDDI Corporation

KDDI supports **WT3 and WT4** as a scope of Rel. 19.

WT3.

WT3 enables 5GC, UE, and perhaps OTT to formulate cross-domain collaboration using the VFL technique. The VFL technique effectively collaborates different domain entities with minimum required information sharing; instead, the 5GC support is required to consolidate information between domains (i.e., consolidate a UE's information between multiple NFs).

WT4.

KDDI supports WT4 with OPPO and ETRI because WT4 is essential to archive the **SA1 requirements**. Additionally, as ETRI and I denoted, NWDAF-NWDAF transfer learning and UE-NW-UE transfer learning should be added to the WT4.

26 – Cisco Systems

We support part of WAt1. WT1. 1.1 ,1.2 and 1.3 has RAN dependency and should be finalised in RAN group first. We are okay with 1.4 and 1.6 but 1.5 needs clear scoping and clarity on model ID (should it be aligned with RAN group?)

Most of items in WT1 is about alignment with RAN. We think WT1 and Wt2 should be merged.

We support WT3 and WT4.

We support WT5.1,5.2,5.3,5.4,5.5 and 5.8. More understanding and scoping is required for 5.6. Sensing is an study item on its own and it should be completed before taking up 5.7.

27 – Orange

WT-5.1, WT-5.2, WT-5.3, WT-5.5 and WT-5.6 should be in Rel-19.

WT-DOCOMO-1 should be in Rel-19.

Nokia's WT on DCCF enhancements should be in Rel-19.

Other WTs should not be in Rel-19.

28 – Guangdong OPPO Mobile Telecom.

response to #27: OPPO has provided comment#12, with a questions per each item of WT5. We understand Orange is promoting WT5 quite strongly. OPPO would like to understand what are responses and if/how our concerns are addressed.

29 – ZTE Corporation.

We are fine to include WT#1 if it is clearly stated that this WT will be started only after SA2 receives RAN WGs request. WT#2 is to be merged into WT#1. Considering the time restriction, we prefer either WT#3(preferred) or WT#4 in the study, but not both since it is not possible to complete both WTs. Regarding on WT#5, we support WT#5.1 and WT#5.2. WT#5.5 can be moved to SA3. WT#5.6, 5.7 and 5.8 needs more clarifications.

30 – Samsung R&D Institute UK

In our view, the proposed WTs need re-structuring to facilitate a better scoping of the work, see Samsung's inputs to feedback form 2. Having said the above, our inputs to this feedback form refer to the WTs proposed by the moderator along our understanding of each of their scope. Kindly note that we also suggest re-wording of the below selected WTs, as shown in feedback form 3.

- **WT1.1** (5GC support for UE/air interface AI/ML)
- **WT1.2** (Enhancements to UE data collection framework)
- **WT1.3** (5GC support for AI/ML model and information sharing to the UE)
- **WT2** (5GC support for AI/ML in NG-RAN)
- **WT5.1** (5GC recommendations)
- **WT5.2 and WT5.3** (prediction, detection, prevention and mitigation of network misbehavior)

In our view, the rest of WTs are either secondary and should be candidate for down-scoping/merging for the following reasons:

- **WTs 1.4/1.5/1.6:** they seem to either be already covered by previous WTs or in the remit of other WGs
- **WT3:** we don't support introducing VFL in the 5GC when we don't yet have cross-domain model sharing capabilities, which in our view is a prior requirement and seems in scope of WT1. At most this WT could look at VFL between AF and NWDAF based on R18 capabilities

- **WT4:** This WT seems related to application AI/ML operation but it is not clear to us how the 5GC can support a specific type of AI/ML application algorithm/technique like transfer learning without any knowledge of the model information per se. We also fail to understand why WT4.3 belongs to this WT on transfer learning. Furthermore, we think support for application AI/ML is secondary for R19 in SA2 as there is already and endorsed R19 AIMLapp item endorsed in SA6. We see cross-domain aspects and new 5GC functionality as having higher priority over this, and the limited TU budget would make it hard to work on all proposed contents
- **WTs 5.4/5.5:** These NWDAF enhancements are secondary in our view and we don't seem to have enough TU on one SID to address them
- **WTs 5.6/5.7/5.8:** We believe these WTs should be considered not by AI/ML item but by the corresponding impacted items (i.e. energy, sensing, MBS, ProSe), where experts will be participating in dedicated SIDs. This is also to fit the AI/ML scope to available TUs and avoid cross-item dependencies

31 – Guangdong OPPO Mobile Telecom.

As previously commented, and following many comments received, OPPO has analyzed and discussed the WTs structure and contents with a several companies, taking also into account the need to compromise, narrow the scope and consolidate the work for R-19. Therefore, here is our proposal which implements these principles:

WT1:

WT#1.1 Whether and how to enable 5GS to leverage the AI/ML Functional Framework led by RAN1 and RAN2 in order to support the cross domain (i.e. UE, RAN, 5GC, OAM and 3rd party) AI/ML operation (e.g. data collection for offline training, UE selection, model transfer/delivery, Model ID alignment, performance monitoring etc.) for the radio interface, the 5GC and the 3rd party application.

Note: Further alignment with SA5 for OAM support for the AI/ML Functional framework.

WT#1.2: Study QoS and Policy control to support the cross domain (e.g. RAN, 5GC etc.) model required AI/ML operations.

WT#2:

Study 5GC extensions to support Transfer Learning in order to expedite the 5GC assistance for the model training or inference operation by leveraging either direct UE-UE communication or UE-NW-UE communication.

Note: This WT is low hanging fruit which leverages mostly existing functionalities, e.g. eNA, eProSe and AIMLsys.

WT#5: OPPO has provided its concerns and questions for clarification for the sub-working tasks of this task in the comment#12, the absolute majority of the comments are in line with the comments provided by other companies for WT5. We haven't received responses for the questions we raised, and, therefore, didn't include it here for now. Moreover, the scope of WT#5 is clearly related to eNA rather than to AI/ML, therefore, it is very important, in our view, not to mix it with other WTs, as done in Samsung reorganizing proposal for WT5.1, WT5.2, WT5.3.

32 – Qualcomm Korea

reply to #16 from OPPO's comments:

WT#3: I agree vertical FL is an important technology, but it is very difficult to support it between AF, 5GC and UE, I do not think we can simply solve this as one of WT in Rel-19.

WT4: I think you try to provide the justification about WT4.3, but for WT#4.1 and WT#4.2, I do not know what is missing comparing to Rel-18. It is also not clear the gap for PC5 interface, we have already support the data transmission on PC5 interface and ML model is just a kind of application layer.

33 – Guangdong OPPO Mobile Telecom.

Just to clarify our comment #32: this proposal simplifies, narrows and merges previously defined WT1, WT2, and WT3 into newly created WT1 and simplifies (and includes suggestions from KDDI/ETRI) the previously proposed WT4 into newly created WT2.

34 – Guangdong OPPO Mobile Telecom.

response to Qualcomm comment#32:

1. Please look into our proposal (comment#31) with the revision of the tasks and of their scope

However, in order to address your concerns for the previously defined WT3 and WT4:

WT#3: OPPO believes that the multi-vendor interoperability for VFL is not the same for the multi-vendor support in eNA Rel18 because the model owner in WT#3 is from the single source (i.e. the AF) for a given VFL operation, unlike what has been defined in the eNA Rel18 (where models could come from multiple sources). Hence, the coordination and the support for the VFL is more easier and feasible to manage even though the 5GC NFs could be from different vendors.

WT4: is not only about the data transfer between UEs, but also about identifying the appropriate target UE to receive the model, and also about enabling the target UE to verify the incoming model to be used for local training. Please refer to SA1 R-19 requirements for a more details.

35 – China Mobile Com. Corporation

WT3, WT5.1, WT5.2, WT5.4, WT5.6 should be in scope.

I WT3 related to VFL, but need to be reworded as indicated in Form 3, since the current scope focus on application AI training and inference.

I WT5.1 relates to NWDAF-assisted recommendations. Currently, the network uses static configuration for decisions e.g. QoS policy, which cannot adapt to the diversity of multi-services and personalized policies. The network needs to be aware of resource status in time and adjust policies dynamically. It is suggested to study whether and how to provide global optimal recommendation to 5GC NFs. For example, based on the analysis of network status, service experience requirements, etc, NWDAF could make policy decisions and adjust user QoS parameters in time.

I WT5.2 relates to signaling storm prediction, detection, prevention and mitigation. As proposed in SWS-230068, the network needs to be more intelligent, proactively, dynamically and globally to prevent and mitigate from signalling storm or network abnormal behavior, such as adjust flow control parameters or back-off timer for NFs based on NF loads and failure rates of different interfaces. Thus, it needs to study the mechanisms of prevention/mitigation for the signaling storm to guarantee the 5GS system stability with the assistance of NWDAF.

I WT5.4 relates to online learning. Up to now, NWDAF based data collection and AI/ML training are offline. AI/ML models need to adapt to rapidly changing data in some use cases. E.g., NWDAF should train application detection ML model rapidly when the characteristics of the packet flows has changed frequently due to application update. Therefore, network architecture could be enhanced to support online

learning, able to quickly adjust the model in real-time based on online feedback data, enabling the model to reflect changes in a timely manner and improve the accuracy of prediction.

1 WT5.6 relates to NWDAF-assisted energy saving. Based on GSMA research and analysis on 31 operators, core network consumes a great amount of energy in operator network. So, it is useful to study whether and how to predict the capacity and load trend of NF(s) with the assistance of NWDAF and study NWDAF assisted solution for energy saving, e.g., load balancing or redistribution among multiple NF instances.

36 – Beijing Xiaomi Software Tech

Xiaomi supports WT1.1, WT1.2 and WT1.3 in the scope, which support what RAN has been studied. WT1.4 should be in SA3 scope, but SA2 needs to provide the requirements for SA3. WT1.6 should be merged into WT1.3.

WT2 is not quite clear, but for our view, it is better to merge into WT1.

WT4.3 should in scope of Rel-19, since it is from SA1 requirement.

Regarding RAN dependency, we need the guidance from SA/SA2 leadership for all the topics that have same issue.

37 – AT&T

We are in support of WT#1 (drop WT#1.4); WT #2, WT# 3, WT#5.2. Rest can be down scoped in interest of TU

38 – HuaWei Technologies Co.

Huawei replies to the comments on WT5.1

Reply to Ericsson comment#8:

For the first question, NWDAF-assisted recommendations are beneficial in some use cases. For example, the NWDAF can provide policy/QoS recommendations to assist the PCF to set QoS parameters that can achieve specific service experience objective (e.g., MOS>4). In addition, the NWDAF only provides recommendations and does not make decisions on behalf of the consumer. The final decision is generated by the consumer based on recommendations and its internal logic. Therefore, there are no two incompatible options for NF control.

For the second question, the NWDAF makes recommendations solely based on its own capabilities and does not rely on the internal logic of consumer. For example, NWDAF derives the recommended QoS only based on the collected data (e.g., RSRP from OAM), and the NWDAF does not need to understand how the PCF generates QoS parameters.

Reply to OPPO comment#12:

NWDAF-assisted recommendations are merely enhancement to the NWDAF capability to provide analytics, but have no impact on the existing NWDAF data collection and analytics exposure architecture, the NWDAF still collects input data and provides analytics output, and the corresponding NF (e.g. PCF etc.) could take it into account while making its decisions, except that the analytics output includes recommended information. Besides, as we replied to Ericsson, the NWDAF does not rely on the internal logic

of consumer to make recommendations, and please note recommendation is one of the popular AI outputs, so we don't think the NWDAF scope will be significantly extended.

Taking NWDAF provides QoS recommendations as an example, the PCF may not be able to determine which QoS can achieve the expected service experience MOS, but the NWDAF can train an AI model to obtain the relationship between the MOS and QoS parameters, then the NWDAF can derive recommended QoS based on the expected service experience MOS. Therefore, we think NWDAF can provide recommendations to assist the consumer in optimizing internal decisions and achieving the expected execution results.

Reply to Qualcomm comment#15:

Firstly, we'd like to clarify the concept of recommendation. Currently, the NWDAF provides statistics or predictions analytics, then the consumer determines actions based on NWDAF analytics, takes actions, and then produces the execution results. In this case, the input from the NF subscribing for NWDAF analytics is basically a set of filters for a given topic (i.e., analytics type) to sharpen the data collection for the analytics output, and the NWDAF generates possible values either that it observed (statistics) or expects to be observed (predictions) for the given topic. However, recommendation means that the consumer first provides the expected results that such consumer would like to reach, then the NWDAF derives the combination of parametrization values or strategies that the consumer could use to reach the expected results. Based on the NWDAF output of possible combinations of parametrization values or strategies, the consumer determines the actions to be taken, takes actions, and then produces the execution results. NWDAF-assisted recommendations can assist in achieving the expected execution results. Especially the NWDAF output of a global optimal recommendation can be quite useful when multiple NFs simultaneously take actions based on the analytics output of the NWDAF, to avoid potential conflicts or mutual impacts by the actions from these NFs. Therefore, in our view, the current NWDAF analytics cannot be called recommendations, and the NWDAF needs to be enhanced to support recommendations.

39 – Intel Deutschland GmbH

Intel supports WT 1.2, WT1.3, WT1.5, WT 5.1, 5.4, 5.5, 5.6, 5.7.

WT 1.4 can be in scope of SA3.

WT 2 seems very RAN driven task. Though coordination with SA2 might be required based on RAN progress as well, this should not to be accounted towards TUs in this study in SA2.

WT 4 is not a priority for Rel-19.

40 – Apple AB

WT 1 and sub-work tasks - We should aim to harmonize the architecture, but at this point in time, we don't think RAN work is in a state that we can do alignment. There is a need to further refine the scope and dependencies of the sub work tasks to align with RAN outcomes.

WT2 - has the same scope as WT1.

WT-3 - We also have concerns on the effectiveness of this kind of operation. As noted by OPPO, this kind of operation has privacy concerns. We should evaluate how the data owner can have control over its data being used for such cross-domain learning and by whom.

<p>WT-4 - We support evaluating Transfer Learning using direct device connection.</p> <p>We also support WT-5.2, WT-5.3 and WT-5.5. Rest of the WTs may be postponed.</p>
<p>41 – Deutsche Telekom AG</p> <p>We support WT-1 and WT-2 (merged).</p> <p>WT-4, 5.7, 5.8, can be postponed.</p>
<p>42 – NTT</p> <p>We support WT-DOCOMO-1. From our perspective as an operator, we believe that customization of AI models is important. As one of the possible cases, transfer learning can increase the model’s generality. However, multiple existing models are needed to be combined then, so it is necessary to discuss a framework that supports such a case.</p>
<p>43 – NTT</p> <p>We also support WT-5.2. AI can be technically applied since there are some methods to detect abnormalities by learning ”normal conditions” based on various data observed during periods when the system is operating normally. We need to discuss a framework that can address signaling storms.</p>

Feedback Form 2: Can any of the Work Tasks above be combined/merged?

<p>1 – CATT</p> <p><i>WT 1 and 2 can be combined/merged by not mentioning RAN interfaces/WGs, for the reasons that: 1) the data collection/model transfer framework can be common; 2) the specific use cases can be discussed during the study.</i></p>
<p>2 – Guangdong OPPO Mobile Telecom.</p> <p>For the WT2, we would like to request clarifications from the submitting companies (what is intention, what/whether there is connection to WT1), and then, based on those clarifications, see if WT2 can be merged with WT1.</p>
<p>3 – Guangdong OPPO Mobile Telecom.</p> <p>For the WT 5.4, we would like to request for clarifications on what it means and, based on those, may make our suggestion on whether it can be merged with another WTs.</p>
<p>4 – vivo Communication Technology</p> <p>Regarding K#2, we also would like to request for clarification. So far tend to agree with CATT and OPPO that it looks better to merge WT#2 into WT#1.</p>

5 – DOCOMO Communications Lab.

There is no need to create separated WT corresponding to the work by different RAN groups. Several sub tasks under WT1 being combined also cover the issues discussed in RAN3. So, it is proposed to merge WT2 into WT1.

6 – InterDigital

With regards to comment #5 by DOCOMO, it is our understanding that the work related to WT2 addresses different Use Cases, so the different WT is not about addressing different RAN groups but different requirements and as such we prefer it be handled separately, as originally proposed.

7 – Nokia Germany

WT 1 and 2 can be merged. It should be an open ended study in coordination with RAN whether a combined framework for all tasks listed as WT 1 subtasks is feasible and desirable, and otherwise whether any core network support for related RAN features is required. Note that service based interfaces are not expected in/towards RAN in Rel-19 and this may be an obstacle to reuse service based 5GC solutions

In WT1:

For WT 1:3: In RAN discussion it is entirely unclear whether anything related will be concluded. Model interoperability between vendors is very hard according to past discussions. Drop this WT.

WT 1.4 and WT 1.6 seem to be specific aspects of WT 1.2. I suggest merging WT 1.4 and WT 1.6 into this WT. Also, WT 1.4 is mainly SA3 related.

WT4

“transfer learning” is not well defined and requires clarification. It feels to a large extent like a special case of federated learning. Consider merging into WT3

8 – T-Mobile USA

Merge WT#2 into WT#1 (into a single WT).

9 – Qualcomm Korea

Prefer to keep WT#1 and WT#2 separate with the following reasons:

- WT#1 focus on the general framework to support the use cases that discussed in RAN1+RAN2, and also some alignment like model ID, LCM, but WT#2 focus on the CN & RAN coordination based on RAN3's progress.
- SA2 may need some architecture / framework enhancement to support WT#1, like UE data collection, ML model downloading procedure, while there is no architecture enhancement to support the AIML procedure for WT#2.
- In our understanding, WT#2 studies how to enhance the existing analytics that supported in TS 23.288 by taking into account the input/output parameters that supported by RAN3, which are totally different to WT#1.

The architecture enhancement for AI based positioning is already covered by WT#1.1, no need to have a standalone WT.

10 – Guangdong OPPO Mobile Telecom.

OPPO prefers to consolidate WT#1 with WT#2. While studying the model identification and model ID assignment in Rel-19 to support the latest “enhanced” LCM framework, SA2 should refer to the requirements defined by **RAN1 and RAN2** (not by RAN3) which were approved in the last RAN#100 in order to enhance the LCM framework to consist of (i) Data Collection, (ii) Model Training, (iii) Model Management, (iv) Model Inference, and (v) Model Storage.

At this point, RAN3 has completed 60% of its normative work (i.e. of **RP-220635**) for Rel-18 which focuses on specific use cases – i.e. Network Energy Saving, Load Balancing and Mobility Optimization with the following specific deployment options for the AI/ML functions (the deployment options are the subset of what RAN1 and RAN2 are considering):

- AI/ML Model Training is located in the OAM and AI/ML Model Inference is located in the gNB (gNB-CU for split RAN).
- AI/ML Model Training and AI/ML Model Inference are both located in the gNB (gNB-CU for split RAN).

From OPPO perspective, the consolidated WT#1 and WT#2 does not preclude any enhancement to the existing analytics which are required to support the LCM framework supported by RAN3 since it is just **a subset of LCM framework defined by RAN1 and RAN2 which has been agreed**. As for having the WT#2 to take the OAM input and output parameters defined by the current normative work from RAN3 to improve the NWDAF analytics support, from OPPO’s perspective, if such an objective gets agreed among SA2 colleagues, it should be part of the WT#5 and not of the WT#2.

11 – HuaWei Technologies Co.

For the WT2, we ask for further clarification on the detail of this WT, in particular, what is the association with 5GC, what is the potential gaps and etc., and then it would be clearer that whether it can be merged into WT1 or not.

12 – Motorola Mobile Com Technology

WT#3.1 and WT#3.2 can be merged

13 – Samsung R&D Institute UK

Our main observation here is that the current scope seems clearly unrealistic for one single SID with the 14 TU limitation, with an unreasonably large number of WTs and sub-WTs. We propose a re-structuring of the WTs reducing its number to three and leveraging some of the consolidation progress in endorsed SP-230759. We understand that further discussion may be required as to which sub-WTs should be kept in the proposed structure and their exact wording. The proposed new structure is as follows:

WT1’ focused on all AI/ML cross-domain coordination aspects

- Scope includes 5GC support for UE/air interface AI/ML, NG-RAN AI/ML, and MDAS (WT# 1.1, 1.2, 1.3, [1.4, 1.5, 1.6,] 2, part of 5.3)

WT2’ focused on 5GC intra-domain AI/ML new functionalities

- 5GC AI/ML-assisted recommendations (WT# 5.1)
- AI/ML-assisted NF coordination, e.g. for prediction, prevention, detection, and mitigation of signaling storms and performance degradation due to misbehaving/conflicting NF operations (WT# 5.2, 5.3)

WT3’ focused on further enhancements of eNA and AIMLsys functionalities

- VFL, transfer learning, sidelink AI/ML, trustworthiness, other NWDAF enhancements (WT# 3, 4, 5.4-5.8)

In our view, this structure also shows WTs in seemingly decreasing order of support. WT3’ is in our view generally speaking the least essential WT, and could be scoped according to available TU capacity after TUs are estimated for WT1’ and WT2’.

14 – Rakuten Mobile

Rakuten is also of the view that the # of WT is quite large and may not be feasible for a single SID/allotted TU limitation and would like to **support** Samsung’s proposed restructuring with the exception of WT 5.6: NWDAF-assisted energy saving that should be prioritised.

15 – SK Telecom

With many WTs and limitations, SK Telecom agrees/supports with Rakuten/Samsung’s new structure.

16 – KDDI Corporation

KDDI agrees with **Samsung’s overall structure** proposed by comment #13.

However, as Samsung also said, **further discussion** is required to prioritization and which sub-WTs are contained to each WT’. For example, WT3 should be in WT1’, and WT4 should be prioritized.

17 – Guangdong OPPO Mobile Telecom.

OPPO would like to provide feedback to Samsung’s comment#13. Samsung’s WT1 includes MDAS and the heavily SA5 dependent 5.3 sub-WT into the current WT#1 based on some assumptions with no justification, especially since it is unclear if/what work has to be done by SA2. The current WT#1 is very self-contained and allows RAN to lead the direction of the RAN AI requirements for SA2 to support. Certainly, there could be improvement to further simplify WT#1 and OPPO is planning to make a more constructive suggestion in our next proposal.

Samsung’s WT#2 is not a restructuring effort per se, it is just selection of the subset of WT#5 and it is unclear why those sub-WTs are explicitly being selected. The current WT#5 is more comprehensive task which allows SA2 to collaborate on making the prioritization decision if/which sub-WTs specially related to eNA are to be kept or to be removed. Furthermore, what exactly is “intra-domain” in the context of the provided comments? Had the scope of eNA, where it belongs, ever extended beyond a single domain, except some coordination with MDAF?

Finally, Samsung WT#3 is also not a restructuring effort per se. It is a set of miscellaneous sub-WTs from different current WTs which are NOT closely related, and therefore it can only cause diverse and chaotic discussions.

On the other hand, the current WT structure has been thoroughly reviewed during the last few weeks based on their respective closely related functionalities. Therefore, using the current structure will lead to more organized and effective discussions.

All-in-all, OPPO agrees with Samsung that the current set of WTs imposes significant challenges to meet 14 TUs ceiling. However, OPPO could not see how the restructure proposal from Samsung is able to reach the goal for 14 TUs. As mentioned above, **OPPO is planning to make a more constructive suggestion in our next proposal, in order to achieve consolidation of the similar tasks, and removals and merge where necessary as also suggested by many companies.**

18 – Guangdong OPPO Mobile Telecom.

Response to #16 from KDDI: OPPO supports KDDI's view that WT3 may be included in WT1, and that WT4 should be prioritized. As mentioned, restructuring will become a part of our next revision proposal.

19 – Cisco Systems

We support part of WAt1. WT1. 1.1 ,1.2 and 1.3 has RAN dependency and should be finalised in RAN group first. We are okay with 1.4 and 1.6 but 1.5 needs clear scoping and clarity on model ID (should it be aligned with RAN group?)

Most of items in WT1 is about alignment with RAN. We think WT1 and Wt2 should be merged.

We support WT3 and WT4.

We support WT5.1,5.2,5.3,5.4,5.5 and 5.8. More understanding and scoping is required for 5.6. Sensing is an study item on its own and it should be completed before taking up 5.7.

20 – Cisco Systems

There is quite a few overlap between WT1 and WT2. These two sections should be combined

21 – vivo Communication Technology

We already had a good discussion and quite a few companies shared their view and it is time to discuss how to re-construct Working Tasks now to meet 14 TU per SID as guided by SA plenary. We are open and so far the proposal from Samsung looks a good try and looks somehow reasonable, which of course needs further improvement.

Comments or suggestions from our side:

1) Regarding relationship with eNA, I have to say, WT1' in general have a close relationship with eNA e.g. Model ID alignment, UE data collection and lifecycle etc. I understood this may relate to whether one SID

or two SIDs and however it looks better to focus on the technical discussion first and later discuss other staff.

2) Regarding WT1', it looks reasonable:

a) Firstly, group all the cross-domain AIML coordination as a starting point including potential any combination of UE/RAN/5GC/OAM and AF. We would like to put VFL and trustworthiness under WT1' as VFL/trustworthiness obviously involve cross-domain AIML coordination

b) Secondly, on the top of a), we can further discuss which combination(s) are essential in R19 e.g. we may remove OAM/MDAS part (we understand/share the concern from OPPO regarding MADS, which may not have much or essential work in R19). we may have open discussion whether VFL or trustworthiness are essential in R19 and remove one or both.

22 – Orange

WT-2 should be merged into WT-1 (but we don't support them for Rel-19).

23 – Qualcomm Korea

Regarding the new structure proposed by Samsung, I think it is unrealistic to fix the TU limit by only restructure the WTs without down scope proposal.

I prefer to keep the structure at it is since there are already lots of inputs about the preference for each WTs. If we restructure the WTs at this time, people may need to provide their comments again based on the new WTs.

Another reason is that I do not want people to spend too much time about how to restructure the new WTs, I do not think people have a consensus about the new structure as Samsung proposed, for example, I do not think it is proper to merge 5.3 into WT#1.

It is moderator's responsibility to summarize that which WTs / sub-WTs have the highest support and which have lowest interest based on all the inputs after the moderator discussion, it is not proper to propose priority sequence for the WTs for discussion.

24 – China Mobile Com. Corporation

WT1 and WT2 may be merged in one WT since both of them are related to RAN. So we suggest to merge into one WT.

25 – AT&T

WT#1 and WT#2 can be merged

26 – ETRI

ETRI also agrees with Samsung's overall structure proposed by comment #13.

However, as Samsung also mentioned, further discussion is required regarding prioritization, such as determining which sub-WTs are included to each WT'.

27 – Intel Deutschland GmbH

WT1 and WT2 can be merged.

28 – Apple AB

We agree to the proposal of merging WT-1 and WT-2.

Regarding Samsung's restructuring proposal, we think the new WTs are too broad and at the end, may lead to same effort estimation.

Feedback Form 3: Should any of the Work Tasks above be reworded? If so, propose the required rewording.

1 – vivo Communication Technology

WT1.1: Whether and how to support a common 5GS AI/ML framework to enable AI/ML for radio interface. This includes studying 5GC/~~LMF~~ extensions (e.g. UE selection, performance monitoring etc.) to enable AI/ML support for the RAN-1 AI/ML use cases;

Propose to delete **LMF** in WT1.1 to have a general statement .

The reasons:

- 1) three use cases are identified by RAN1 i.e. CSI feedback enhancement, Beam management, Positioning accuracy enhancements
- 2) CSI feedback enhancement, Beam management themselves do not touch SA2 architecture, which are in the scope of RAN
- 3) Compared to the other two use cases, positioning architecture is defined and specified by SA2 and so in order to support positioning accuracy enhancements, SA2 need to study Architecture enhancement to support AI based Positioning. It is proposed to add an additional WT1.5: Architecture enhancement to support AI based Positioning

2 – vivo Communication Technology

Propose to add an additional WT1.5: Architecture enhancement to support AI based Positioning

The reasons are:

- 1) the CSI feedback enhancement, Beam management are identified by RAN and do not touch SA2 architecture, which are in the scope of RAN

2) Compared to the other two use cases, positioning architecture is defined and specified by SA2 and so in order to support positioning accuracy enhancements, SA2 need to study Architecture enhancement to support AI based Positioning.

3 – CATT

WT 1.1: to be reworded as following:

Whether and how the 5GC provides any assistance to support AI/ML use cases in RAN;

WT 1.2, 1.3, 1.5 and 1.6: to be merged and reworded as following:

Whether and how to enhance data collection and model transfer framework and procedures to support AI/ML use cases in RAN;

4 – Guangdong OPPO Mobile Telecom.

WT 5.1 and WT5.2: it is too open ended, hence we would like to ask the supporting companies to submit more clarifications on the objectives and, based on those, propose some rewording

5 – Guangdong OPPO Mobile Telecom.

WT4.3: We propose to state: "Whether and how to transfer AI model between the UEs via direct UE communication" instead of "direct device connection"

6 – Guangdong OPPO Mobile Telecom.

WT3.2: We propose the following slightly modified text: "How to identify/select the required NF(s) within the 5G Core domain **and the UEs** corresponding to the local feature in order to collaborate on the VFL operation (i.e. training or inference);

7 – Guangdong OPPO Mobile Telecom.

We agree with Vivo comment on RAN1's progress on positioning, however we believe it is already covered by WT1.1. in generic way, therefore, a new WT is not needed, but we are opened to the suggestion on WT1.1 reworded text

8 – Guangdong OPPO Mobile Telecom.

In our view, WT1.3 can be slightly reworded to: "Whether (and how) to support model transfer/delivery **among UE, gNB, 5GC and OTT**"

The reason for such suggested rewording is that model may be transferred or delivered to the UEs, but it may also come from gNB, 5GC and OTT to the UE according to the RAN1/RAN2 considerations.

9 – Guangdong OPPO Mobile Telecom.

In our view, WT1.5 can be reworded to:

”WT1.5: Study the Model ID alignment to support the AI/ML model Lifecycle management as defined by RAN1.”

The reason is that the use of the Model ID could apply to the different aspects of the lifecycle management (LCM) of AI/ML model: e.g., model training, model deployment, model inference, model monitoring, model updating.

10 – Guangdong OPPO Mobile Telecom.

We propose to rework WT1.6 along the following lines:

”WT1.6: Study QoS and policy control to support **AI enabled RAN framework**”

The reason is that, as it is written right now, WT#1.6 is incomplete. Different functions within the RAN AI framework could require PCC/QoS support from 5GC (e.g. supporting the model inference operation, performance feedback etc.). Hence, it should not limited to RAN model transfer and delivery only.

11 – ETRI

WT4: We propose the rewording like ”Study 5GC extensions to support Transfer Learning in order to expedite the 5GC assistance for the model training or inference operation for the direct device connection scenario from SA1 Rel-19 FS_AIML_MT_ph2”

Reason: it seems to only focus on the direct device connection scenario from SA1 Rel-19 FS_AIML_MT_ph2 considering the description of WT4.1, 4.2, and 4.3. But, the existing description can be also applied to the NWDAF-to-NWDAF scenario as another additional candidate work task, which is indicated by [WT-ETRI-1] in section 2.2.

12 – vivo Communication Technology

Regarding WT#5.2, to my understanding, it is highly related to **S2-2306550** submitted in Berling SA2 meeting and please Alla refer to it for the details.

13 – vivo Communication Technology

Regarding WT#1.1, we still want to have a additional WT#1.5 for AI based positioning and however if some company have strong view then we can live with by rewording WT#1.1 on the top of proposal from CATT:

”Whether and how to enhance 5GC to support AI/ML use cases in RAN e.g. AI based positioning.”

The reason is that, as mentioned before, AI based positioning is different from the other two use cases identified by RAN1 i.e. positioning have a decent impact on SA2 as LMF is located in 5G core network.

Regarding *WT 1.2, 1.3, and 1.5*, we prefer to have them standalone to allow readers to clearly understand what we will study.

Regarding how to reword WT#1.3, we slightly prefer to keep the original text as it is, to our understanding, the proposal from OPPO seems to make the scope too wide e.g. so far RAN1 identify the use case such as model delivery to UE. Better to focus on this aspect in R19 due to limited time.

Also, it looks somehow solution specific e.g. implying OTT server or 5GC or gNB deliver Model to UE., which should be studied in TR phase. Better to keep it more general.

Regarding WT1.5, we would like to further reword it on the top of proposal from OPPO as we SA2 already defined Model ID in R18 eNA_ph3 and alignment between RAN and SA2 is needed.

”WT1.5: Study the Model ID alignment to support the AI/ML model Lifecycle management as defined by RAN1 **and SA2**.”

14 – Guangdong OPPO Mobile Telecom.

reply to comment #12 by Vivo: thanks for your clarification. Indeed, S2-2306550 describes in a details what signaling storm is. However, as per our understanding, the aspects of signaling storm (and, specifically) aspects covered by S2-2306550 may go far beyond NWDAF/analytics coverage, therefore we propose to add a note that only signaling storm analytics related aspects will be covered in R-19.

15 – Guangdong OPPO Mobile Telecom.

reply to the comment #13 by Vivo:

WT#1.3: we believe that our text suggestion is fully aligned with the current status of the RAN2, Please see the following extracts from the approved RAN2 report. OPPO’s proposed wordings is to summarize the latest status only.

»»» Extracts from RAN2#122 report

For the data generation entity and termination entity deployed at different entities, RAN2 assumes:

o For CSI enhancement and beam management use cases:

- For model training, training data can be generated by UE/gNB and terminated at gNB/OAM/OTT server
- For NW-sided model inference, input data can be generated by UE and terminated at gNB.
- For UE-side model inference, input data/assistance information can be generated by gNB and terminated at UE.
- For model monitoring at NW side, performance metrics can be generated by UE and terminated at gNB.

o For positioning enhancement use case:

- For model training, training data can be generated by UE/gNB and terminated at LMF/OTT server
- For NW-sided model inference, input data can be generated by UE/gNB and terminated at LMF and/or gNB

- For UE-side model inference, input data/assistance information can be generated by LMF/gNB and terminated at the UE
- For model monitoring at NW side, performance metrics can be generated by UE/gNB and terminated at LMF.

WT1.5: We believe it is RAN1/2 responsibility to define requirements for Model ID according to the RAN2 “agreed” revised LCM framework i.e. allowing the RAN to lead the requirements for RAN AI’s Model ID discussions, therefore we prefer to keep the text as is.

16 – China Telecommunications

WT5.1: We propose to reword it as ”WT5.1: NWDAF-assisted recommendations (SWS-230013, SWS-230014, SWS-230021, SWS-230045, SWS-230058, SWS-230068, SWS-230033, SWS-230034), including policy/QoS recommendations”

Reason: Current description seems to limit recommendations in policy/QoS, what the recommendation exactly is should be left to study phase, we do not need to specify it here.

17 – InterDigital

WT#1.3: We also prefer the modifications proposed by Oppo, as they are aligned with current RAN1/2 work as highlighted in comment #15. However, we proposed a slight modification on the wording: ”Whether (and how) to support model transfer/delivery to **UE via gNB, 5GC or OTT**”

18 – Nokia Germany

For the merger of WT1 and WT2, the high level description of **WT1** could read:

“Study enhancements to support AI enabled RAN based on conclusions of the RAN study.”

I suggest splitting positioning from WT 1.1 into a separate sub-WT.

For WT 1:3: In RAN discussion it is entirely unclear whether anything related will be concluded. Model interoperability between vendors is very hard according to past discussions. Drop this WT.

In WT 1.5, it is unclear what models are meant.

WT3:

Many input contributions suggested “cross-domain coordination” for AI-ML operations. This could also include such aspects as providing QoS policy.

Vertical federated learning can be studied, but this should be a sub-aspect. And for that use cases should be studied as a first step.

There might be overlap with WT1 for RAN UE interactions

WT5

WT5.1 is very open ended. NWDAF analytics are already designed with special use cases and consumers in mind and serve as a kind of recommendations. Unclear whether extensions for a closed-loop control are required. Better focus special use cases (or drop WT)

Unclear what WT5.4 “Online learning” means

WT 5.5 could be reworded as follows:

Study possible improvements related to requirements for trustworthiness of Analytics as defined by EU regulations, including improvements to analytics, models, and input data

19 – vivo Communication Technology

Regarding WT#1.5 Study the Model ID alignment, Lifecycle management, we SA2 already did a good job in R16 eNA/R17 eNA_ph2/R18 eNA_ph3 in terms of Model ID definition and Model/Analytics performance for classification in TS23.288 which is the number of correct predictions out of all predictions

We understood that Model ID or feature/FG report to network is still under discussion, which may take some time to have conclusion e.g. in or after August RAN meeting.

However, regarding ML model performance, RAN also have a good discussion and looks promising at least for RAN AI positioning otherwise how to measure the accuracy of RAN AI positioning as commented by OPPO.

However, the current wording looks a little bit ambiguous, we propose to rephrase WT#1.5 to make it more general

WT1.5: Study the Model ID alignment, Lifecycle management alignment between SA2 and RAN e.g. in terms of Model performance and Model ID;

20 – Qualcomm Korea

We also agree to remove "LMF" from WT 1.1.

21 – Motorola Mobile Com Technology

new WT3.1 (merge of 3.1 and 3.2): Identify whether and how VFL across domains (UE-5GC, 5GC-5GC, 5GC-edge) can be supported including selecting the required nodes across domains to support model training.

revised WT#5.3: Study further information exchange between NWDAF, MDAS and ADAES for improving analytics accuracy

22 – HuaWei Technologies Co.

WT1:

WT1 does not need rewording. We need to wait for RAN conclusion, then SA2 will have better knowledge to understand what to do.

WT3:

WT3 does not need rewording. Considering that VFL would need complex privacy protection methods to protect local data privacy, so overall the VFL may cost a lot for all the involved entities. Before we agree something, we have to justify the use cases and what will be the scope to support VFL.

WT5.1:

We understand the intention of China Telecom, but we need a specific use case to justify why the NWDAF-assisted recommendation is needed at this stage, so we propose the WT5.1 can be reworded to:

WT5.1: NWDAF-assisted recommendations (SWS-230013, SWS-230014, SWS-230021, SWS-230045, SWS-230058, SWS-230068, SWS-230033, SWS-230034), e.g., policy/QoS recommendations.

One of the use cases is the policy/QoS recommendations. For example, the NWDAF derives recommended QoS parameters that can achieve MOS>4 based on the service experience objective (e.g., MOS>4) provided by PCF and the collected input data, and feeds back to the PCF, then the PCF can set the QoS parameter by considering the recommended QoS parameters.

23 – Orange

WT-5.3: Study further information exchange between NWDAF, MDAS and ADAES for analytics on misbehaving NF (e.g. abnormal behaviour, performance degradation, operational conflict etc.)

24 – Samsung R&D Institute UK

Yes, most of the content requires re-wording. Here's a re-wording proposal for the WTs we do support:

- **WT1' (WT1 in moderator's proposal)** reworded to '5GC support for AI/ML cross-domain coordination'
- **WT1.1' (WT1.1 in moderator's proposal)** reworded to '5GC support for UE/air interface AI/ML to support use cases defined by RAN1'
- **WT1.2' (WT1.2 in moderator's proposal)** reworded to 'Enhancements to UE data collection framework'
- **WT1.3' (WT1.3 in moderator's proposal)** reworded to '5GC support for delivery of AI/ML models and information to the UE'
- **WT1.4' (WT2 in moderator's proposal)** reworded to '5GC support for AI/ML in NG-RAN'
- **WT1.5' (WT5.3 in moderator's proposal)** reworded to 'Support for further information exchange between MTLF and MDAS'
- **WT2' (WT2 in moderator's proposal)** reworded to 'Support for 5GC intra-domain AI/ML new capabilities'
- **WT2.1' (WT5.1 in moderator's proposal)** reworded to 'Support for 5GC AI/ML-assisted recommendations'
- **WT2.2' (WT5.2 and part of 5.3 in moderator's proposal)** reworded to 'Support for AI/ML-assisted NF coordination, e.g. for prediction, prevention, detection, and mitigation of signaling storms and performance degradation due to misbehaving/conflicting NF operations'
- **WT3' (spread across multiple WTs in moderator's proposal)** re-worded to 'Further enhancements of previous eNA and AIMLsys capabilities'
 - o Example sub-WTs in WT3' could be WT3/4/5.4/5.5 (we're flexible on wording)

25 – Samsung R&D Institute UK

A correction on the text above:

- **WT2’ (~~WT2 in moderator’s proposal~~)** reworded to ‘Support for 5GC intra-domain AI/ML new capabilities’ to capture commonalities of proposed WT2.1’ and WT2.2’

26 – China Mobile Com. Corporation

WT1.2 ”enhance UE data collection framework”, it should be clarify the necessity of UE data collection, what benefit can be get from the UE data collection for 5GC, and the potential effect for 5G framework.

WT3: Study the following potential enhancements to enable 5G system to assist cross-domain (e.g. UE, 5G Core, application, OAM) application AI training and inference (so-called “Vertical Federated Learning (VFL)”). The ”application” should be deleted in the above sentence, since it limit the research scope .

WT5.5 relates to analytics and models trustworthiness, it seems like the model performance and analytics accuracy as defined in current TS, however we are not sure it is useful for analytics and models consumers. We think it may lead by SA3 for data and models security. Hope the description of the WT5.5 can be more clear, can explain why SA2 should do and what benefits can SA2 get.

2.2 Additional Work Tasks

As well as the initial set of Work Tasks in section 2.1 companies can request to add additional Work Tasks. The naming of these additional Work Tasks should follow the format: WT-company name-# (eg WT-Samsung-1) so that other participants can reference them.

Feedback Form 4: Are there any additional Work Tasks that should be part of Rel-19?

1 – vivo Communication Technology

Propose to add an additional WT1.5: Architecture enhancement to support AI based Positioning

The reasons are:

- 1) the CSI feedback enhancement, Beam management are indentified by RAN and do not touch SA2 architecture, which are in the scope of RAN
- 2)Compared to the other two use cases, positioning architecture is defined and specified by SA2 and so in order to support positioning accuracy enhancements, SA2 need to study Architecture enhancement to support AI based Positioning.

2 – China Mobile Com. Corporation

Propose to add an additional WT5.9: Whether and how to support Reinforcement Learning

The background are as follows:

- Reinforcement learning can generate the optimal model based on the dynamic environment;
- Support more complex scenarios by allowing interaction between action and environment, helping to achieve the end-to-end feedback of the network.

3 – Guangdong OPPO Mobile Telecom.

Question to China Mobile: Not sure the above mentioned newly suggested WTS relates to NWDAF and should come under NWDAF objectives. Please explain the rationale behind.

4 – ETRI

[WT-ETRI-1]

We propose to add an additional WT5.10: Whether and how to support Transfer Learning in order to expedite the model training or inference operation by NWDAF.

Reason:

- One of the major challenges in AI/ML in practical applications is the significant amount of time it takes for the training process to complete.
- To mitigate the issue, transfer Learning can be used to help NWDAF expedite the model training or inference operation, different from learning every task from scratch.

5 – China Mobile Com. Corporation

Response to OPPO: In this stage, ideally before June 29th, the additional WT can be added as indicated in the Kick Off email of moderated discussion. Also, the content proposed as WT5.9 was described in the workshop slide(SWS-230068) from our side.

6 – Guangdong OPPO Mobile Telecom.

Question for clarification (comment #4 from ETRI) - right now, there is an objective already related to Transfer learning (WT4). Do you propose to extend it as well to include NWDAF related aspects?

7 – Guangdong OPPO Mobile Telecom.

Response to comment #5 from China Mobile: we are absolutely fine with adding a new objectives at this point! Your proposal is to add it under NWDAF objectives hence the question was about a wider context and whether this belongs to a wider objectives or, it is NWDAF related only, in your view, please clarify.

8 – KDDI Corporation

To ETRI#4

We agree with the idea of ETRI and propose further revisions to include the support of the UE-network-UE transfer learning, as follows:

WT5.10r2: Whether and how to support Transfer Learning, including NWDAF-NWDAF and UE-network-UE, in order to expedite the model training or inference operation by NWDAF.

Reason:

- As denoted in CPR 8.1.1-1 of TR22.876, the location and times of the direct device connection are limited.
- Network assistance, i.e., specification of UE-network-UE Transfer Learning, is necessary to expand the availability of Transfer Learning.

9 – KDDI Corporation

To Oppo#6

As ETRI mentioned in Section 2.1 #11, we also support the idea of ETRI that to separate the Transfer Learning topic regarding direct device connection to WT#4 and the others to WT#5.10.

10 – Guangdong OPPO Mobile Telecom.

Reply to the comments #4, #8 and #9: we would like to request for some clarifications: for the mentioned case of "UE-network-UE transfer learning", is it just a transfer of the model from UE to network then to UE or NWDAF actually needs to be involved to perform the transfer learning? Please clarify. Perhaps, we can put some more generic objectives to potentially study the issue and come up with solutions under WT4?

11 – vivo Communication Technology

propose to add new WT#5.9: How to support UE data collection in case of NAT

This issue has been discussed and agreed in Berlin SA2 meeting but not resolved so far. Better to add it the moment, if this problem is resolved by August SA2 meeting, then we can take it out.

12 – China Mobile Com. Corporation

Reply to comment#7 from OPPO: Yes, we are open, but currently it only includes NWDAF related aspects.

13 – Guangdong OPPO Mobile Telecom.

Reply to #12: Thanks for the clarification! Then we suggest to have a note clarifying that only NWDAF related aspects are to be studied in R-19.

14 – KDDI Corporation

Reply to OPPO #10

Thanks for the comment. Regarding "UE-network-UE transfer learning," we consider that NWDAF is involved only in the model transfer part (not involved in the training procedures). In the case of "UE-network-UE transfer learning," NWDAF can be a "network"; e.g., NWDAF supports the transfer of the model from UE to ADRF to another UE.

As you mentioned, we are open to including [WT5.10r2] in WT#4 as a Transfer Learning related item. Instead, we understand the idea of ETRI to focus WT#4 on direct device connection-related items. KDDI intends to involve "UE-network-UE" transfer in any WTs, and the suggestion from ETRI sounds most reasonable to us so far.

15 – Guangdong OPPO Mobile Telecom.

reply to the comment #11 by Vivo: we are fine with that, propose to add note at this point that it is pending August's meeting decisions on R18 AI/ML.

16 – ETRI

Reply to OPPO(#6, #10) and KDDI(#8, #9, #14):

Thank you for your comments.

We have the same view as KDDI and we can accept WT5.10r2 proposed by KDDI in #8.

Regarding whether to include WT5.10r2 in WT#4, we are also open. But, if WT5.10r2 is included in WT#4, I believe the wording should be revised to clarify WTs depending on each target scenario including

- 1) the transfer learning scenario to consider the direct device connection from SA1 Rel-19 FS_AIML_MT_ph2
- 2) and another transfer learning scenario for NWDAF-NWDAF and UE-network-UE.

17 – DOCOMO Communications Lab.

WT-DOCOMO-1 (a subtask of WT5): Whether and how to support operator's custom AIML models for analytics & recommendations by NWDAF

18 – China Telecommunications

We support the idea from ETRI, transfer learning within network (i.e. transfer learning scenario for NWDAF-NWDAF) is worthy to be studied to reduce training time and improve training efficiency.

WT4 said "5GC assistance for the model training or inference operation", it seems like 5GC only supports transfer learning between UEs instead of transfer learning between NWDAFs so we think it is better to be added in WT5, or the description of WT4 needs to be reworded.

19 – ZTE Corporation.

Not sure how WT5 can fly. It includes so many sub WTs without any common aspect. We suggest to split each sub bullet into a separated WT.

20 – Beijing Xiaomi Software Tech

[WT-Xiaomi-1]

propose to add WT1.3a : Whether (and how) to support AI model transfer/delivery to the NG-RAN or other 5GC NF(s) if 5GC impacts identified by RAN

Reasons: for RAN AI, there hasn't been concluded that AI models delivery/transfer to NG-RAN from AI models storage location is excluded. so this should be captured in the WT.

21 – Guangdong OPPO Mobile Telecom.

Reply to comment#20 by Xiaomi: we agree with the rational behind this comment, and propose to use our suggested already provided rewording as a baseline: "Whether (and how) to support model transfer/delivery among UE, gNB, 5GC and OTT".

22 – KDDI Corporation

Reply to ETRI#16, CT#18, and OPPO#10:

KDDI agrees with the suggestion from ETRI#16. So far, consider WT5.10r2 in WT#4 with rewording as ETRI suggestion is a preferable option.

Reasons: As ZTE #19 mentioned, there are many items in WT#5 under a large umbrella of "NWDAF-related items. " So, in terms of the consistency of SID, WT5.10r2 seems suitable to be included in WT#4 as a transfer learning-related item.

23 – Nokia Germany

New WT to study DCCF Enhancements for data collection and exposure such as support for bulk data requests and support of collection of vendor-specific data in addition to standardized data.

24 – MediaTek Inc.

Regarding WT suggested by Vivo: "Architecture enhancement to support AI based Positioning", in our view, this can be considered as part of WT1.3 so we do not need a separate WT.

25 – vivo Communication Technology

Response to #24 provided by MediaTek:

Agree that "Architecture enhancement to support AI based Positioning" could be considered as part of WT1.3 only in terms of Model delivery to UE in case of case 1 defined by RAN i.e. UE based Direct AI/ML positioning.

However, in our view, AI based Positioning do need a system level study and touch many areas not only model delivery e.g. 5GC architecture enhancement e.g. potential coordination between LMF and NWDAF and data collection enhancement for AI based Positioning.

Therefore, in our view, it looks better to have a standalone sub-WT (under WT#1) for AI based Positioning (also proposed by Nokia).

26 – LG Electronics France

Yes, leftover from Rel-18 AIMLsys: 5GC information exposure to UE.

27 – HuaWei Technologies Co.

To China Mobile#2:

We support the intention but "Reinforcement learning" is a little bit open ended. The scope cannot be clearly reflected by this term, e.g. people may first want to discuss which entity is AI agent. We propose it can be reworded to:

Whether and how to support additional NF feedback related to the NWDAF analytics and model training to improve the correctness.

This is also aligned with the discussion in R18.

To KDDI#8:

We'd like some clarification on the use cases.

For the "UE-network-UE transfer learning", could you clarify in what scenario the UE needs to transfer the model to another UE via network, and what could be the role of NWDAF?

For the "NWDAF-NWDAF transfer learning", it already supports that the NWDAF requests/subscribes model from another NWDAF, and the NWDAF can already fine-tune the model depending on the internal implementation, so it needs to be justified what the technical gap is.

To DOCOMO#17:

This WT seems to be the internal implementation in NWDAF, or may be related to SA5 work. Before agreeing this WT, it needs to be clarified what is the impact on NWDAF/5GC.

To Nokia#23:

In current specification, we don't see any NWDAF analytics needs vendor-specific data. Could you clarify why the vendor-specific data is needed, and what kind of vendor-specific data may be needed?

28 – DOCOMO Communications Lab.

In Response to **HuaWei #27**

In Rel-18, sharing/transferring ML models between MTLF, AnLF, and ADRF is supported through service operations defined by SA2. However, these operations are designed for the ML models which are already embedded within these NFs. Currently, there is no standard procedure (and corresponding service operations) in case an operator (due to reasons such as deployment scenarios) needs to use a custom/external ML model (which was developed/built in e.g., OAM) for a specific Analytics ID, instead of those pre-embedded ML models in NWDF.

The proposed WT is to study how to address this issue.

29 – KDDI Corporation

In response to **HuaWei #27**

First of all, I consider that the UE-network-UE and NWDAF-NWDAF transfer learning is one of the detailed scenarios of WT4. Thus, I would like to clarify that I support WT4, and the answer below is upon the assumption that WT4 is studied in Rel19.

For the "UE-network-UE transfer learning," I consider as follows;

Scenario: As I posted on #8, the location and times of the direct device connection are limited (denoted in CPR 8.1.1-1 of TR22.876). In more detail, depending on the propagation environment and antenna equipment (e.g., D2D distance is larger than UE-RU distance), D2D communication quality and coverage are sometimes inferior to UE-NW-UE communication.

Role of NWDAF: In such a case, the NWDAF (perhaps, other NF) should expose the information (e.g., QoS) to the application for selecting D2D or UE-NW-UE.

For "NWDAF-NWDAF transfer learning," as ETRI's comment #4, I consider as follows;

In Rel18, the inter Analytics ID transfer learning is not clearly supported. To provide efficient NWDAF-NWDAF transfer learning, NWDAF with MTLF should know what analytics ID is suitable and available for the initial model to train an ML model. Please see ETRI's comment #4 for more detail.

30 – China Mobile Com. Corporation

Yes.

Propose to add an additional WT5.9: Whether and how to support Reinforcement Learning.

The background is as follows:

- Reinforcement learning can generate the optimal model based on the dynamic environment;
- Support more complex scenarios by allowing interaction between action and environment, helping to achieve the end-to-end feedback of the network.

31 – Apple AB

Yes, WT-APPLE-1: User consent framework enhancement for user data collection and exposure

Feedback Form 5: If there are any additional Work Tasks required, describe them

1 – DOCOMO Communications Lab.

WT-DOCOMO-1: In the current specification, there is no standard procedure for operators to instruct NWDAF to utilize a custom model (which is provided by operator) for generating predictions. However, there is a need for this capability in certain circumstances, such as special deployment scenarios, where operators may prefer to use its own custom model, which is specifically tailored for certain analytic IDs, rather than relying on pre-deployed models in NWDAF. The objective of this WT is to establish a standardized approach that enables operators to customize the AIMLs utilized by NWDAF for generating predictions and recommendations.

2 – Nokia Germany

Frequently analytics also rely on vendor-specific data and the DCCF should also support collection of such data. While details will not be standardized ways of DCCF discovery, and combining request and notifications for standardized and vendor-specific data may require some standardization.

3 – LG Electronics France

WT-LGE-1: 5GC information exposure to UE

whether and how to enhance the 5GC to expose information to the UE to facilitate its Application AI/ML operation

4 – Apple AB

WT-APPLE-1: User consent framework enhancement for user data collection and exposure

5 – Apple AB

In Rel-18 AIMLSys we had discussions on exposing analytics that could be linked to subscriber/user to 3rd party AF. In Rel-19, there are proposals to define UE data collection framework. We think an essential part of dealing with data is guaranteeing user privacy and providing control to the owner of data.

3 Dependencies

These feedback forms will help define the dependencies between Work Tasks, dependencies of Work Tasks on other Working Groups (SA, RAN or CT), and dependencies on other potential SA2 Rel-19 SIDs and WIDs. The Work Tasks can be from the list in section 2.1, or any additional Work Tasks identified in the feedback in section 2.2.

Feedback Form 6: Describe the dependencies that any of the Work Tasks have on other 3GPP Working Groups

<p>1 – CATT</p> <p><i>WT 1 and 2 have dependencies on RAN WGs.</i></p>
<p>2 – Guangdong OPPO Mobile Telecom.</p> <p>Our view is that corresponding another SID’s analytics related objectives should be moved under that corresponding SID, therefore we propose:</p> <ol style="list-style-type: none">1. As WT5.6 relates to energy efficiency/saving SID, moving energy efficiency analytics related objectives under Energy efficiency/savings SID2. As WT5.7 relates to Sensing SID, moving Sensing analytics related objectives under Sensing SID3. As WT5.8 relates mostly to ProSe SID, moving its analytics related objectives under ProSe SID
<p>3 – Guangdong OPPO Mobile Telecom.</p> <p>Comment #2 - mistakenly put to this section, moved to another section already</p>
<p>4 – Guangdong OPPO Mobile Telecom.</p> <p>WT5.3 has dependency on the work done already by SA5 and also on their related plans for MDAF potential work in R-19</p>
<p>5 – vivo Communication Technology</p> <p>Regarding how to organize another SID’s analytics related objectives, we have a long discussion since Rel 16 eNA and the previous practice is to capture standalone WT(s) both in eNA (from analytics point of view) and another SID (from specific service flow point of view) respectively as we do need close coordination between these SIDs and eNA and either eNA or another SID can not do the job separately.</p> <p>For example, in R18 eLCS_ph3 and R18 eNA_ph3, we had a very successful practice and very good coordination is achieved between LCS colleagues and eNA colleagues e.g. having conf call to synchronize each other and work together to consolidate and improve alternative solution i.e. LCS colleagues focus on LCS related part and eNA colleagues focus on analytics related part.</p> <p>R18 eLCS objectives related to analytics:</p>

- WT#2: Study how the location services can benefit from NWDAF reporting and how the NWDAF use cases can benefit from location services, e.g. enhanced accuracy in certain UE location or population flow statistics data that require UE locations smaller than TA/cell

Note 1: For objective WT#2, coordinated activities between the study FS_eNA_PH3 and this study are needed.

R18 eNA_ph3 objectives related to LCS::

WT#4.2: NWDAF enhancements considering the finer granularity of location information than TA and cell level

NOTE: Coordinated activities between the study FS_eLCS_PH3 and this study are needed if NWDAF need to get Location information.

Therefore i propose to keep WT#5.6, 5.7 and 5.8 at the moment and let's focus whether to have them in R19 and also take into account discussion outcome from the corresponding SID(s)

I would like to share our view regarding WT5.7: NWDAF assisted Sensing, we tend to delay this to future Release as R18 sensing should focus on basic feature e.g. architecture enhancement to support sensing.

Regarding WT5.6: NWDAF-assisted energy saving, we see the benefit to study it in R19 (with close coordination with Energy Efficiency / Energy Saving as a Service).

Regarding WT5.8: NWDAF assisted 5G MBS and ProSe, we are open and if time permits, we are ok to have it in R19.

6 – vivo Communication Technology

Comment #2 - mistakenly put to this section and comments on OPPO's previous comments on this thread , moved to another section

7 – vivo Communication Technology

Comment #2 - mistakenly put to this section and comments on OPPO's previous comments on this thread , moved to another section

8 – DOCOMO Communications Lab.

- There is a tight dependency between WT1 & WT2 and RAN1, RAN2 and RAN3.
- In WT3.1, VFL between 5GC and OAM has dependency on SA5, VLF between 5GC and RAN has dependency on RAN.
- WT5.6 has dependency on SA5 work on energy efficiency and also on the "Energy Efficiency / Energy Saving as a Service" topic proposed to Rel-19.
- WT5.7 has dependency on "Integrated Sensing and Communication" proposed for Rel-19.
- Newly proposed WT-DOCOMO-1 has dependency on SA5.

9 – ZTE Corporation.

WT#1 and WT#2 has dependency on RAN working groups.

WT#5.2 and WT#5.3 may have dependency on SA5, but we can start from SA2 first.

10 – Nokia Germany

WT 1 and 2 have dependencies on the RAN Rel-18 study which is not yet concluded. We should revisit them once the RAN study concludes (presumably towards the end of the year)

11 – Nokia Germany

See merging proposals

WT1 and WT2, and WT 3 and WT4 overlap.

12 – Nokia Germany

Please ignore post 11. Was in wrong feedback form

13 – Qualcomm Korea

WT1 and WT2 have RAN dependency.

WT2 is related to the Rel-18 WID in RAN3, we think SA2 can have the study in Rel-19 based on RAN's progress in Rel-18.

For WT1 we think that SA2 can start the study to investigate the possible architecture options. This work is orthogonal to the RAN1 led AI/ML study for the air interface aspects.

WT5.6 has dependency with energy saving and WT 5.7 has dependency with Sensing, since it is not clear the scope for WT5.6 and WT5.7, it is not clear how much dependency with the other SIDs.

14 – Guangdong OPPO Mobile Telecom.

In our view, **WT#2** will need further discussions among RAN3 and SA2 colleagues since, in our view, there is no specific requirement from RAN3 on the table currently.

15 – Guangdong OPPO Mobile Telecom.

WT1: OPPO agrees with QC's comment#13 for QC's assessment and proposal to go ahead with the study of the possible architecture options for the RAN AI support.

16 – LG Electronics France

WT1 and WT2 have RAN dependencies.

<p>17 – HuaWei Technologies Co.</p> <p>WT1 and WT2 have dependencies on RAN. WT5.3 and 5.5 have dependencies on SA3.</p>
<p>18 – Cisco Systems</p> <p>WT1 and WT2 has RAN dependencies. WT5 has sensing and energy saving topics which has dependency on lot of other groups like SA5.</p>
<p>19 – Orange</p> <p>WT-1.1 is dependent on RAN.</p>
<p>20 – Samsung R&D Institute UK</p> <ul style="list-style-type: none">- WT1’ as proposed by Samsung in Section 2.1 relates to AI/ML functionality defined in RAN 1/2/3, SA 4/5- If start of the SA2 work requires work completion/agreements by another WG, this should be stated in the SID and the SID may be later revised. But, it is not reasonable in our view to leave the content out and waste the release.
<p>21 – China Mobile Com. Corporation</p> <p>WT1 and WT2 dependencies on RAN1/2/3 WGs (AI/ML related SIDs). WT5.3 ”MDAF related” may be dependencies on SA5, but it can be studied in SA2 initially.</p>

Feedback Form 7: Describe dependencies between the Work Tasks

<p>1 – CATT</p> <p><i>Have dependencies on AI related work tasks(/SIDs/WIDs) in RAN WGs. The common data collection and/or model transfer framework and procedures designed for RAN AI and 5GC assistance to RAN AI may require confirmation/feedbacks from RAN WGs.</i></p>
<p>2 – DOCOMO Communications Lab.</p> <p>- There is a tight dependency between WT1 and WT2.</p>
<p>3 – Nokia Germany</p> <p>See merging proposals WT1 and WT2, and WT 3 and WT4 overlap.</p>

4 – Nokia Germany

WT 5.6 has overlap with proposed energy saving study. Better address this aspect as part of that study

WT 5.7 Coordination with dedicated SID on sensing would be required. Unclear how related AI-ML enhancements could be discussed before basic principles for sensing architecture are known. Better study this aspect as part of the sensing SID and drop it here.

WT 5.8 ProSe has overlaps with proposed SID on ProSe enhancements and should be studied there.

5 – Nokia Germany

Please ignore post#4 in wrong feedback form

6 – HuaWei Technologies Co.

WT1 and WT2 have strong dependencies.

7 – Orange

WT-1.2, WT-1.5 and WT-1.6 are dependent on WT-1.1.

WT 1.4 is dependent on WT-1.3.

WT4 is dependent on WT-1.3.

8 – Samsung R&D Institute UK

In our view, our proposed WTs structure/scope in Section 2.1 allows for a clean separation of WTs, minimizing cross-WT dependencies to seemingly none at this stage. Other WT structure/scope configurations however may exhibit some cross-WT dependencies (e.g. cross-domain WT and VFL WT)

9 – China Mobile Com. Corporation

WT1.3, WT1.4, WT1.5 and WT1.6 dependencies on WT1.1 and WT1.2.

WT1.4 dependencies on WT1.3

WT2 dependencies on WT1

10 – China Mobile Com. Corporation

1 Some WT(s) may have dependency on other SID(s), but this SID can focus on the part of AI/ML related study.

11 – China Mobile Com. Corporation

Please ignore post #10

Feedback Form 8: Describe any dependencies on potential work/study items that might be created as a result of the other Q3 moderated discussions.

1 – CATT

WT 5.6 has dependency on “Energy Efficiency / Energy Saving as a Service”;

WT 5.7 has dependency on “Integrated Sensing and Communication”.

2 – Guangdong OPPO Mobile Telecom.

Agree with CATT comment, and,

Our view is that corresponding another SID’s analytics related objectives should be moved under that corresponding SID, therefore we propose:

1. As WT5.6 relates to energy efficiency/saving SID, moving energy efficiency analytics related objectives under Energy efficiency/savings SID
2. As WT5.7 relates to Sensing SID, moving Sensing analytics related objectives under Sensing SID
3. As WT5.8 relates mostly to ProSe SID, moving its analytics related objectives under ProSe SID

3 – Guangdong OPPO Mobile Telecom.

WT5.3 has dependency on the work done already by SA5 and also on their related plans for MDAF potential work in R-19

4 – China Mobile Com. Corporation

Regarding WT5.6/5.7/5.8, strongly suggest to keep them in this SID instead of taking out, just like what we did in previous releases to avoid the data analytics related work in a very distributed manner, which obviously is not helpful to SID project management. But for WT5.7, it seems a little bit early to study in R19, since R19 is the first release for Sensing topic.

5 – vivo Communication Technology

Regarding how to organize another SID’s analytics related objectives, agree with China Mobile and actually we had a long discussion since Rel 16 eNA and the previous practice is to capture standalone WT(s) both in eNA (from analytics point of view) and another SID (from specific service flow point of view) respectively as we do need close coordination between these SIDs and eNA and either eNA or another SID can not do the job separately.

For example, in R18 eLCS_ph3 and R18 eNA_ph3, we had a very successful practice and very good coordination is achieved between LCS colleagues and eNA colleagues e.g. having conf call to synchronize each other and work together to consolidate and improve alternative solution i.e. LCS colleagues focus on LCS related part and eNA colleagues focus on analytics related part.

R18 eLCS objectives related to analytics:

- WT#2: Study how the location services can benefit from NWDAF reporting and how the NWDAF use cases can benefit from location services, e.g. enhanced accuracy in certain UE location or population flow statistics data that require UE locations smaller than TA/cell

Note 1: For objective WT#2, coordinated activities between the study FS_eNA_PH3 and this study are needed.

R18 eNA_ph3 objectives related to LCS::

WT#4.2: NWDAF enhancements considering the finer granularity of location information than TA and cell level

NOTE: Coordinated activities between the study FS_eLCS_PH3 and this study are needed if NWDAF need to get Location information.

Therefore i propose to keep WT#5.6, 5.7 and 5.8 at the moment and let's focus whether to have them in R19 and also take into account discussion outcome from the corresponding SID(s)

I would like to share our view regarding WT5.7: NWDAF assisted Sensing, we tend to delay this to future Release as R18 sensing should focus on basic feature e.g. architecure enhancement to support sensing.

Regarding WT5.6: NWDAF-assisted energy saving, we see the benefit to study it in R19 (with close coordination with Energy Efficiency / Energy Saving as a Service).

Regarding WT5.8: NWDAF assisted 5G MBS and ProSe, we are open and if time permits, we are ok to have it in R19.

6 – Guangdong OPPO Mobile Telecom.

Reply to comment #5 from Vivo: As we don't know yet whether analytics objectives will be included in R-19 Sensing, energy efficiency and 5G MBS and ProSe, the best way forward, in our view, would be to put a comment saying that, depending on the objectives defined for those SIDs, the above mentioned objectives in AIML might also be added at a later phase. What do you think?

7 – Guangdong OPPO Mobile Telecom.

Reply to comment #4: please see if you are OK with the way we suggest in #6

8 – China Mobile Com. Corporation

Reply to comment #7: tend to keep them at this moment.

In our understanding, these WTs are originally proposed in this SID, to say the least, even if these relevant SIDs may not exist, those WTs in this SID can be further studied independently if approved. On the other hand, if relevant SID will be available in R19, this SID can focus on the analytics related part, we can still have such WT, and probably one NOTE can be needed to say something like coordinated activities between these SIDs are essential. Hopefully the above can clarify your question.

9 – Guangdong OPPO Mobile Telecom.

reply to the comment #8 by China Mobile: We believe that if the analytics related objective is not approved for the corresponding R-19 study (i.e. Energy Efficiency, Sensing, ProSe studies), we can't study the same under AIML study for NWDAF related objectives, hence would like to ask for the corresponding note at this point and then, based on the progress of those SIDs, see whether we can remove it.

10 – Nokia Germany

WT 5.6 has overlap with proposed energy saving study. Better address this aspect as part of that study

WT 5.7 Coordination with dedicated SID on sensing would be required. Unclear how related AI-ML enhancements could be discussed before basic principles for sensing architecture are known. Better study this aspect as part of the sensing SID and drop it here.

WT 5.8 ProSe has overlaps with proposed SID on ProSe enhancements and should be studied there.

11 – China Telecommunications

Respond to comment #9 and comment #10: We support CMCC and vivo's view, as previous release, we already have experience in cross-SID cooperation, we can have a NOTE about coordinated work if related SID is also approved. For WT5.8, ProSe has been studied two phases and this WT may only refer to what has been studied in previous release, so we think it can also be studied although ProSe SID is not approved.

12 – HuaWei Technologies Co.

WT5.6 has dependency on Energy Efficiency.

WT5.7 has dependency on Sensing.

WT5.8 has dependency on ProSe.

13 – Orange

WT-5.7 is dependent on Sensing.

14 – Samsung R&D Institute UK

In our view, our proposed scope in Section 2.1 eliminates the dependencies on other SA2 study/work items in Rel-19 to none at this stage. However, other sub-WTs in the moderator's initial scope do exhibit dependencies as explained in Samsung's inputs to feedback form 1 (e.g. WT# 5.6/5.7/5.8)

15 – China Mobile Com. Corporation

Some WT(s) may have dependency on other SID(s), but this SID can focus on the part of AI/ML related study.

4 Partitioning

These questions will help determine whether there is one, or more than one, Study Item, Work Item or TEI-19 item to be created from these Work Tasks.

Feedback Form 9: Should there be more than one SID, WID or TEI-19 item created based on the Work Tasks?

1 – CATT

No. One SID is sufficient.

2 – DOCOMO Communications Lab.

- Yes, considering the timing of Rel-19 and the amount of the work proposed, it seems having two SID-s/WIDs is more appropriate than a big one.

3 – ZTE Corporation.

No, we prefer one SID on AI/ML with limited scope considering the limited capacity for Rel-19.

4 – Nokia Germany

One SID is sufficient

5 – MediaTek Inc.

WT1, WT3, WT4 and WT5 are quite orthogonal to each other. We do not see any merit to combine all in a single study. We need more than one study item to accommodate such diverse list of requirements.

In particular, WT5 (and possibly WT3 if any scope for work in SA2) need a separate study item as continuation of eNA.

6 – Qualcomm Korea

It depends on the agreed scope based on the summary of moderated email discussion.

If only WT1 and WT2 are agreed in the scope of Rel-19, there is no need to have another SID/WID for the WTs.

But if WT3, 4 or 5 are also agreed in the scope of Rel-19, It is also OK for us to have another SID to differentiate WT1+2 from other WTs.

7 – HuaWei Technologies Co.

No, only one.

8 – Samsung R&D Institute UK

Assuming the current scope can be significantly reduced (e.g. by downsizing WT3' in Samsung's proposed WT structure), one SID should be enough; otherwise Samsung's proposed WT3' could be a separate SID, if needed.

9 – China Mobile Com. Corporation

No, one SID will facilitates the integration of AI/ML related WTs.

Feedback Form 10: If the answer to the above question is yes, describe how the Work Tasks should be partitioned into different items.

1 – DOCOMO Communications Lab.

- WT5 already encompasses 8 key issues for discussion, which is similar in scope to many SIDs/WIDs in Rel-18. These issues primarily focus on enhancing NWDAF and can be considered as a continuation of eNA_Ph3 from Rel-18. Therefore, one SID/WID would encompass WT1 (including WT2) and WT3, which primarily address cross-domain AI issues, while another SID/WID (i.e., eNA_Ph4) would cover WT5 for further advancements of NWDAF.

2 – MediaTek Inc.

We can see a clear separate scope for WT1.

WT2 needs RAN3 feedback.

For WT3, the scope of work in SA2 is very unclear to us.

Where to fit WT4 also requires some discussions.

Also we see a separate scope for WT5 as continuation of eNA.

3 – Qualcomm Korea

We think WT1+WT2 can be partitioned in a SID and WT3, 4, 5 can be partitioned in another SID.

4 – Samsung R&D Institute UK

If an additional SID were necessary, part or all of the contents of WT3, WT4 and WTs 5.4/5.5 could form a separate SID.

5 SUMMARY OF NWM DISCUSSION

Following is a summary of the NWM discussion for AI/ML study item proposal in Rel-19. This contains moderator proposals based on the feedback from all the forms, considering the need to limit the TU of the final SID proposal.

Table 2:

FF#1: Which of the above Work Tasks should be in scope of Rel-19?		
Companies providing feedback: 27		
WT1		
	WT1.1	<p>Supportive (14): Docomo, Rakuten, Nokia, Samsung, Mediatek, Vivo, Xiaomi, AT&T, SK Telecom, Qualcomm, CATT, T-Mobile, Oppo, DT</p> <p>Conditional (4): Ericsson, Huawei, Cisco, Lenovo (require RAN progress first)</p> <p>Against: N/A</p>
	WT1.2	<p>Supportive (16): Qualcomm, CATT, T-Mobile, Oppo, DT, Docomo, LGE, Rakuten, AT&T, Nokia, Samsung, Mediatek, Xiaomi, Vivo, Intel, SK Telecom</p> <p>Conditional: Ericsson, Huawei, Cisco, Lenovo (require RAN progress first)</p> <p>Against: N/A</p>
	WT1.3	<p>Supportive (15): Qualcomm, CATT, T-Mobile, Oppo, DT, Docomo, LGE, Rakuten, AT&T, Samsung, Mediatek, Xiaomi, Vivo, Intel, SK Telecom</p> <p>Conditional (4): Lenovo, Ericsson, Huawei, Cisco (require RAN progress first)</p> <p>Against (1): Nokia</p>

	WT1.4	<p>Supportive (8): Mediatek, Vivo, Cisco, CATT, T-Mobile, Oppo, Qualcomm, DT</p> <p>Conditional: -</p> <p>Against (10): Docomo, Ericsson, Xiaomi, Huawei, Samsung, Nokia, AT&T, Intel, KDII, Oppo (relates to SA3 work)</p>
	WT1.5	<p>Supportive (11): Cisco, CATT, T-Mobile, Oppo, Qualcomm, DT, Docomo, Rakuten, Intel, Vivo, AT&T</p> <p>Conditional:</p> <p>Against (5): Nokia, Ericsson, Mediatek, Huawei, Samsung (mostly related to RAN or out of scope of SA2)</p>
	WT1.6	<p>Supportive (10): Cisco, CATT, T-Mobile, Oppo, Qualcomm, DT, Docomo, Rakuten, Cisco, AT&T</p> <p>Conditional (): Vivo, Huawei (need to wait for RAN and can be merged with previous ones)</p> <p>Against (4): Mediatek, Samsung, Nokia, Xiaomi</p>
WT2		
		<p>Supportive (6): CATT, Rakuten, Qualcomm (separated from WT1), SK Telecom, Samsung, AT&T</p> <p>Conditional (10): T-Mobile, Cisco, Docomo, ZTE, Vivo, Nokia, Oppo, Apple, DT, Xiaomi (merge with WT1)</p> <p>Against (4): Intel, Huawei, Mediatek, Ericsson</p>

WT3		
	WT 3.1	<p>Supportive (10): Lenovo, CATT, Docomo, Oppo, Vivo, KDDI, AT&T, Rakuten, Cisco, CMCC</p> <p>Conditional (2): Ericsson (RAN out of scope), ZTE (either WT3 or WT4)</p> <p>Against (6): Qualcomm, Huawei, Samsung, Apple, T-Mobile, Mediatek</p>
	WT 3.2	<p>Supportive (10): Lenovo, CATT, Docomo, Oppo, Vivo, KDDI, AT&T, Rakuten, Cisco, CMCC</p> <p>Conditional (2): Ericsson (RAN out of scope), ZTE (either WT3 or WT4)</p> <p>Against (6): Qualcomm, Huawei, Samsung, Apple, T-Mobile, Mediatek</p>
	WT 3.3	<p>Supportive (9): CATT, Docomo, Oppo, Vivo, KDDI, AT&T, Rakuten, Cisco, CMCC</p> <p>Conditional (2): Ericsson (RAN out of scope), ZTE (either WT3 or WT4)</p> <p>Against (6): Qualcomm, Huawei, Samsung, Apple, T-Mobile, Mediatek</p>

	WT 3.4	<p>Supportive (9): CATT, Docomo, Oppo, Vivo, KDDI, AT&T, Rakuten, Cisco, CMCC</p> <p>Conditional (2): T-Mobile, ZTE (either WT3 or WT4)</p> <p>Against (6):Qualcomm, Huawei, Samsung, Apple, Mediatek, Ericsson</p>
WT4		
	WT4.1	<p>Supportive (5): Interdigital, Oppo, Rakuten, KDDI, Cisco,</p> <p>Conditional (4): China Telecom, Apple, ZTE, Huawei</p> <p>Against (9): Samsung, Docomo, Nokia, Intel, DT, Ericsson, T-Mobile, Mediatek, Qualcomm</p>
	WT4.2	<p>Supportive (5):Interdigital, Oppo, Rakuten, KDDI, Cisco</p> <p>Conditional (3):China Telecom, Apple, ZTE</p> <p>Against (10): Samsung, Docomo, Nokia, Intel, DT, Ericsson, T-Mobile, Mediatek, Qualcomm, Huawei</p>
	WT4.3	<p>Supportive (7):Interdigital, Oppo, Rakuten, KDDI, Cisco, CATT, Xiaomi</p> <p>Conditional (3):China Telecom, Apple, ZTE</p> <p>Against (10):Samsung, Docomo, Nokia, Intel, DT, Ericsson, T-Mobile, Mediatek, Qualcomm, Huawei</p>
WT5		

	WT5.1	<p>Supportive (14): CATT, China Telecom, Docomo, KDDI, Rakuten, Cisco, Orange, Vivo, SK Telecom, Huawei, Lenovo, ZTE, Samsung, CMCC</p> <p>Conditional (): -</p> <p>Against (4): Qualcomm, Oppo, Mediatek, Ericsson</p>
	WT5.2	<p>Supportive (17): CATT, China Telecom, Docomo, KDDI, Nokia, Rakuten, Cisco, Orange, Vivo, SK Telecom, Lenovo, AT&T, ZTE, Samsung, CMCC, Apple, NTT</p> <p>Conditional (1): Ericsson</p> <p>Against (3): Qualcomm, Oppo, Mediatek</p>
	WT5.3	<p>Supportive (12): CATT, China Telecom, Docomo, Nokia, SK Telecom, Lenovo, Rakuten, Cisco, Huawei, Orange, Samsung, Apple</p> <p>Conditional ():</p> <p>Against (5): Qualcomm, Oppo, Mediatek, Ericsson, Huawei</p>
	WT5.4	<p>Supportive (4): CATT, China Telecom, CMCC</p> <p>Conditional ():</p> <p>Against (7): Qualcomm, Oppo, Mediatek, Rakuten, Docomo, Ericsson, Samsung</p>

	WT5.5	Supportive (9): CATT, China Telecom, Docomo, Nokia, Orange, Vivo, Lenovo, Cisco, Apple Conditional (): - Against (7): Qualcomm, Oppo, Mediatek, Ericsson, T-Mobile, ZTE, Samsung
	WT5.6	Supportive (7): CATT, China Telecom, Docomo, Rakuten, Cisco, Orange, CMCC Conditional (): Against (7): Qualcomm, Oppo, Mediatek, Ericsson, Lenovo, Samsung, ZTE
	WT5.7	Supportive (4): CATT, China Telecom, Docomo, Futurewei Conditional (): - Against (8): Qualcomm, Oppo, Mediatek, Ericsson, ZTE, DT, Cisco, Samsung.
	WT5.8	Supportive (4): CATT, China Telecom, Docomo, Cisco Conditional (): - Against (9): Qualcomm, Oppo, Mediatek, Ericsson, DT, T-Mobile, Vivo, Samsung, ZTE

Table 3:

FF#2: Can any of the Work Tasks above be combined/merged?	
Companies providing feedback: 21	

WT1	-
WT2	Merge with WT1: Oppo, CATT, Vivo, Docomo, Nokia, T-Mobile, Oppo, Cisco, Orange, CMCC, AT&T, Intel, Apple
WT3	Merge with WT1: KDDI, Oppo WT3.1, WT3.2 merging: Lenovo
WT4	Merge into WT3: Nokia
WT5	-
Other	Samsung kindly proposed a helpful but drastic restructuring to potentially reduce TUs, by moving sub-WTs into different WTs. However, this came after many comments on existing WTs were already provided, and thus it makes it impossible to re-evaluate all comments wrt the new proposal. The proposal is supported by Rakuten, SK Telecom, KDDI, and ETRI, and opposed by Oppo, Apple, and Qualcomm.

Table 4:

FF#3 Should any of the Work Tasks above be reworded? If so, propose the required rewording.	
Companies providing feedback: 12	
Summary	Extensive rewording has been proposed by various companies, intermixed with the Samsung proposal to restructure the WTs completely and reword them. Moderator decision is not to copy here the extensive content of the 26 comments, readers can check the original form

Table 5:

FF#4 Are there any additional Work Tasks that should be part of Rel-19?	
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FF#5: If there are any additional Work Tasks required, describe them	
Companies providing feedback: 13	
Summary	9 new WTs have been suggested, most supported only by the proposing company.

Table 6:

FF#6: Describe the dependencies that any of the Work Tasks have on other 3GPP Working Groups	
Companies providing feedback: 13	
Summary	<p>Dependencies of WT 1 and WT2 on RAN have been highlighted by many companies, with suggestions to clarify in the scope that progress in SA2 must be dependent on RAN progress.</p> <p>Dependencies on eNA have been identified by various companies.</p> <p>Several comments raised about sub-WTs of WT5 dependencies on other SIDs (e.g. Sening, ProSe) or other WGs (e.g. SA5).</p> <p>Several comments have raised dependencies on SA3 for some sub-WTs, with suggestions to move the work to SA3.</p>

Table 7:

FF#7: Describe dependencies between the Work Tasks	
Companies providing feedback: 7	

Summary	Dependencies between WT 1 and WT2 have been raised by various companies. Overlap between WT3 and WT4 was also raised.
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Table 8:

FF#8: Describe any dependencies on potential work/study items that might be created as a result of the other Q3 moderated discussions.	
Companies providing feedback: 8	
Summary	Dependencies on sensing, Prose, and energy efficiency SIDs have been identified for sub-WTs of WT5, with both proposals to remove them and proposals to keep them separated.

Table 9:

FF#9: Should there be more than one SID, WID or TEI-19 item created based on the Work Tasks?	
FF# 10: If the answer to the above question is yes, describe how the Work Tasks should be partitioned into different items.	
Companies providing feedback: 8	
Summary	Five companies indicated a single SID is sufficient and preferred. Four companies highlight how some WTs are orthogonal to each other (e.g. WT1/WT2 wrt WT3/WT4/WT5), and if all get sufficient support then separating them in different SIDs may be preferable (one SID for WT1/WT2, one SID for WT3/WT4/WT5).

6 MODERATOR PROPOSAL

- **Moderator Proposal 1: Proposed conclusion - WT1 is IN, reworded according to proposals**
 - Most sub-WTs of WT1 receive strong support, conditional to having RAN complete their work first in order to align and leverage RAN results.
 - Clarifications and rewording are required, several suggestions seem promising.
 - Based on clear consensus, it needs to be merged with WT2.
 - WT1.4 is OUT since it is closely related to SA3 responsibilities, not SA2.
- **Moderator Proposal 2: Proposed Conclusion - WT2 is merged into WT1**
- **Moderator Proposal 3: further study is needed on whether WT3 is IN or OUT and with what scope**
 - There is a slight preference for keeping the WT3 wrt WT4, various comments on overlap between the two.
 - Clarifications on scope wrt RAN and scope of inference are required.
 - To be discussed whether it is IN or OUT or downscoped considerably based on input.
- **Moderator Proposal 4: Proposed Conclusion - WT4 is OUT**
 - There does not seem to be strong support to have WT4 in Rel. 19.
 - Several comments very critical of scope, need, and whether this was discussed previously and discarded.
- **Moderator Proposal 5: Proposed Conclusion - WT5 is IN with downscoping focused on 5.1 and 5.2**
 - WT5.1 receives support, but strong comments against wrt the fact this is already supported and that new solutions for this have been discussed and rejected already. Clarifications needed wrt how this fits in the work and what is new
 - WT5.4 receives low support with indication scope is unclear and seems related mostly to implementation.
 - Only WT5.1 and WT5.2 receive strong support. Reword and rescope of WT5.1 and WT 5.2 only
 - Postpone WT5.3, 5.4, 5.5, 5.6, 5.7, and 5.8, several strong suggestions that related work is either out of scope of SA5 or needs to be carried out in related SIDs.
- **Moderator Proposal 6: Proposed Conclusion - Additional WTs proposed: all received little support, and due to the TU limitations, they are considered OUT**