

3GPP TSG RAN Rel-19 workshop

Taipei, June 15 - 16, 2023

Agenda item: 5. Specific RAN1/2/3-led Rel-19 topics

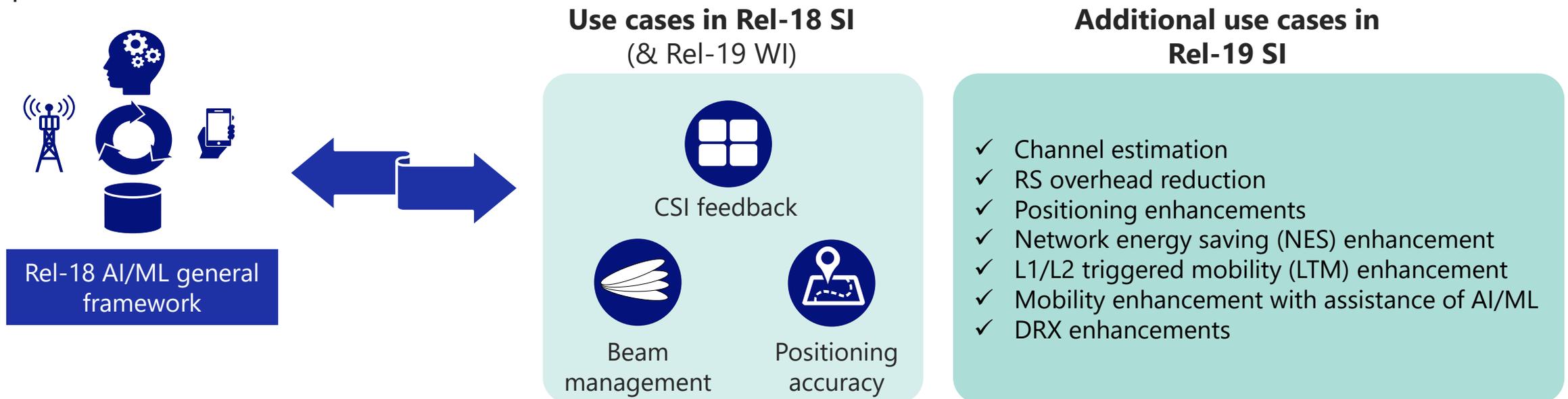
RWS-230134

Extended study on AIML for air interface

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Consideration on the extended AI/ML study at Rel-19

- ◆ The study on AI/ML for air interface at Rel-18 set up a framework for the support of AI/ML based features for NR including the AI/ML model transfer, data collection, etc.
- ◆ More AI/ML use cases can be further studied in Rel-19 under the same AI/ML framework as concluded from the Rel-18 study.
- ◆ For Rel-19 and beyond, from air interface perspective, **additional AI/ML use case study** should be organized in a per WG manner, e.g., RAN1 and RAN2 may focus on different set of use cases.
- ◆ For Rel-19 and beyond, the additional AI/ML use case study can be also based on the Rel-18 features being specified for NR.



AI/ML-based channel estimation

◆ Justification

- AI/ML-based channel estimation has the potential to improve accuracy and to reduce RS overhead. It could be useful for both UE-sided DL DMRS based channel estimation and NW-sided UL DMRS based channel estimation.

◆ Objective

- Study AI/ML-based DL/UL channel estimation to improve accuracy and to reduce RS overhead
- Study the data collection for model training of AI/ML-based channel estimation
- Study the performance of model inference of AI/ML-based channel estimation
- Study the method of model monitoring of AI/ML-based channel estimation
- Study new DL and UL DMRS patterns for AI/ML-based channel estimation

AI/ML-based RS overhead reduction

◆ Justification

- In R18 SI phase, evaluations show measurable gains of using AI/ML models for RS overhead reduction. However, AI/ML for RS overhead reduction is not selected as the final representative use case due to the potential for additional workload.

◆ Objective

- Study AI/ML for RS overhead reduction as a new use case from RAN1 perspective
- Study enhancements on DM-RS overhead reduction
 - e.g., based on AI/ML model for channel estimation
- Study enhancements on CSI-RS overhead reduction
 - e.g., based on AI/ML model for CSI compression and for beam management
 - The RS overhead reduction could be in spatial-domain, antenna-port domain, frequency domain and time domain

AI/ML-based positioning enhancements

◆ Justification:

- In Rel-18, the use case of positioning enhancement for AI/ML for the air interface only focuses on accuracy improvement, while other aspects of positioning enhancement are not considered. The current agenda of Expanded and Improved NR positioning aims to enhance low power, high accuracy, and low latency positioning, specifically for sidelink, LPHAP, and RedCap scenarios.
- The use of AI/ML models can further enhance the power and latency aspects of positioning. Additionally, the combination of AI/ML models with phase carrier information can be beneficial in achieving sub-centimeter positioning accuracy.

◆ Objective:

- Study enhancements for positioning power consumption.
- Study enhancements for positioning latency reduction by configuring suitable PRS/SRS resources based on AI/ML models.
- Study further enhancements for positioning accuracy, aiming to achieve sub-centimeter level positioning, e.g., by the combination of AI/ML models and phase carriers.

AI/ML for NES enhancements

◆ Justification:

- During the Rel-18 work for Network Energy Saving, there is not sufficient discussion on the triggering events for NES operation
- The AIML based approach may enable the network to collect the necessary data from the UE and to help the network to correctly configure and adapt the NES pattern, which may further improve the energy saving gain for the network.

◆ Objectives:

- Study AI/ML for NES enhancements (Rel-18 NES feature) as a new use case from RAN1/2 perspective
 - enhancements on antenna 'ON/OFF' and power adjustment in spatial and power domain with the assistance of AI/ML model
 - enhancements on 'Configuration of cell DTX/DRX for NES' using AI/ML model

AI/ML for L1/L2 triggered mobility (LTM)

◆ Justification:

- The L1/L2 triggered mobility (LTM) being discussed at Rel-18 may introduce very frequent handover (or ping-pong handover) if the LTM handover decision is not made properly.
- The L1 measurements and reporting for L1/L2 triggered mobility may introduce even higher overhead on the air interface than traditional handover.
- Acquiring the TA of candidate LTM cell(s) is critical for RACH-less LTM performance. The prediction of the TA and its change of the candidate LTM cell(s) can save the efforts from the UE to acquire the TA.

◆ Objectives:

- Study AI/ML for 'L1/L2 triggered mobility' (Rel-18 LTM feature) as a new use case from RAN1/2 perspective
 - enhancements on the handover decision for L1/L2 triggered mobility to avoid ping-pong handover
 - enhancements on L1 measurements and reporting for L1/L2 triggered mobility based on AI/ML model
 - enhancements on TA measurement configuration and TA update prediction using AI/ML model

Mobility enhancement with the assistance of AI/ML

◆ Justification:

- The current handover decision for mobility is made by the network based on the measurement report from the UE. However, the measurement report causes high overhead on the air interface.
- The traditional mobility procedure lacks self-learning ability for handover decision, which may improve the handover successful rate.

◆ Objectives:

- Study the AIML based Mobility enhancement, where the network may present less control on a concrete mobility event but just control the mobility at a very high level, e.g., decision on which AIML model is to be used, AIML model training, performance observation, etc.
- Study the UE based Mobility enhancement with the assistance of AIML
 - The UE can automatically adjust the mobility parameters configured from the network to improve the performance.
 - The mobility may be fully managed by the UE based on its AIML algorithm. This changes the traditional HO decision logic.
 - RRM measurement results of future time instances can be predicted.
- Study the following scenarios based on different AIML training approach for Mobility enhancement
 - Network performs the AIML training for mobility decision. Network transfers the trained AIML model to the UE for its execution.
 - When the UE receives the initial AIML model from the network, each UE may continue AIML model training. Then eventually, different UE may run totally different AIML models for inference, even though the initially trained model may be the same.
 - Completely UE based AIML model training for mobility enhancement

AI/ML for DRX enhancements

◆ Justification

- By C(connected)-DRX mechanism, UE in RRC_CONNECTED does not have to continuously monitor PDCCH, which improve the power saving gain. However, as UE in C-DRX non-Active Time can not receive PDCCH until next C-DRX Active Time, the trade-off between power saving and latency is introduced. If the upcoming traffic burst can be predicted by AI/ML, an adaptive C-DRX can be matched to let UE optimally monitor PDCCH, then based on this, both power saving and latency can be improved simultaneously.

◆ Objectives:

- Study AI/ML for C-DRX as a new use case from RAN2 perspective
- Study basic design for AI/ML framework for AI based C-DRX, such as what parameters are needed as AI/ML model input, output
- Study and evaluate AI based C-DRX framework, e.g., whether a new C-DRX pattern (which is different from the legacy C-DRX) is needed or not
- Study and evaluate high layer procedures and protocol changes needed to support AI based C-DRX
 - L1 procedures are not precluded when necessary

Summary

- ◆ From RAN1 perspective, the following cases can be further studied
 - AI/ML based channel estimation
 - AI/ML based RS overhead reduction
 - AI/ML based positioning enhancements on latency, reliability and power saving
 - AI/ML based NES enhancements
 - AI/ML for L1/L2 triggered mobility (LTM)
- ◆ From RAN2 perspective, the following cases can be further studied
 - Mobility enhancement with the assistance of AIML can be a primary use case
 - AI/ML based DRX enhancements
 - Other use case is not precluded

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