[RAN94e-R18Prep-19] AI/ML for NG-RAN - Version 0.0.5
RAN

3GPP TSG RAN Meeting #94-e RP-21xxxx

6-17, Dec, 2021

Source: RAN3 Chair (ZTE)

Title: Moderator's summary for discussion [RAN94e-R18Prep-19] AI/ML for NG-RAN

Agenda Item: x.x

1 Initial Round

1.1 Introduction

This email discussion is to continue the discussion on the potential R18 projects on AI/ML for NG-RAN (led by RAN3) in RP-211662:

- AI/ML for NG-RAN WI: Based on the outcome of RAN3-led Rel-17 SI "FS_NR_ENDC_data_collect".

- Additional Use Cases for AI/ML for NG-RAN SI: Study of additional use cases for RAN3 project.

The following discussion is based on the additional guidance on RAN Rel-18 Email Discussion during October 20th to 29th in RP-212657.

1.2 R18 AI/ML for NG-RAN WI

The AI/ML functional framework and high-priority AI based use cases (e.g., network energy saving, load balancing and mobility optimization) have been being discussed in RAN3 in Rel-17 SI "FS_NR_ENDC_data_collect" . The solutions to these three use cases were initially discussed in the last RAN3#113e meeting, and the agreements were captured into the TR37.817.

The following items are proposed as the objectives of R18 WI based on the conclusion of R17 AI/ML study in RAN3:

a) Specify data collection enhancements and signaling support over interfaces for AI/ML-based Network Energy Saving, Load Balancing and Mobility Optimization; (RAN3, RAN2)

b) Support AI/ML functionality in both non-split architecture and split architecture; (RAN3)

c) Signaling impacts to support transferring large size of AI/ML data in a security way.(RAN3)

Please note here that RAN2 will be involved if any impact of UE e.g. additional assistance information is identified.

Feedback Form 1: Q1-1: Do companies agree on the proposed objectives for R18 AI/ML for NG-RAN WI as above?

1 – TELECOM ITALIA S.p.A.

agree. As a comment, maybe it would be better to have a more general statement of objective 1 (do we need to identify the use cases or is it sufficient to define a procedure valid for all use cases?

a) Specify data collection enhancements and signaling support over interfaces ~~for AI/ML-based Network Energy Saving, Load Balancing and Mobility Optimization~~; (RAN3, RAN2)

2 – Samsung R&D Institute UK

In general, we are fine for bullet a) and bullet b).

For bullet a), the current text may open the door for all proposals e.g. some inputs denied in SI phase. Our proposal is to update it as follow:

a) Specify data collection enhancements and signaling support over interfaces for AI/ML-based Network Energy Saving, Load Balancing and Mobility Optimization concluded at SI phase; (RAN3, RAN2)

For bullet c), transferring necessary data over network interfaces are already covered by bullet a). If the main focus of this bullet is for security. It's in SA3 domain. A note could be added e.g. the security requirement and mechanism may need to be discussed in SA3.

3 – China Mobile Com. Corporation

We are fine with the objectives.

4 – AT&T

We would like it noted that the enhancements and signaling may be common (at least partially) across the listed use cases. Also, the enhancements and signaling designed should not be precluded from being used for other use cases if desired by the network.

5 – Verizon UK Ltd

We generally agree to the objectives a, b, and c.

Prefer a slight rewording for Objective a to potentially allow for some enhancements/signaling across use cases, both agreed and potentially for others as desired by the network:

a) Specify data collection enhancements and signaling support over interfaces for AI/ML-use cases.

6 – China Mobile International Ltd

Additional comments from CMCC, for objective c, it is more safer to add a note regarding the security issue rather than a clear objective, since security is the domain of SA3. Up to now, we didn't study this in the SI.

7 – CATT

In general ,we are Ok with the objective.

For a),it seems there are different views on which use cases should be included.Since the Rel-18 WI aims to do the normative work corresponinding to Rel-17 SI,we propose to keep the current statement and add a

note that the use cases could be revisited at the end of Rel-17 study phase. For c), we agree that SA3 needs to be involved since security is in SA3 domain.

8 – LG Electronics Inc.

Agree with a) and b).

On c), it is within the scope of SA3. We suggest to add a note like what did for other items, i.e., on security impacts, coordination with SA3 is necessary.

9 – Lenovo Mobile Com. Technology

a) Yes, in general. It is better to clarify no AI/ML capability of UE is required here, since there is no evidence in the ongoing SI that UE AI/ML capability is required for the first release to support AI/ML for RAN. AI/ML capability of UE is also relevant to the other discussion regarding AI for radio.

b) Yes, in general, but what's new comparing to a) and c)?

c) Yes, if the need is concluded in SI.

10 – vivo Mobile Communication Co.

We are generally fine with the objectives, but some details should be clarified.

For split architecture in bullet b), enhancement on F1 interface is essential, while bullet a) already covers the signaling support over interfaces.

we think bullet c) should related to SA3.

11 – Spreadtrum Communications

We generally agree with the listed objectives. For objectives c), the security is in the scope of SA3, maybe a note could be added here that some coordination with SA3 is necessary.

12 – NEC Corporation

In general we support listed potential objectives, but we would like to clarify some points.

Regarding a): Does it mean that it is proposed to specify only interfaces from Data Collection to Model Training and Model Inference; i.e. output from Model Inference to Actor will not be considered?

Regarding c): Where is it coming from taking into account the current study?

In addition, WI could consider the following:

- Focus on the current NG-RAN architecture and interfaces
- Focus on the use cases prioritized in Release-17 RAN3 study
- AI/ML Model Training and Model Inference algorithms are not specified in this RAN3 WID
- For the prioritized use cases, several deployment options identified in Release-17 RAN3 study should be considered
- Specify inputs to Model Training and Model Inference from Data Collection
- Specify outputs from Model Inference to Actor and Data Collection
- Existing SON procedures may serve as a basis and may be further enhanced
- New RAN AI/ML specific procedures may be defined

- Existing measurements may be reused
- New specific measurements may be defined

13 – Rakuten Mobile

We support NEC's proposal above!

14 – ZTE Corporation

Moderator's reply to NEC's questions:

Regarding a): Does it mean that it is proposed to specify only interfaces from Data Collection to Model Training and Model Inference; i.e. output from Model Inference to Actor will not be considered?

Moderator: The AI framework describes the interaction between AI logical functions, the stanndard impact needs to be analyzed case by case (e.g., the location of AI logical function). If the output from Model Inference needs to be exchanged between NG-RAN nodes, then the standard impact over interface should also be specified.

Regarding c): Where is it coming from taking into account the current study?

Moderator: RAN3 had some discussion on this in RAN3#113e and companies seem have the consensus that data security is important for AI/ML deployment. Add a note like seems acceptable, e.g., On security impacts, coordination with SA3 if needed.

The additional bullets proposed for WI have already been captured in TR37.817.

15 – NTT DOCOMO INC.

We are fine with the objectives.

16 – Apple Benelux B.V.

b) is fine.

Regarding a), it is not clear to us what would be the RAN2 impacts. The Rel-17 RAN3 SI have not identified any UE impacts so far and RAN2 was not involved in that SI. We think RAN2 should be removed.

NOTE: this is not to say that we are against RAN2 studies and normative work on AI/ML, quite the contrary. We think RAN2 should have a proper study focused on objectives which are in RAN2 scope (see the next questions for details).

Regarding c), it is very much unclear how it can be specified considering the following assumption (which is captured in TR 38.817): "The detailed AI/ML algorithms and models for use cases are implementation specific and out of RAN3 scope". If the models are out of scope, then what data exactly is proposed to be transferred in bullet c)? This should be clarified.

17 – ZTE Corporation

We are fine with the three objectives listed above. In Rel-18 WI, we should focus on the normative work to the outcome of the Rel-17 SI, so solutions on three high-priority use cases (Network Energy Saving, Load Balancing and Mobility Optimization) is to considered to be specified during ReI-18 WI. Other new AI-based use cases could be studied in the Rel-18 SI when Rel-18 WI is completed.

For bullet c), it is fine to add a note that coordinate with SA3 if needed.

18 – Huawei Tech.(UK) Co.. Ltd

We believe the details wording, should be based on approved conclusion of the SI on-going.

The objective a) principle is fine for us, but wording need to be revised e.g. interfaces should be clarified as “existing NG-RAN interfaces”

The other objective seems to not appropriated, there is no reason to differentiate here the different types of gNB. It seems also to us at this level the wording “non-split architecture and split architecture” is misleading, considering that the different type of architecture could lead to different AI/ML data collection ….

Last objective might be valuable but too early to state without SI completion and TR approval.

19 – Nokia

We believe the R18 work item should focus on the use cases prioritized in the R17 study and that detailed objectives should be based on the conclusions of the R17 study in RAN3. Thus, bullets (a) and (b) look fine but security aspects are SA3 scope.

20 – Deutsche Telekom AG

We are generally fine with the objectives, but we would propose to merge bullets (a) and (b) as signalling over interfaces is already mentioned in (a) and we should avoid to mention explicit use cases at this stage as the SI is still ongoing:

”(a) Specify data collection enhancements and signaling support over interfaces supporting both non-split and split RAN architecture for AI/ML-based use cases; use cases to be considered will be outcome of the Rel-17 SI.”

The current bullet (c) should be rephrased to take into account SA3’s involvement/impact. Furthermore, the meaning of the term ”AI/ML data” is unclear. Are only data meant that are collected as input to Model Training/Inference function or also Model related data with respect to model lifecycle management (LCM) (model transfer/update, etc.)?

21 – InterDigital Germany GmbH

Agree on a, b and c. Note it isn’t clear from discussions whether c will involve any standardization changes and should involve SA3

22 – Ericsson LM

Fine with a) and b). With respect to c): it was already discussed in RAN3 that whether there will be large amounts of data depends on the exact types of information to be signalled and how they will be signalled, hence it is some sort of self fulfilled prophecy if we place in an objective that we need to solve a bit data transfer problem, i.e. it means we have already created the problem before it has appeared. Regarding the security objective, it was discussed in RAN3 that current interfaces are already secured, hance there was no problem detected that could justify an objective.

In general we should focus on what the Rel-17 SI generates as topics for RAN3 to follow on, which are pretty much a) and b).

23 – Qualcomm Technologies Int

Qualcomm:

a) Agree

b) Could be a note or sub-bullet of a)

c) Agree in general. "AI/ML data" can be changed to: "AI/ML data e.g. model, training/inference data"

24 – Futurewei

We agree the above specified objectives a) and b).

Item c) should be covered under a), thus, we suggest removing it while adding a note in a) to indicate security aspect should be included.

25 – VODAFONE Group Plc

We support work in this area and are generally supportive of objectives a, b, c.

26 – Intel Deutschland GmbH

We agree with objective a) and b). For a), we agree with Samsung.

In RAN3 #113e meeting, whether the size of AI data (e.g. inputs/outputs, model related data) is large needs to be studied on use case basis. Also security aspects is in SA3's domain. Both large size data and security is not concluded in Rel-17 SI. Hence, we don't think objective c) should be included in Rel-18 objective.

27 – Continental Automotive GmbH

We consider a) as priority.

Feedback Form 2: Q1-2: Do you agree that RAN3 is the primary WG, and RAN2 is the secondary WG for this R18 AI/ML for NG-RAN WI?

1 – Samsung R&D Institute UK

Agree

2 – China Mobile Com. Corporation

Agree

3 – AT&T

Agree

4 – Verizon UK Ltd

Agree

5 – CATT

Agree

6 – LG Electronics Inc.

Agree

7 – Lenovo Mobile Com. Technology

Agree

8 – vivo Mobile Communication Co.

Agree

9 – Spreadtrum Communications

Agree

10 – NEC Corporation

Agree

11 – Rakuten Mobile

Agree

12 – NTT DOCOMO INC.

Agree

13 – Apple Benelux B.V.

We agree that RAN3 is the primary group, but we have concerns about the RAN2 scope - RAN2 wasn't involved in the SI, and as of now the TR 38.817 does not contain any RAN2 impacts.

We think RAN2 should have a proper study on AI/ML, centered around RAN2 objectives (see the next question for details).

14 – ZTE Corporation

Agree

15 – Huawei Tech.(UK) Co.. Ltd

We are fine for RAN3 primary WG and RAN2 as secondary responsibility

16 – Nokia

Agree

17 – Deutsche Telekom AG

Agree

18 – InterDigital Germany GmbH

Agree

19 – InterDigital Germany GmbH *We agree with Samsung that bullet a) should be related to bullet b) and that it should be higher priority, to define the next round of use cases, but we support inclusion of bullet c) and bullet d) and are open to bullet e).*
20 – Ericsson LM Agree
21 – Qualcomm Technologies Int Agree
22 – Futurewei We agree that RAN3 is the primary WG and RAN2 is the secondary WG for this Rel-18 WI.
23 – VODAFONE Group Plc agree
24 – Intel Deutschland GmbH Agree

1.3 R18 Further Study on AI/ML for NG-RAN SI

According to the previous email discussion, companies show interests to have a new R18 SI led by RAN3 in order to have further study on AI/ML for NG-RAN.

The potential objectives proposed by companies are listed as below:

a) Study network entities and interface procedure support for model training/inference, data management, model management;

b) Study High layer related new use cases (e.g., AI/ML for slicing, QoE and etc.);

c) Study integration and collaboration of OAM AI/ML, 5GC AI/ML, NG-RAN AI/ML and Air interface AI/ML;

d) Mobility support for AI/ML based solutions;

e) Use of SBA approaches;

...

Feedback Form 3: Q1-3: Companies are invited to provide comments on the above potential objectives for R18 further study on AI/ML for NG-RAN SI.

1 – TELECOM ITALIA S.p.A.

agree with the proposal

2 – Samsung R&D Institute UK

We think use case study should have higher priority than others. Considering both WI and SI in Rel-18, the scope of the study should not be too broad. In our view, the objectives could be:

a) Study High layer related new use cases (e.g., AI/ML for slicing, URLLC and etc.);

b) Study network functionalities and interface procedure to support the use cases;

3 – China Mobile Com. Corporation

We share the view with Samsung that we should firstly study the potential use cases, and then the potential standards impact for the use cases on existing nodes, functions, and interfaces, as we are doing in R17 AI SI.

4 – AT&T

We support the study of new use cases as well and also the potential enhancements associated with bullet a). Again, commonality of the procedures/signaling across use cases should be considered and encouraged if possible.

5 – Verizon UK Ltd

Agree with the proposal. Common framework and signaling that enables novel AI/ML use cases is important in addition to specifying some new example use cases. Also integration with OAM AI/ML, 5GC AI/ML, Air Interface AI/ML and O-RAN should be considered.

6 – CATT

We support to study the procedure/approach to support model management and data management as well as study new use cases i.e. bullet a) and bullet b).

As to other bullets, it seems e) is an possible option of a) and also c) ould be merged into a).We think d) could be discussed together with b).

7 – LG Electronics Inc.

We think that b) is the first priority, that is, to further study the new use cases, e.g., QoE, MDT.

In addition, a) and c) can be considered on improving the architecture, i.e., study the integration of AI functions in 5GC and NG-RAN.

Others can be considered later. Especially on Mobility, the overlapping with " AI based Air interface" should be avoided.

8 – Lenovo Mobile Com. Technology

a) and b) shall be considered as the next step of NG-RAN evolution to better support AI/ML features/use cases. We consider a proper design of AI model/task management among network entities is essential to support future proof use cases, not only AI for network use cases as in b) but also network for AI use cases in the coming future.

c) and e) are OK in general, and can be considered as part of a) and b)

d) we are not sure what's the difference compared to the mobility optimization use case under Release 17 discussion.

9 – vivo Mobile Communication Co.

Mobility support in bullet d) should be clarified as to what the difference is to the Mobility Optimization in R17 SI.

we think we should first study the potential use cases and further identify the specific impact on data and model management.

10 – Spreadtrum Communications

In our views, the objectives of the SI could be divided into two parts. We should firstly focus on the study of potential new use cases (i.e. bullet b), and then analyze the impact on the standards.

11 – NEC Corporation

In general we support listed potential objectives, but we would like to clarify some points.

Regarding a): Does it mean to study specification of interfaces between Model Training and Model Inference? Or something else is included?

Regarding b): Why are these use cases called High layer?

Regarding d): What is the meaning of this objective?

In addition, SI could consider the following:

- New interfaces and/or functional entities may be considered if needed
- Multi-vendor interoperability between different AI/ML model parts (Data Preparation, Model Training, Model Inference)
- Possibility to pre-select and pre-train some ML models for given tasks could be studied

12 – ZTE Corporation

Moderator's reply to NEC's question:

Regarding a): Does it mean to study specification of interfaces between Model Training and Model Inference? Or something else is included?

Moderator: a) proposes to study interface procedures to support model training/inference (if they are located in different NG-RAN nodes, then the interaction between them needs to be studied over interfaces), AI data management, model management case by case or in a common way.

Regarding b): Why are these use cases called High layer?

Moderator: In order to differentiate with those use cases in anotther SI, which is led by RAN1.

Regarding d): What is the meaning of this objective?

Moderator: Some company raised this in last email discussion, my understanding is to guarantee the performance of the AI enabled feature during UE mobility.

13 – NTT DOCOMO INC.

Agree with NEC that SI could also consider multi-vendor interoperability between different AI/ML model parts (Data Preparation, Model Training, Model Inference)

14 – MediaTek Inc.

The scope of d) Mobility support for AI/ML based solutions needs further clarification. For example, whether there is any RAN2 or UE impact?

15 – Apple Benelux B.V.

Many of the proposed objectives fall into RAN2 scope, rather than RAN3. For example, ”High layer related new use cases (e.g., AI/ML for slicing, QoE and etc.)” and “mobility” are clearly in RAN2 domain, not RAN3.

We think some of those objectives indeed need to be addressed in a Rel-18 SI, but that SI should be RAN2-led (with RAN3 as a secondary group). Furthermore, additional RAN2 objectives can be considered, including: mobility, measurement optimizations, paging optimizations, etc.

16 – ZTE Corporation

Agree to study with Bullet a), b) and c) with highest priority. It’s sure that new potential AI-based use cases should be studied. The common signaling and interface procedure (e.g.. model management, data management, AI functionality management.) is also important to be studied in R18.

17 – Huawei Tech.(UK) Co.. Ltd

The principle of new SI in rel-18 addressing new use case, via SI makes sense.

However the text proposal objectives looks based on assumption of the conclusion of existing Study which does not exist today. The point a) seems breaking existing agreement on re-using 5G Advanced architecture. The point c) same and seems to be link to use case, d) and e) need more common understanding ….

18 – Nokia

We believe that RAN3 should continue to study additional use cases for AI/ML in NG-RAN, but the timing of the study needs further discussion (see response to Q1-5) and may impact the potential objectives.

19 – Deutsche Telekom AG

We see the SI focus on new architectural issues. For that, there is a need to combine bullets (a) and (c) as they are related to an overall AI/ML framework across 3GPP domains; especially the AI/ML model LCM process has to be properly set together with OAM and possibly aligned with 5GC/NWDAF framework, i.e. strong interrelation with SA5 (MDAS) and SA2 (eNA) is required. This may also incorporate the usage of SBA in bullet (e).

Further use cases as proposed in (b) may be considered. In the RAN3 Rel-17 SI a list of those use cases which were down-prioritized is still available and can be the basis for a further selection. The term ”higher layer” is somehow confusing in (b) and shouldn’t be mentioned here.

The meaning of bullet (d) is unclear for us (see also the feedback of other companies).

20 – InterDigital Germany GmbH

Yes, we should continue the work with a new study lead by RAN3 but the new use cases and study of the integration and collaboration of other AI/ML in 5GC and O&M would require some interactions with other working groups.

21 – Ericsson LM

Disagree. We shall not have a Rel18 SI in parallel with a WI derived from the Rel17 SI. Running a WI in parallel with a SI will only bring confusion and make any agreements in normative phase unstable.

We should consolidate the result of the current RAN3 SI on AI, into normative phase first. Only after we complete normative phase we might decide on the next steps. The situation is of course different for groups like RAN1, where they need to investigate interactions between RAN and UE and where they need to run a study. A RAN1 SI may run in parallel with a RAN3WI, but that should not impact work in RAN3.

On the objectives:

On a), model training/inference was already studied in Rel17. Data management and model management are out of RAN3 scope. In fact RAN3 agreed that AI models are proprietary, so it is not clear what standardization work should be carried out if the subject of such work is proprietary.

On b), before starting studying new use cases we need to converge on normative work for the use cases already studied. It would otherwise be counter productive to study new possible techniques when we did not even manage to transform the Rel17 study into specifications.

On d) Mobility optimization and load balancing is already studied in Rel17

On e) this was not discussed at all and there is no motivation to promote a service based architecture. It should first be explained what would the RAN gain with such approach before we can think of an objective like that

22 – Qualcomm Technologies Int

We support all the above objectives. These are very useful.

One consideration is that we should check and avoid duplication with RAN1 led AI/ML SI, for example: a) could be included in that SI too.

23 – Futurewei

If there is a new Rel-18 SI for AI/ML in addition to the WI following the Rel-17 SI "FS*NR*ENDC*data*collect", we suggest only considering new use cases and the associated standards impact while reusing the architecture and framework defined under the Rel-17 SI to reduce the amount of potential effort involved in Rel-18 timeframe.

24 – InterDigital Germany GmbH

We agree with Samsung that bullet a) should be related to bullet b) and that it should be higher priority, to define the next round of use cases, but we support inclusion of bullet c) and bullet d) and are open to bullet e).

25 – Intel Deutschland GmbH

Considering the workload and scope in Rel-18, following objectives to be prioritized:

a) study high layer related new use cases (e.g. AI/ML for slicing, QoE and IAB, etc)

c) study integration and collaboration of OAM AI/ML, 5GC AI/ML AI, NG-RAN AI/ML;

For integration collaboration with AI/ML for air interface, we prefer to study after RAN1 SI outcome.

For other objectives, in the parallel email discussion [RAN94e-R18Prep-08] AI/ML for air interface, 3GPP framework for AI/ML is also discussed. We are wondering whether objective a) d) and e) should be considered together with AI/ML for air interface, considering a unified framework in NG-RAN to support AI Intelligence. Hence, we think a) d) e) can also wait and study until we have a clear view on both impact from NG-RAN and air interface use cases.

Feedback Form 4: Q1-4: Do you agree to approve this new SI in R18? If yes, do you agree that RAN3 is the leading WG for this R18 further study on AI/ML for NG-RAN SI?

1 – TELECOM ITALIA S.p.A.

agree

2 – Samsung R&D Institute UK

Agree to approve this new SI and RAN3 is the leading WG

3 – China Mobile Com. Corporation

In general we agree to approve the new SI and R3 is the leading WG. But as we suggest in Q1-5, we prefer Option1b) 1 WI is approved, the R18 SI could be approved only after the R18 WI is completed.

4 – AT&T

Agree to approve the SI with RAN3 taking the lead.

5 – Verizon UK Ltd

Agree

6 – CATT

Agree to approve the new SI in Rel-18 and RAN3 is the leading WG

7 – LG Electronics Inc.

Agree to approve this RAN3-led new SI

8 – Lenovo Mobile Com. Technology

Agree

9 – Spreadtrum Communications

Agree to approve the SI. And we agree that RAN3 is the leading WG.

10 – NEC Corporation

Agree to both

11 – Rakuten Mobile

Agree to both

12 – NTT DOCOMO INC.

Agree

13 – Apple Benelux B.V.

Yes, but the SI should be RAN2-led (with RAN3 as a secondary group).

14 – ZTE Corporation

Agree. RAN3 leading.

15 – Huawei Tech.(UK) Co.. Ltd

Considering that Rel-18 is already in overload context, assuming we cannot approved all proposed items, considering the impact on different WG also, considering RAN1 is also running a study on that topic, considering the first SI did not reach any conclusion yet, these questions are untimely

16 – Nokia

See response to Q1-5.

17 – Deutsche Telekom AG

Agree

18 – InterDigital Germany GmbH

agree

19 – Ericsson LM

Please see our input on *Q1-3*.

20 – Qualcomm Technologies Int

Yes, we would like R18 to have such a SI.

Not strong opinion on leading WG. If a) is included in the SI, we slightly prefer RAN2 to lead the study.

21 – Futurewei

We are OK with a new Rel-18 SI focusing on additional use cases for NG-RAN and RAN3 is the primary WG.

Given that there is WI work following the Rel-17 SI “FS_NR_ENDC_data_collect”, we suggest considering only a few new use cases.

22 – VODAFONE Group Plc

agree

23 – Intel Deutschland GmbH

Agree to approve this new SI.

For working group, we agree RAN3 is the leading group. RAN2 should also be included as secondary group for mobility support, etc, if needed.

1.4 R18 Organization Issue

If companies have consensus to approve a new SI as discussed in Chapter 3. There are two ways on the table on how to organize the discussion for R18 AI/ML for NG-RAN WI and R18 further study on AI/ML for NG-RAN SI:

Option1) 1 WI and 1 SI approved, the R18 SI starts only after the R18 WI is completed

Option2) 1 WI approved, 6 months SI phase, then 12 months WI

Option3) 1 WI and 1 SI approved, the discussion on SI and WI are in parallel in whole R18 timeline

In order to avoid the risk of overlapping discussion which may delay the completion of R18 WI, it seems better to avoid parrallel discussion of SI and WI, e.g., Option3).

Feedback Form 5: Q1-5: Which option do you prefer to organize the R18 discussion on AI/ML for NG-RAN in RAN3?

1 – China Mobile International Ltd

5G+AI is a topic that will last for several releases, it seems no urgent and not sensible to have a WI + SI in parallel in Rel-18.

We had an ongoing study on AI for NG-RAN in Rel-17, the AI framework and the solutions for the three prioritized use cases are under discussion. Following the conclusion of the SI, approval of a WI and accomplishment of the normative work should be the prioritized task in Rel-18. This task could give us an outlook of the RAN specifications to support AI, e.g., how the AI framework and use cases impacts NG-RAN functionality and network interfaces. This Rel-18 normative work build a basis and reference for any further new study. Having a WI and SI sequentially could also allow us keep focus and deliver the AI related specification with high quality.

So in our view, **a Rel-18 WI should be first approved and finished before starting any further study. After the WI is finished, if time allows, further study can be approved and discussed.**

In light of the above observation, another alternative option in the category of option 1, we name it **option 1b)** should be considered,

Option1a) 1 WI and 1 SI approved, the R18 SI starts only after the R18 WI is completed

Option1b) 1 WI is approved, the R18 SI could be approved only after the R18 WI is completed

Option2) 1 WI approved, 6 months SI phase, then 12 months WI

Option3) 1 WI and 1 SI approved, the discussion on SI and WI are in parallel in whole R18 timeline

2 – TELECOM ITALIA S.p.A.

ok with option 1

3 – Samsung R&D Institute UK

Our preference is Option 3. The normative work for Rel-18 WI has been sufficiently discussed in Rel-17 AI SI. The scope is clear. The new SI will focus on new use cases. Therefore, there is no much dependency to start the discussion on SI. This will give more time for analyzing new use cases.

4 – AT&T

We support Option 3 but could live with Option 2 as well. The motivation is that, the normative phase may include work which is common across Rel-17 and Rel-18 use cases, so some parallel effort is acceptable.

5 – Verizon UK Ltd

Prefer Option3, can live with Option 1 as a second choice.

6 – CATT

We have sympathy with CMCC and are OK with the new proposal 1b.

7 – LG Electronics Inc.

Option 1 is preferred in order to avoid the potential overlapping.

8 – Lenovo Mobile Com. Technology

Option 3) or Option 1)

First of all, it's better to standardize the conclusion of R17 SI by a follow up WI in R18. The proposed R18 SI to address next step RAN evolution shall be taken separately. Thus Option 2) is not suggested.

With respect to whether the proposed R18 SI shall be taken in parallel with the R18 WI or after R18 WI. If time allows, we prefer 3) to take them in parallel since the relevant discussions are independent. Otherwise, 1) is also fine.

Besides, it's also worth mentioning that SA5 plans to study the coordination between OAM and RAN node for AI model management, we consider the proposed R18 SI is in the same pace/spirit as SA5.

9 – Spreadtrum Communications

We are OK with option 1). In this way, the new SI could follow the commonality principles agreed in R17 SI and R18 WI, which will make the discussion more reasonable.

10 – NEC Corporation

1st priority: Option 1

2nd priority: Modified Option 2: First 12 months WI, then 6 month SI

11 – Rakuten Mobile

We would like to support option 1.

12 – NTT DOCOMO INC.

We prefer option1, let's first guarantee the completion of R18 WI. After that, if time allows, then study Rel-18 SI.

13 – Apple Benelux B.V.

Since the SI should be RAN2-led, and the WI will be RAN3-led with little to no RAN2 impact, there is no issue to approve both simultaneously.

14 – ZTE Corporation

We should focus on the WI first and after the completion of WI, followed by a new SI.

Option 1 is preferred.

15 – Huawei Tech.(UK) Co.. Ltd

See response above

16 – Nokia

Option 1 is our preference, i.e. further study begins only after the R18 WI is completed, and then any follow-on normative work would be in R19. In case of Option 1, the SI objectives can be approved later e.g. when the R18 WI is (nearly) completed and we have a more mature understanding of what should come next.

17 – InterDigital Germany GmbH

We agree that we need to have a study item to look at additional use cases, but we also feel that we need to begin to integrate other AI/ML aspects (5GC, O&M, air interface) into a complete structure. Therefore, we think that option 3 is the best, the potential objectives in the proposals for study after proper clarification could not overlap at all with the proposed objectives for the work item. Of course option 1 is an alternative but a short study would only allow addressing a couple of new use cases, and probably not begin the discussion on interrelation with 5GC and other AI/ML related work, which we think should happen sooner rather than later.

18 – Deutsche Telekom AG

The first priority is certainly to start the WI, but at least discussions in the SI on architectural evolution and alignment with SA5 and SA2 could start independent on the WI progress.

Therefore, our proposal would be a modified version (3) with a partial overlap having the WI during first 3 or 6 months of Rel-18 as only AI/ML activity and then starting the SI in parallel focusing on architectural/functional alignment. Addition of new use cases can be shifted to the second phase of the SI, because at that point in time the experience from the WI use case implementation is available.

19 – Ericsson LM

CMCC Option 1b) is a good starting point. In our view, WI is started in Rel18. In the second half of the WI duration RAN plenary should discuss whether the progress in the WI points at the need of a new SI. Only if this is confirmed a new SI can be planned. Option 1b) can be further clarified as:

Option 1b) 1 WI is approved, the R18 SI could be approved only after the R18 WI is completed and when the need is confirmed.

It is not reasonable to preempt the discussion on the need a SI by agreeing to a SI right now. As mentioned before, at the end of the Rel18 WI we might even realise that all we need is another WI and not a SI.
20 – Qualcomm Technologies Int In principle, option 3 would be our preference.
21 – Futurewei As AI/ML is a relatively new subject for 3GPP, we suggest adopting Option 1). This will allow us to complete a full cycle of standard development on AI/ML related project and learn from our experience for future projects.
22 – Intel Deutschland GmbH It depends on the scope of Rel-18 SI. Based on our comment in Q3, Option 3 is preferred. From current proposed new use cases in Rel-18, the overlap between WI and SI are minimum. Hence, parallel discussion would allow more study time for new use cases.

1.5 Moderator's Summary

Q1-1: Do companies agree on the proposed objectives for R18 AI/ML for NG-RAN WI as above?

It seems most of companies are fine with the objectives a), but some companies suggest some refinement here. Since three high-priority use cases has studied in the Rel-17, during WI phase, we should focus on these use case based on the outcome of the SI, and other use cases could be studied in the Rel-18 WI. In addition, whether UE new measurement is still under discussion, which means RAN2 needs be involved in the normative work. So, it is reworded as:

Specify data collection enhancements and signaling support over current NG-RAN interfaces and architecture (including non-split architecture and split architecture) for AI/ML-based Network Energy Saving, Load Balancing and Mobility Optimization. (RAN3, RAN2):

For c), majority companies consider to add a note to involve SA3, since security is in SA3 domain. Some companies suggest to remove the security impacts. So, moderator propose to add a note:

Note: On security impacts, coordination with SA3 when needed.

Proposal1) The following items are proposed as the objectives of R18 WI:

- **Specify data collection enhancements and signaling support over current NG-RAN interfaces and architecture (including non-split architecture and split architecture) for AI/ML-based Network Energy Saving, Load Balancing and Mobility Optimization. (RAN3, RAN2)**

Note: On security impacts, coordination with SA3 when needed.

Q1-2: Do you agree that RAN3 is the primary WG, and RAN2 is the secondary WG for this R18 AI/ML for NG-RAN WI?

23/24 companies agree that RAN3 is the primary WG, and RAN2 is the secondary WG for Rel-18 WI, while 1

company considers that RAN2 should not be involved in the WI. Considering UE new measurement is still under discussion in RAN3 SI, which may bring impact on RAN2. Therefore, RAN3 is the primary WG, and RAN2 is the secondary WG for this R18 AI/ML for NG-RAN WI can be regarded as the assumption.

Proposal2) RAN3 is the primary WG, and RAN2 is the secondary WG for this R18 AI/ML for NG-RAN WI.

Q1-3: R18 Further Study on AI/ML for NG-RAN SI

Some companies mentioned that the objectives of SI should be confirmed after R18 WI is completed. Here, moderator tries to explain that the timeline of R18 WI and R18 SI is discussed in the final question, and it seems over half the companies tend to R18 SI starts only after the R18 WI is completed. So, moderator suggests the scope of SI objectives here would be regarded as a starting point.

Almost all companies mentioned that other new potential high-layer use cases should be further studied in the Rel-18 SI. So, moderator tries to keep the Bullet b) in the objectives as a high priority. In order to avoid confusion, ”high-layer” is replaced by ”for NG-RAN”.

For Bullet a), 14 companies agree to study network entities and interface procedure support for model training/inference, data management, model management, while one company mentioned that AI/ML model is proprietary, and data management and model management are out of RAN3 scope. The details of AI/ML model are proprietary, but AI/ML model exchanging between model training and model inference should consider especially for multi-vendor interoperability. And some companies suggest to merge bullet c) into bullet a). Here, moderator tries to rephrase bullet a) as below:

Study network entities and interface procedures to support data management and model management, including:

- Multi-vendor interoperability between different AI/ML functions (e.g., Data Collection, Model Training, Model Inference).
- Integration and collaboration of OAM AI/ML, 5GC AI/ML, NG-RAN AI/ML and Air interface AI/ML.

For bullet d), most of companies think it needs to be further clarification. And Bullet e) seems could be involved into the bullet c). Hence, moderator suggest to drop bullet d) and e) into the scope of R18 SI objective currently.

Proposal3) The following items are proposed as the objectives of R18 SI:

- **Study new use cases for NG-RAN (e.g., AI/ML for slicing, QoE and etc.);**
- **Study network entities and interface procedures to support data management and model management, including:**
    - **Multi-vendor interoperability between different AI/ML functions (e.g., Data Collection, Model Training, Model Inference).**

- **Integration and collaboration of OAM AI/ML, 5GC AI/ML, NG-RAN AI/ML and Air interface AI/ML.**

Q1-4: Do you agree to approve this new SI in R18? If yes, do you agree that RAN3 is the leading WG for this R18 further study on AI/ML for NG-RAN SI?

18 companies agree that RAN3 is the leading WG for this R18, and 2 companies recommend that SI should be RAN2-led (with RAN3 as a secondary group), while other 3 companies mentioned that the R18 SI should be confirmed after R18 WI is completed. Here, moderator tries to conclude that RAN3 is the primary WG, and RAN2 is the secondary WG for this potential R18 AI/ML for NG-RAN SI.

Proposal4) RAN3 is the primary WG, and RAN2 is the secondary WG for this potential R18 AI/ML for NG-RAN SI.

Q1-5: Which option do you prefer to organize the R18 discussion on AI/ML for NG-RAN in RAN3?

Based on the comments above, most companies are focus on option1 and option3.

14 companies can adopt option 1 that the R18 SI starts only after the R18 WI is completed, while 9 companies prefer option 3 that the discussion on SI and WI are in parallel in whole R18 timeline.

Proposal5) Let's further check companies' view on the second round based on Option1):

Option1a) 1 WI and 1 SI are approved on Dec, the SI only starts after the R18 WI is completed.

Option1b) 1 WI is approved on Dec, the R18 SI could be proposed and approved only after the R18 WI is completed.

2 Intermediate Round

According to the summay from the initial round of email discussion, the follwing questions are raised for further discussion.

The following items are proposed as the objectives of R18 WI based on the 1st round of summary:

- **Specify data collection enhancements and signaling support over current NG-RAN interfaces and architecture (including non-split architecture and split architecture) for AI/ML-based Network Energy Saving, Load Balancing and Mobility Optimization. (RAN3, RAN2)**

Note: On security impacts, coordination with SA3 when needed.

Feedback Form 6: Q2-1: Do companies agree on the objectives for R18 AI/ML for NG-RAN WI as above?

1 – Apple Benelux B.V.

The objective is extremely vague. In fact, the objective reads like a SI objective, not a WI.

In order to proceed to the normative phase, we need a clear objective (for both RAN3 and RAN2).

2 – InterDigital Germany GmbH

We are ok with these objectives, though we are open to further description

3 – Futurewei

We agree with the proposed objectives in general.

4 – Nokia

Yes, these objectives are a good baseline. Further details can be added, as needed, at the conclusion of the R17 study.

5 – Continental Automotive GmbH

We agree with the proposal.

6 – Samsung R&D Institute UK

We agree the objectives in general. Further details can be added at the conclusion of the R17 study if needed.

7 – China Mobile International Ltd

Considering we still have three meeting cycles before the Rel-17 accomplishment, we are fine with the objectives proposed by the moderator in general. The details can be further added if needed, when the Rel-17 SI completes.

8 – China Mobile International Ltd

In addtion to the above objectives, a note should be added below:

Note: The objectives are subject to further refinement when the Rel-17 SI finishs.

9 – AT&T

Agree with China Mobile that the current description may be a bit vague and could be improved once the Rel-17 study item is completed.

10 – ZTE Corporation

We agree with the proposed objectives

11 – Beijing Xiaomi Mobile Software

Agree with CMCC. We think the objectives should be well studied in R17 SI.

12 – CATT

The propsoed objectives are fine in current stage and could be revisited at the end of Rel-17 WI

13 – Lenovo Mobile Com. Technology

Yes, we agree

14 – LG Electronics Inc.

Yes, in principle we agree. We may revise the detailed WI objectives in Dec. based on the outcome of the on-going SI.

15 – vivo Mobile Communication Co.

Agree with the objectives as baseline. Further discuss the details based on the conclusion of SI.

16 – CAICT

We support moderator's proposal.

17 – Intel Deutschland GmbH

Agree. However, we don't think the notes about security aspects is needed, as there's no security impact is identified based on current discussion in Rel-17 SI.

18 – Huawei Tech.(UK) Co.. Ltd

It makes sense for many reasons, and will be easier to converge on a Work Item Description when Study Item will be completed, for now we can proceed with the WI schedule and TUs.

19 – Spreadtrum Communications

We generally agree with the proposal.

20 – NEC Corporation

We support the objective above.

Also, we would like to thank moderator for clarifying our questions and taking into account our inputs.

Regarding other bullets we proposed in the initial round, we agree that most of them are included in the current version of TR 37.817. However, we think it would be beneficial to also include them in the WI description to have clear scope of the WI. We could discuss this further when discussing WI description.

21 – Ericsson LM

The objectives are ok.

22 – Deutsche Telekom AG

We generally agree with the objective. With respect to further details we have to wait for outcome of Rel-17 SI; therefore we support CMCC's proposal to add a note on that.

23 – Qualcomm Technologies Int

Agree

24 – MediaTek Inc.

The objective and responsibility are not entirely clear, please find our clarification suggestions.

Based on the study conclusion of selected use cases, specify

- Data collection enhancements (RAN2?)

- Signaling support over current NG-RAN interfaces (RAN3)
- Other identified architecture modifications (RAN3, RAN2?)

Selected AI/ML use cases are

- Network Energy Saving
- Load Balancing
- Mobility Optimization

25 – ZTE Corporation

Moderator's feedback to MediaTek questions:

The first bullet already covers all the bullets you listed. Data collection covers both UE report (if needed for the solution) and the RAN data collection between RAN nodes. Therefore, RAN3 and RAN2 will be involved together. While the third bullet proposed "Other identified architecture modifications" is too vague to be included as objective. I think the current description should be fine.

The following items are proposed as the objectives of R18 SI based on the 1st round of summary:

- **Study new use cases for NG-RAN (e.g., AI/ML for slicing, QoE and etc.);**
- **Study network entities and interface procedures to support data management and model management, including:**
  - **Multi-vendor interoperability between different AI/ML functions (e.g., Data Collection, Model Training, Model Inference).**
  - **Integration and collaboration of OAM AI/ML, 5GC AI/ML, NG-RAN AI/ML and Air interface AI/ML.**

Feedback Form 7: Q2-2: Do companies agree on the objectives for R18 AI/ML for NG-RAN SI above as a baseline to be approved?

1 – Apple Benelux B.V.

No.

Mobility should be added as a use-case. Other higher layers use cases should also be considered. In fact, the use case list should be more precise and not just an example (with "e.g.").

Study of UE and air interface impacts should be explicitly mentioned.

We do not understand how "Multi-vendor interoperability between different AI/ML functions (e.g., Data Collection, Model Training, Model Inference)" can be achieved without standardizing the ML models and algorithms (which most companies seem to be against). Furthermore, we do not understand what does it even mean to "study…interoperability" to begin with.

2 – InterDigital Germany GmbH

We are ok, though the bullet on multi-vendor interoperability could be better defined.

3 – Futurewei

We prefer to moving on with Option 1b) in Q2-3 so the objectives for R18 AI/ML for NG-RAN SI can be discussed and determined after we complete R18 WI.

4 – Nokia

There is no need to discuss the SI objectives now, since the SI starts only after the R18 WI is completed.

5 – Samsung R&D Institute UK

Fine for the first bullet.

For the second main bullet, our proposal is to reword it as: "Study network functionality and interface procedures to support the agreed new use cases enabled by AI/ML". New functionality may be needed, the functionality distribution over the existing network entities needs to be discussed. We don't see the necessity to have new network entities. Also the point on the "support the data management and model management" is not clear and could be implementation issue.

Multi-vendor interoperability is important, therefore the first sub-bullet is ok.

For the integration and collaboration of OAM AI/ML, 5GC AI/ML and NG-RAN AI/ML, we think this issue should be mainly handled by SA2. It's possible to study the integration and collaboration of NG-RAN AI/ML and Air interface AI/ML in RAN3. But considering the Air interface AI/ML SI will be handled in parallel to this SI. It's better to discuss the integration issue after the completion of Air interface AI/ML SI.

6 – China Mobile International Ltd

We also suggest proceeding with Option 1b) in Q2-3, so the objectives for R18 AI/ML for NG-RAN SI can be discussed and determined after we complete R18 WI or when we almost finish the Rel-18 WI.

7 – AT&T

We think the moderator's proposal is a reasonable starting point. Multi-vendor interoperability is a very important objective and could even be considered as a main-level bullet since it may impact use cases differently and the ability to coordinate across different network entities and interfaces (e.g. air interface, core network, OAM, etc.).

8 – ZTE Corporation

We agree with the proposed objectives of SI.

9 – Beijing Xiaomi Mobile Software

We think the use case should also include mobility management. Although there is some study on mobility in R17 SI, the solution is mainly limited to RAN3. The benefit and spec impact is rather limited. Traditionally, mobility management is handled by RAN2. We think RAN2 led mobility management shall be studied further.

10 – Lenovo Mobile Com. Technology

Yes, we agree

11 – CATT

We are OK with the first objective.

For the second objective,we are not sure whether the term" **network entities and interface procedures** " include Uu interface or not.From our point of view,procedures related both network interface and air interface should be considered.We propose to make it clear in the text.

12 – LG Electronics Inc.

In principle, it is fine to be a baseline. But there is no hurry to approve the SI in Dec. since option 1b is preferred in Q2-3.

On "Integration and collaboration", we may study it for OAM AI/ML, 5GC AI/ML, NG-RAN AI/ML since the specs are/will be available for SA/RAN3, but for Air interface AI/ML it depends on the outcome of "AI ML Air interface SI" next year.

13 – vivo Mobile Communication Co.

We prefer Option 1b) for Q2-3, thus, the specific objective shall be decided after the R18 WI is completed.

14 – CAICT

We support the first objective and more dicussions on other objectives for the SI could be operated after at least R17 SI finished.

15 – Intel Deutschland GmbH

Agree with the first bullet.

For the second bullet, we think data management and model management aspects should be studied considering a common solution/framework for both AI/ML for RAN and AI/ML for air interface.

As discussed in email discussion [08] AI/ML for air interface, a common framework related to training/inference, data/model management is proposed as a RAN2 leading objective. Hence, to avoid duplicate discussion on the same topic in different SI, discussing data/model management procedures for Air interface AI/ML in RAN1-led SI "AI/ML for air interface" is preferred.

For RAN3-led SI, the scope should mainly focus on integration and collaboration of OAM AI/ML, 5GC AI/ML and NG-RAN AI/ML for **SON/MDT use cases**, this also includes multi-vendor interoperability and data/model management between OAM/5GC and NG-RAN.

Based on above discussion, following objectives are proposed as Rel-18 NG-RAN SI:

- Study new use cases for NG-RAN (e.g., AI/ML for slicing, QoE and etc.);
- Study integration and collaboration of OAM AI/ML, 5GC AI/ML and NG-RAN AI/ML for **SON use cases** (e.g. load balancing, network energy saving, mobility optimization)
    - Multi-vendor interoperability between different AI/ML functions (e.g., Data Collection, Model Training, Model Inference) at OAM, 5GC and NG-RAN.
    - Data management and model management between OAM/5GC and NG-RAN.

16 – Huawei Tech.(UK) Co.. Ltd

This is untimely; Rel-18 is already in overload context, considering RAN1 is also running a study on that topic, considering the first SI did not reach any conclusion yet, considering there no any normative agreement on this wide area, etc … We strongly prefer to wait before decide any contents.

17 – NEC Corporation

We support the objective above.

Also, we would like to thank moderator for clarifying our questions and taking into account our inputs.

18 – Ericsson LM

As mentioned before, we strongly object to approve a study item or indeed a study item scope even before the WI on AI/ML is started. The WI will for sure reveal the real issues to be addressed at the next stage of standardization for AI/ML support.

Especially the second part of the objective is not agreeable because at this point in time it is not even known what normative specification will be achieved for AI/ML in RAN, OAM and CN. Hence the objective is highly questionable as we cannot commit to integration of solutions in different systems when we do not even know what these solutions are.

19 – Spreadtrum Communications

We are fine with the first bullet.

For the second bullet, as the SI may be postponed, we could have more disussion based on the outcome of R18 WI.

20 – Qualcomm Technologies Int

Agree in general. Data storage and discovery/subscription/reporting are also important for multi-vendor interworking. We prefer to explicitly mention as: "(e.g., Data Collection including data storage and data discovery/subscription/reporting, Model Training, Model Inference)".

21 – Deutsche Telekom AG

We agree with the proposal of the moderator.

We see especially the 2nd part as important to align AI/ML approaches e.g. on model lifecycle management between different 5GS domains.

22 – MediaTek Inc.

We also concern on the open-ended study, we suggest to narrow-down the use cases and clarify the scope.

- Study new use cases for NG-RAN AI (RAN3)
  - slicing optimization for what purpose?
  - QoE optimization for what purpose?
- Study specification impact specifically for the given use case on network entities and interface procedures to support data and model management (RAN3, RAN2)
- Multi-vendor interoperability can be addressed

23 – Verizon UK Ltd

We agree with the objectives proposed by the moderator and they reflect the initial round discussion. We believe the exact list of use cases can be finalized during the SI phase discussions. Multi-vendor interop is important for AI/ML functions to achieve the full potential for AI/ML and should be studied.

The following options are proposed in 1st round of summary for further discussion:

Option1a) 1 WI and 1 SI are approved on Dec, the SI only starts after the R18 WI is completed.

Option1b) 1 WI is approved on Dec, the R18 SI could be proposed and approved only after the R18 WI is completed

Feedback Form 8: Q2-3: Which option do you prefer to organize the R18 discussion on AI/ML for NG-RAN in RAN3?

1 – Apple Benelux B.V.

Neither. The Rel-18 SI should be led by RAN2.

2 – InterDigital Germany GmbH

Out of these 2 options we would prefer 1a, but as long as we have TUs reserved for a follow-up SI we could agree to 1b.

3 – Futurewei

We prefer Option1b) as this option allows us to apply whatever we learn from R18 WI and make a better proposal for R18 SI.

4 – Nokia

We prefer option 1b. The SI objectives can be discussed later, after the R18 WI has progressed and when we have a better understanding of what should come next.

5 – Samsung R&D Institute UK

Considering the WI and SI will focus on different use cases, we don't see the dependency of the WI and SI. Another option could be:

Option 1c) 1 WI and 1 SI are approved in Dec and start the SI at the later stage. The exact time is to be decided in the RAN meetings next year.

Option 1c is an intermediate option which gives more flexibility. We prefer this Option 1c as way forward.

6 – China Mobile International Ltd

Option 1b is a reasonable way forward which follows the normal procedure. The objectives of SI can be discussed later when we have almost finished the WI, it seems no hurry on this.

In order to reflect the discussion that we may consider a possible SI in Rel-18, we could possibly set a 9 month or 12 month target for the WI. If we succeed finishing the WI, the SI can be approved and discussed in the remaining time of the Rel-18.

7 – AT&T

We prefer that the WI and SI are approved together to ensure appropriate planning can be done for the overall Rel-18 package in December. As for the timing of the SI, we think Samsung has a point that this can be flexibly decided next year based on the overall workload situation and the Rel-18 WI completion does not necessarily need to be explicitly tied to the start of this study item.

8 – Beijing Xiaomi Mobile Software

Either is fine to us. This is mainly dependent on the objective and TU allocation.

9 – ZTE Corporation

We prefer option 1b. Since the Objective of SI is still have different view and it seems hard to ahieve agreement on Dec, it it suggest to discuss the scope of SI after RAN AI WID has been completed.

10 – CATT

Considering the nomative work on some specific use cases may provide potential reference to the study of other use cases in Rel-18,it seems reasonable to discuss and approve the Rel-18 SI after the completion of Rel-18 WI.So,we prefer option 1b.

11 – Lenovo Mobile Com. Technology

Option 1a) if companies can agree on the objectives now, we think it's ok to approve it on Dec. Since it will be anyway start after R18 WI, it will not consume extra TU before R18 WI finishes.

12 – LG Electronics Inc.

Since the on-going SI is not yet completed in Dec., option 1b) is preferred in order to ensure a proper scope for Rel-18 SI.

13 – vivo Mobile Communication Co.

Option 1b) is preferred to decide the specific objective of R18 SI after the R18 WI is completed.

14 – Intel Deutschland GmbH

Between the proposed options, Option 1a) is slightly preferred. However, the scope of SI could be revised based on R18 WI and RAN1 R18 SI progress.

15 – Huawei Tech.(UK) Co.. Ltd

see above

16 – NEC Corporation

We prefer Option 1a.

17 – Ericsson LM

As we commented in the first phase this option is not agreeable to us. It does not make sense to agree to the start of a SI when we do not even know what results the Rel18 WI will provide. It is very likely that we will not need a new SI, but a continuation of normative work, just like it was done for many other topics. For example, when work was started in SON for LTE, a study was started (Rel9) with outcomes captured

in TR36.902 and after that normative work was carried out up until Rel12. Namely, SON did not need any further SI for three releases after the first SI. Likewise, the WI phase may reveal that there are problems unknown right now, in which case a decision on whether to tackle them via a SI or aWI will need to be taken. We therefore propose to agree to a WI in Rel18 and to leave discussions on a further SI for a later stage, e.g. nearer the end of Rel18 normative work.
18 – Spreadtrum Communications Option 1b) is OK. Since there is no agreement on the objectives of the SI. More time is needed to make the scope clearer.
19 – Qualcomm Technologies Int Qualcomm: Option 1a is acceptable. But, the SI has no dependency on the WI. We don't see any problem of parallel working on SI and WI.
20 – Deutsche Telekom AG From the 2 listed options we prefer Option 1a. But as already stated in the initial round, at least the work on the 2nd part (multi-vendor interoperability, collaboration with other 5GS domains) can start earlier (see also Samsung's proposal to the intermediate round noted as Option 1c).
21 – Verizon UK Ltd We prefer Option 1a out of these two options.

2.1 Moderator's Summary

Q2-1: Do companies agree on the objectives for R18 AI/ML for NG-RAN WI as above?

Summary

According to the feedback from the intermediate round of email discussion, majority of companies are fine with the objectives of R18 WI, and the objectives are subject to further refinement when the Rel-17 SI finishes. Hence, the objectives of this R18 WI are refined as below:

- Specify data collection enhancements and signaling support over current NG-RAN interfaces and architecture (including non-split architecture and split architecture) for AI/ML-based Network Energy Saving, Load Balancing and Mobility Optimization. (RAN3, RAN2)

Note: On security impacts, coordination with SA3 when needed.

Note: The objectives are subject to further refinement when the Rel-17 SI finishes.

Proposal1) Approve the above as the objectives of R18 WI.

Q2-2: Do companies agree on the objectives for R18 AI/ML for NG-RAN SI above as a baseline to be approved?

14 companies agree the objectives for R18 AI/ML for NG-RAN SI as a starting point, and 6 companies would suggest to discuss the scope of objectives after Rel18 WI is completed. Here, moderator tries to conclude the potential objectives for Rel-18 for reference later. Hence, the objectives of this R18 SI are refined as below:

- Study new use cases for NG-RAN (e.g., AI/ML for slicing, QoE and other potential use cases);
- Study network functionality and interface procedures to support the agreed use cases enabled by AI/ML, including:
  - Multi-vendor interoperability between different AI/ML functions (e.g., Data Collection, Model Training, Model Inference).
  - Integration and collaboration of OAM AI/ML, 5GC AI/ML, NG-RAN AI/ML and Air interface AI/ML.

Proposal2) Taking the above potential objectives as reference for future Rel-18 SI approval.

Q2-3: Do companies agree on the objectives for R18 AI/ML for NG-RAN SI above as a baseline to be approved?

8 companies prefer option 1a, while 9 companies can adopt option 1b. And 2 companies put forward option 1c that WI and 1 SI are approved in Dec and start the SI at the later stage. And 3 companies considered that the discussion on Rel-18 SI should wait for a later stage. Moderator think option 1b seems a good compromised way to go forward among camps.

Proposal3) Option 1b seems a compromised way to go forward that a R18 WI is approved in Dec, the R18 SI could be proposed (takes the above SI objectives into account) and approved only after the R18 WI is completed.

3 Final Round

The following R18 AI/ML for NG-RAN WI draft is proposed to be approved:

Justification

5G networks are expected to meet the challenges of consistent optimization of increasing numbers of key performance indicators (KPIs) including latency, reliability, connection density, user experience, etc. Artificial Intelligence (AI) /Machine learning (ML) provides a powerful tool to help operators to improve the network management and the user experience, by analyzing the data collected and autonomously processed that can yield further insights.

The study item 880076 “Study on enhancement for data collection for NR and EN-DC” studied general high-level principles, AI/ML functional framework and the potential use cases, and the identified potential solutions for these use cases. The accomplishments of the study for AI enabled RAN are documented in TR37.817. The normative work based on the conclusion of R17 SI should be continued in R18.

Objective

The detailed objectives of the WI are listed as follows:

- Specify data collection enhancements and signaling support over current NG-RAN interfaces and architecture (including non-split architecture and split architecture) for AI/ML-based Network Energy Saving, Load Balancing and Mobility Optimization. (RAN3, RAN2)

Note: On security impacts, coordination with SA3 when needed.

Note: The objectives are subject to further refinement when the Rel-17 SI finishes.

Feedback Form 9: Question 3-1: Do you agree the above WID draft for R18 AI/ML for NG-RAN?

1 – Apple Benelux B.V. We have serious concerns with the level of detail of the proposed WI objective. Such vague WID will result in a lot of time wasted on discussions what actually needs to be specified in the WI. This can be used as a basis for further discussion, but we are very far from a useful WID that can actually be approved. Furthermore, RAN2 scope is unclear. The objective only mentions ”network interfaces”, there is no mentioning of the air interface. If there are no air interface impacts, what would be the RAN2 scope?
2 – AT&T We have concerns with agreeing to the scope as written given that the Rel-17 SI is not concluded and it is not yet clear if a Rel-18 SI would also be approved.
3 – Nokia With the newly introduced 2nd Note (”the objectives are subject to further refinement when the Rel-17 SI finishes”), we believe that RAN2 should be removed (for now) from the objective since RAN2 scope is currently unclear. RAN2 can be added later, if needed, during the “refinement when the Rel-17 SI finishes” as captured in the 2nd Note.
4 – InterDigital Germany GmbH We are ok with the objectives
5 – Futurewei Yes. We agree with the WID draft for R18.
6 – CATT Since the Rel-17 SI is still ongoing,it is not easy to provide more detailed objective at current stage.We are fine to take the objectives proposed by the moderator as the starting point and further refine after the Rel-17 SI finish.
7 – Lenovo Mobile Com. Technology Yes it may be refined considering the R17 SI progress though.

8 – vivo Mobile Communication Co.

Agree on the draft WID as baseline for the specific objective discussion after the SI is completed.

9 – ZTE Corporation

Moderator's feedback to Apple's question:

In order to solve the concern, removing RAN2 for now from the objective, and the second note updates as below:

Note: The objectives and any other involved working groups are subject to further refinement when the Rel-17 SI finishes.

10 – Deutsche Telekom AG

We are fine with the current proposal. The note related Rel-17 SI outcome will allow further clarification and detailing in next step.

11 – Samsung R&D Institute UK

We agree with the objectives as baseline. With the second note, it can be refined when the Rel-17 SI is completed

12 – LG Electronics Inc.

Yes, in principle we agree. To be further refined when the on-going SI is completed.

13 – Ericsson LM

Agree them as Baseline for Rel 18 WID.

14 – Intel Deutschland GmbH

Agree with above justification and objectives.

15 – China Mobile International Ltd

Agree with the justification and objective as starting point, further refinement can be added when the SI finishs. This justification and objective can be documented in a draft WID after the final round dicussion

16 – NEC Corporation

We would propose two modifications:

1. Adding energy efficiency to the list of KPIs.
2. Adding note on coordination with SA5 on OAM aspects.

Proposed text with modifications is below:

Justification

5G networks are expected to meet the challenges of consistent optimization of increasing numbers of key performance indicators (KPIs) including latency, reliability, connection density, user experience, **energy**

efficiency, etc. Artificial Intelligence (AI) /Machine learning (ML) provides a powerful tool to help operators to improve the network management and the user experience, by analyzing the data collected and autonomously processed that can yield further insights.

The study item 880076 "Study on enhancement for data collection for NR and EN-DC" studied general high-level principles, AI/ML functional framework and the potential use cases, and the identified potential solutions for these use cases. The accomplishments of the study for AI enabled RAN are documented in TR37.817. The normative work based on the conclusion of R17 SI should be continued in R18.

Objective

The detailed objectives of the WI are listed as follows:

l Specify data collection enhancements and signaling support over current NG-RAN interfaces and architecture (including non-split architecture and split architecture) for AI/ML-based Network Energy Saving, Load Balancing and Mobility Optimization. (RAN3, RAN2)

Note: On security impacts, coordination with SA3 when needed.

Note: On OAM aspects, coordination with SA5 when needed.

Note: The objectives are subject to further refinement when the Rel-17 SI finishes.

17 – TELECOM ITALIA S.p.A.

agree

18 – Spreadtrum Communications

Yes□we agree with the objectives.

19 – Huawei Tech.(UK) Co.. Ltd

We can accept the draft WID with following changes:

- The Note must be Editor's note i.e. FFS
- The 2nd Editor's note should include "rewording" The objectives are subject to further refinement and rewording when the Rel-17 SI finishe.
- "(including non-split architecture and split architecture)" should be remove at this stage we do not see any reason for that
- Again "Specify data collection enhancements and signaling support over current NG-RAN interfaces and architecture", this wording is misleading can be interpreted in many way!! Replace "over current" by "within existing" is much clearer and match to the current agreement of the SI.

20 – Qualcomm Technologies Int

We agree

21 – MediaTek Inc.

We thank moderator's efforts. We also suggest to remove R2 for the time being, it is always possible to add supporting WG once the scope becomes clear.

Feedback Form 10: Question 3-2: Can you accept Option 1b as a compromised way to go forward?

1 – Apple Benelux B.V.

No.

We think there are many useful AI/ML-based optimization that fall into RAN2 scope (e.g. mobility), which haven't been covered by the RAN3-led Rel-17 SI and therefore cannot be properly addressed in the currently proposed WID. Those will need to be studied further with proper RAN2 involvement and the current proposal doesn't guarantee such work would even start in Rel-18.

2 – AT&T

As stated before, we don't agree with linking the approval of a Rel-18 SI which covers new use cases to the conclusion of the Rel-18 WI completion. We do not see 1b as a compromise - in other words, the Rel-18 work should be approved as a package.

3 – Nokia

Yes

4 – InterDigital Germany GmbH

We agree with AT&T that the work is more of a package. However we can agree with 1b if space is made with TU reserved explicitly for the study item (as it was for R17 at the start for some work).

5 – Futurewei

Yes, we accept Option 1b) for moving forward.

6 – CATT

It is OK for us to take option 1b as the wayforward.However,similar concern as interdigital,it should be guaranteed that TU is reserved for the Rel-18 SI.

7 – Lenovo Mobile Com. Technology

We still prefer option 1a, but option 1b is acceptable.

8 – vivo Mobile Communication Co.

Yes

9 – Deutsche Telekom AG

Ok with 1b under the assumption that TUs are explicitly reserved for the SI, i.e., the Rel-18 WI and SI should be considered as a package from the beginning avoiding that the SI will be abandoned (see also other companies' views).

10 – Samsung R&D Institute UK

We agree to approve the WI on Dec..

Regarding the SI, the Rel-18 WI and SI should be considered as a package from the beginning. At least TU should be reserved as companies suggested.

If it is not possible to have package approval on Dec., the SI could be left open. As the time going on, the RAN can evaluate whether the SI can be started based on the overall workload situation and the Rel-18 WI progress. There is no need to agree Option 1b now.

11 – LG Electronics Inc.

Yes.

12 – Verizon UK Ltd

We prefer Option 1a among 1a and 1b. Among all the options, we prefer Option 3. Option 1b is definitely not a compromise, Option 1a is a compromise. Rel-18 WI and SI should be considered as a package from the beginning. The SI could be started preferably in parallel or as a compromise at a later point of time (say 6 months after WI start).

13 – Ericsson LM

We can commit now to have discussions later on, towards the end of the Re-18 WI on a Rel-18 SI approval.

14 – Intel Deutschland GmbH

Ok with the proposal. However, we see "integration and collaboration with Air interface AI/ML" would be overlapped with AI/ML air interface SI. It would be good to add "integration and collaboration with air interface AI/ML" into a NOTE, taking the progress of RAN1-led SI into account.

15 – China Mobile International Ltd

Ok with the proposal 1b. We should first approve the WID in December. Discussion on apporval of a potential SI can be at the end of Rel-18 WI.

16 – NEC Corporation

Our preference is Option 1a, but if Option 1b is acceptable to all companies, we can also accept it.

17 – Spreadtrum Communications

Yes we are fine with option 1b).

18 – Huawei Tech.(UK) Co.. Ltd

We do support to start the WI AI/ML NG-RAN (and SI AI/ML Air Interface) at beginning of rel-18. The wording of 1b is too strong, there is too many unknown information today to take clever decision on second SI on AI/ML, and we prefer to postpone this discussion after start of rel-18. As "package" we can schedule some the TU for the SI.

19 – Qualcomm Technologies Int

For us, 1b is acceptable. But, in last round, the supporters of 1a and 1b are comparable. Option 1a enables longer time for the study, even if the total TU is same. If possible, we still prefer 1a.

The potential objectives of the R18 SI are refined as below:

- Study new use cases for NG-RAN (e.g., AI/ML for slicing, QoE and other potential use cases);
- Study network functionality and interface procedures to support the agreed use cases enabled by AI/ML,

including:

- Multi-vendor interoperability between different AI/ML functions (e.g., Data Collection, Model Training, Model Inference).
- Integration and collaboration of OAM AI/ML, 5GC AI/ML, NG-RAN AI/ML and Air interface AI/ML.

Feedback Form 11: Question 3-3: Do you agree to take the above potential objectives as reference for future Rel-18 SI approval?

1 – Apple Benelux B.V.

What's the point of discussing this, unless we are going to approve the SI in December?

2 – AT&T

We are OK with the list of objectives as a starting point for the draft SID.

3 – Nokia

There is no need to agree to any SI objectives now, since the SI will start only after the work item is completed. However, if there is a strong desire to capture "something" (e.g. as a placeholder), then we can only agree to capture the following for now:

"- Study new use cases for NG-RAN."

4 – InterDigital Germany GmbH

We are OK with the list of objectives as a starting point for the draft SID

5 – Futurewei

No.

In Question 3-2, the moderator proposed to choose Option 1b) for the way moving forward. If Option 1b) is accepted by the group, Question 3-3 is not necessary, as the objectives of the R18 SI can be defined after the WI completes.

We propose to delay the discussion on the objectives of the R18 SI at this stage until R18 WI completes.

6 – CATT

Considering we alreay spend quite some efforts on discussing the objectives on the Rel-18 SI and it seems the current version is the best we could achieve,we are OK to take the proposed objectives as the starting point.After the completion of Rel-18 WI,we could revisit the objectives and make further refinement.

7 – Lenovo Mobile Com. Technology

Yes, they seem fine as a start point for future discussion, of course it may be refined considering progress in R18 WI and other groups too.

8 – Deutsche Telekom AG

The listed items are fine for us to describe the intended focus for the SI.

9 – Samsung R&D Institute UK

We agree with the objectives except the last sub-bullet. For the "Integration and collaboration of OAM AI/ML, 5GC AI/ML, NG-RAN AI/ML and Air interface AI/ML.", SA2 have already agreed to collaboration with SA5 MDAS/MDAF (OAM AI/ML) as one of objectives for Rel-18 eNA. Duplication discussion in SA and RAN should be avoided. We don't know yet what can be concluded on Air interface AI/ML, it's too early to discuss the integration and collaboration.

10 – LG Electronics Inc.

In principle, it is fine to be a reference. This can be revisited after the WI is completed.

11 – Ericsson LM

We remain our view that we should agree to a WI in Rel18 and to leave discussions on a further SI for a later stage, e.g. nearer the end of Rel18 normative work.

12 – Verizon UK Ltd

We support the list of objectives as a starting point for the draft SID. Also we prefer adding another objective - Explore framework enhancements for better support of AI/ML use cases.

13 – Intel Deutschland GmbH

Ok with the proposal. However, we see "integration and collaboration with Air interface AI/ML" would be overlapped with AI/ML air interface SI. It would be good to add "integration and collaboration with air interface AI/ML" into a NOTE, taking the progress of RAN1-led SI into account.

14 – Intel Deutschland GmbH

As we commented in last question, we think it would be good to add a NOTE to take the progress of air interface AI/ML SI into account.

We suggest with following changes:

- Integration and collaboration of OAM AI/ML, 5GC AI/ML, and NG-RAN AI/ML ~~and Air interface AI/ML~~.

Note: integration and collaboration with air interface AI/ML to be considered based on progress of Air interface AI/ML SI.

15 – China Mobile International Ltd

Considering we don't need to approve a SID at December, and the current situation shows we are a little far from covergence, we could keep the objectives open and re-discuss them later on.

16 – NEC Corporation

Agree.

17 – TELECOM ITALIA S.p.A.

The listed items are fine for us to describe the intended focus for the SI.

18 – Spreadtrum Communications

Yes, the above objectives could be a good starting point, and the details can be revisited based the outcome of WI.

19 – Huawei Tech.(UK) Co.. Ltd

No.

We are supporter of a second Study Item for new promising use cases investigate as example distributed AI/ML. The example provided in brackets are too restrictive.

We need to follow the same principle as today, start from the use cases. That does not allow to take now assumption on "network functionality and interface procedures to support", "interoperability between different AI/ML functions", "Integration and collaboration of OAM AI/ML, 5GC AI/ML, NG-RAN AI/ML and Air interface AI/ML". All these aspects must be justified with use case and take account the WI.

Same view as Nokia if something need to be captured.

4 Conclusions

According to the feedback in the final round, the RAN3 led R18 WI on AI for NG-RAN is agreeable to be approved in Dec with further editorial updates.

Conclusion1) The RAN3 led R18 AI for NG-RAN WI to be approved in Dec.

As discussed in the previous rounds of email discussion and also follow the current RAN3 SI discussion, both non-split architecture and split architecture are considered for the solution. Therefore, "including non-split architecture and split architecture" is needed.

The wording "refinement" is general enough to include the meaning of rewording. No need to complicate the description.

The other editorial updates are accepted in the updated version of WID as below.

Conclusion2) Take the draft WID below as the baseline to be approved:

Justifications

5G networks are expected to meet the challenges of consistent optimization of increasing numbers of key performance indicators (KPIs) including latency, reliability, connection density, user experience, energy efficiency, etc. Artificial Intelligence (AI) /Machine learning (ML) provides a powerful tool to help operators to improve the network management and the user experience, by analyzing the data collected and autonomously processed that can yield further insights.

The study item 880076 "Study on enhancement for data collection for NR and EN-DC" studied general high-level principles, AI/ML functional framework and the potential use cases, and the identified potential solutions for these use cases. The accomplishments of the study for AI enabled RAN are documented in TR37.817. The normative work based on the conclusion of R17 SI should be continued in R18.

Objectives

The detailed objectives of the WI are listed as follows:

Specify data collection enhancements and signaling support within existing NG-RAN interfaces and architecture (including non-split architecture and split architecture) for AI/ML-based Network Energy Saving, Load Balancing and Mobility Optimization. (RAN3)

Note: On security impacts, coordination with SA3 when needed. On OAM aspects, coordination with SA5 when needed.

Editor's Note: The objectives and any other involved working groups are subject to further refinement when the Rel-17 SI is completed.

Conclusion3) It is proposed to take option1b) as a compromised way to handle R18 SI, with the understanding that 6 months TU will be reserved for R18 SI if needed. [no consensus]

Conclusion4) Take the objective list below as a starting point for the draft SID, which needs to be revisited after the WI is completed. [no consensus]

The potential objectives of the SI are listed as follows:

- Study new use cases for NG-RAN (e.g., AI/ML for slicing, QoE and other potential use cases);
- Study network functionality and interface procedures to support the agreed use cases enabled by AI/ML, including:
    - Multi-vendor interoperability between different AI/ML functions (e.g., Data Collection, Model Training, Model Inference).
    - Integration and collaboration of OAM AI/ML, 5GC AI/ML, NG-RAN AI/ML if identified.
      Note: Integration and collaboration with air interface AI/ML to be considered based on progress of Air interface AI/ML SI.