Email discussion summary for [RAN-R18-WS-crossFunc-OPPO] - Version 0.0.1
RAN

3GPP TSG RAN Rel-18 workshop RWS-210635
Electronic Meeting, June 28 - July 2, 2021

Agenda Item: 4.3

Source: OPPO

Title: Email discussion summary for [RAN-R18-WS-crossFunc-OPPO]

1 Introduction

This email discussion covers following documents:

RWS-210051 Motivation of introduction of AI/ML in physical layer OPPO

RWS-210052 Motivation of study of RAN enhancement for AI/ML OPPO

2 RWS-210051

Feedback Form 1: Question for clarification on RWS-210051

1 – Intel Technology India Pvt Ltd

In slide 10, how does the payload for Type II compare with AI based methods?

2 – Xiaomi Communications

[Xiaomi]: Thank you for the contribution. We have one question on P14. Can you explain more about your consideration why release 18 should focus on the link level use case

3 – Futurewei Technologies

FUTUREWEI supports the proposal of leveraging the principles introduced under RAN3 Rel-17 SI FS*NR*ENDC*data*colle when studying AI/ML potentials for PHY layer and think use cases like CSI compression and channel estimation are valid candidates as part of the study for Rel-18.

We proposed some other candidate use cases, e.g., beam selection, MCS selection, mmWave signal blockage detection and multi-functional-block PHY layer optimization. We also believe common evaluation methodology and datasets are important as well when investigating AI/ML-based functionalities. Our proposal is described in RWS-210038, https://www.3gpp.org/ftp/TSG_RAN/TSG_RAN/TSGR_AHs/2021_06_RAN_Rel18_ 210038.zip . Feel free to provide your views as well at: https://nwm-trial.etsi.org/#/documents/4751

4 – Spreadtrum Communications

Thanks for the nice contribution. Regarding the use case in your slides, for receiver with noise-compression (slide 11), what is the impact on the specification? In our opinion, it is a UE implementation. So, should the specification impact be one of the important conditions for identifying the use cases?

5 – Sony Corporation

Thanks for the contribution. We have a question.

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Could you clarify the figure in page 9 of RWS-210051? What is the meaning of the left hand side box, right hand side box and each of the arrows? And, could you clarify the difference between each case 1 5?

6 – Lenovo (Beijing) Ltd

Thanks for sharing, and we have one question in the initial proposals in page 14. What do you mean 'the potential impact on hardware and software'?

7 – China Mobile Com. Corporation

Thanks for the proposals. We are interested in and supportive for AI/ML on physical layer. May I ask two questions for the proposals in Page14:

1) in the first proposal, we are wondering by saying "without touching algorithm", how to align the evaluations among companies. We was thinking for the purpose of commercial usage, we anyway need to evaluate the performance of models like CNN, DNN based on a set of typical parameters, just like what we done in UDC SI.

2) in the third proposal, it said "focus on link level use cases", we are fine with that, while we think the performance in system level is also needed, in order to have a whole picture on the gain for frequency efficiency, delay, throughput.

8 – HUAWEI TECHNOLOGIES Co. Ltd.

Thank you very much for the contribution. Please find one question for clarification as below:

Q1. In Page 14, "To take principle introduced in FS*NR*ENDC*data*collect for network optimization into account", what kind of principle in your mind here? In our understanding, at least the following two should be reused:

- Detailed AI/ML algorithms and models shall be left for implementation;
- Existing network architecture and interfaces of NR should be reused.

9 – Nokia Corporation

Have you considered how to ensure predictable UE behaviour with AI/ML in UE and how to ensure that UE always meets its minimum requirements with AI/ML and UE performance in enhanced in many cases?

10 – Guangdong OPPO Mobile Telecom.

Many thanks for all your valuable questions and comments, here are the 1st round responses:

1 – Intel Technology India Pvt Ltd

[OPPO] For Type II, they are eType II codebook based solution that introduced in Rel16. 49bits and 128bits are assumed in this simulation for TYPE II (L=2) and TYPE II (L=4) respectively.

2 – Xiaomi Communications

[OPPO] One reason is that cell level use cases had been already studied in RAN3, where one potential WI is expected in Rel18. While link level use cases have not been touched before whose quantitative results and evaluation methods could be helpful to identify the benefit of AI/ML for NR system.

3 – Futurewei Technologies

[OPPO] Thanks for your supporting. We are glad to see that FUTUREWEI are interested in more topics. We are fine to discuss these additional use cases are well.

4 – Spreadtrum Communications

[OPPO] thanks, from our side, the answer could be yes/no □

We think how to set/configure a proper AI denoising model and how to trigger the denoising model adaptively updating may have some potential specification impacts.

5 – Sony Corporation

[OPPO] the grey box stands for logical node within 3GPP system e.g. UE or gNB and the line with arrows stand for interface between those nodes e.g. Uu interface. The black box stands for AI/ML algorithm where identical shape means same algorithm. For case1/2, the AI/ML algorithm is implemented by vendor without impact the interface hence no spec impact is expected. But it doesn't mean it is always the case i.e. some AI/ML may need some assistant information from peer node such as the case listed in slide 11. Case4 means when AI/ML algorithm is aligned between nodes via some manner, then information exchanged over interface can be put in a transparent box but the input/output of the AI/ML should be standardized so that enhanced information format e.g. new codebook can be introduced to improve the performance. Case 5 goes the traditional direction i.e. the information exchanged over interface is enhanced by assuming AI/ML can do something more which is not crystal clear before studying them in Rel18. I hope this clarify our idea J

6 – Lenovo (Beijing) Ltd

[OPPO] Well, no pain, no gain J the potential impact on hardware and/or software could be one metric to assess the pain of the AI/ML algorithm.

7 – China Mobile Com. Corporation

[OPPO]

1) "without touching algorithm" means AI/ML algorithm itself is a black box in the study. But we need evaluate performance of reference models as you also pointed out. Relevant factors could be the reference training dataset, the reference training method, the reference loss function and other super-parameters utilized in AI/ML training and inference. And then based on the reference model, enhanced AI/ML solutions can be compared fairly.

2) Both link level and system level simulation are needed to evaluate link level use cases. To kick off easier, we can start with link level simulation to filter in initial stage.

8 – HUAWEI TECHNOLOGIES Co. Ltd.

[OPPO]: Agree. In addition we think SA architecture is the focus.

9 – Nokia Corporation

[OPPO]: Prediction depends on the time scale and UE's speed heavily. For link use cases, we think UE's behavior can be predicted in few ms considering its real time characteristics. If UE is moving very slowly i.e. when the channel is flat in time domain, then more can be predicted and vice versa. As for "how to ensure that UE always meets its minimum requirements with AI/ML and UE performance in enhanced in many cases", we don't have clear answer for the moment and intend to think this is part of the study.

Feedback Form 2: 2nd round questions and comments on RWS-210051

1 – Samsung Electronics Polska

1. In page 10 for CSI compression,

what is the type of compressed CSI for feedback? E.g. antenna-delay CSI for compression or angle-frequency CSI for compression?

2. In page 11 for noise-compression,

what is the meaning of 'noise-compression'? Also, What is Oppo's thinking about potential RAN1 enhancement?

2 – Guangdong OPPO Mobile Telecom.

A1, It is antenna-delay CSI

A2, noise-compression means to reduce noise level with the help of AI/ML algorithm i.e. denoising. We think firstly we need to identify some reference models to show the performance gain in the SI stage. Then, how to help network to choose a proper denoising model to handle different channel state and different transmission requirements need further discussion

3 RWS-210052

Feedback Form 3: Questions for clarification on RWS-210052

1 – ZTE Corporation

The study of AI traffic seems interesting. Do you think it can included as an objective item in the RAN1/RAN2-led AI based air interface study item?

2 – CAICT

It is also important for RAN to support AI related application. In Page 5/6/7, What do the different colors in the tables mean?

3 – LG Electronics France

Q) Do you think it is beneficial to study both network-centric ML approach and UE-centric ML approach or it is better to only consider network-centric ML approach in Rel-18?

4 – Spreadtrum Communications

Thanks for your valuable contribution. The AMMT topic led by SA1 is a good beginning of AI to be integrated in 5G-Advanced. Here we have some questions about the scope.

Q1: Do you exclude the use cases that have not been discussed in the AMMT topic?

Q2: As some communication requirements have been discussed and summarized in TR 22.874, at this stage, is it necessary to define a new QoS parameter to satisfy the requirement of AI use cases?

5 – MediaTek Inc.

Thanks for the contributions. Some questions for clarification:

1) Any priority of the AI use cases to down-scope and study in Rel-18?

2) What performance parameters (AI-related) should be studied?

3) Any potential areas of improvement identified by OPPO?

6 – Samsung Electronics Polska

What is the difference for RAN to support high-data-rate low-latency service and AI/ML related use cases?

7 – China Mobile Com. Corporation

Thanks for the contribution. Do you take the AI model as black box or not in this SI? Do you plan to mainly focus on the enhancement for air interface to meet the requirement of AI use cases.

8 – Guangdong OPPO Mobile Telecom.

Many thanks for all your valuable questions and comments, here are 1st round response:

1 – ZTE Corporation

[OPPO]: Yes. We think study on AI/ML consists two parts mainly: part 1 is how to improve NR system performance via introduction of AI/ML; part 2 is to assess AI traffic to see whether current NR system can support those AI traffics smoothly or not and if not, how to resolve the identified issues.

2 – CAICT

[OPPO]: The red color means requirements which can almost impossible for NR system to meet even we do some enhancement. The yellow color means requirements which may be met for NR if further enhancement is introduced in Rel18. The green color means requirements which can be met already by current NR system.

3 – LG Electronics France

[OPPO]: At this stage we think both are important.

4 – Spreadtrum Communications

[OPPO] A1: No, that's not the intention. The listed cases are just for example.

[OPPO] A2: I think TR22.874 only capture the outcome of the study. SA1 is planning a WID to capture the key requirements into specification. Whether new QoS parameters are needed or not is a question for solution which is definitely a valid approach in SA. Note OPPO already circulated a relevant proposal in SA2. If you are interested in it, please contact me J

5 – MediaTek Inc.

1) Any priority of the AI use cases to down-scope and study in Rel-18?

[OPPO]A1: We are open at this stage. I guess how to narrow down could be the study in initial stage.

2) What performance parameters (AI-related) should be studied?

[OPPO]A2: As we pointed out the (experienced) data rate seems the key metrics in SA1. But we can assess this again as well as other performance e.g. latency. In addition it is important also to understand the detail traffic pattern from RAN point of view due to the fact that AI traffic is brand new in RAN even it is already there J

3) Any potential areas of improvement identified by OPPO?

[OPPO]A3: The logic could be bit similar as we did on XR/CG i.e. potential area will be identified only after RAN has better understanding how the traffic looks like and what is the challenging key performance. At this stage we think we can explore the area to improve spectrum efficiency, data compression, maybe also SPS/CG pattern etc.

6 – Samsung Electronics Polska

[OPPO]: If you check the table in slide 5, you will find the E2E latency in Application level is not so stringent. But delay budget left for data communication is limited to e.g. 2ms which is very challenging considering the data size could be up to 3M Bytes.

7 – China Mobile Com. Corporation

[OPPO]: Not exactly. The AI model itself i.e. the intrinsic structure and algorithm is black box, but its size and performance requirement should be evaluated and identified.

We think Uu interface is definitely the focus for RAN side. But other network interface is not excluded either. Plus SA solution could be also complement part e.g. to introduce new QoS parameter.

Feedback Form 4: 2nd round questions and comments on RWS-210052

1 – MediaTek Inc.

Thanks for the answers.

Could you elaborate on ”data compression”?

2 – Guangdong OPPO Mobile Telecom.

some of the AI traffic can be compressed to transfer in more efficient way. In TR 22.874 you can find both uncompressed and compressed federated learning are studied in SA1.

4 Conclusion