Study on AI/ML for mobility

RP-233528
Agenda item: 9.1.2.4
3GPP TSG-RAN#102
Edinburgh, Scotland, December 11-15, 2023
Source: Kyocera Corporation

© KYOCERA Corporation

Background (1/2)

- In RAN#101, huge interests were observed for AI/ML for mobility which was derived from AI/ML for air-interface [RP-232611], and the moderator's summary of RAN2-led AI/ML for mobility study [RP-232622]

For mobility under connected mode, the potential scopes/directions of the study item include:

- Type of mobility
  - L3-based mobility and L1/L2-triggered mobility (LTM) are both considered
- HO optimization in Network side [/UE side], including
  - Candidate/target cell prediction in L3-based mobility, or, candidate/target beam(s) and cell(s) prediction in LTM
- RRM measurement and event prediction, including
  - Beam-level measurement prediction
  - Cell-level measurement prediction, e.g., using intra-frequency measurement results to forecast the RRM measurement of inter-frequency/inter-RAT cells
  - HO failure/RLF prediction
  - Measurement events prediction
- LCM framework and others
  - The conclusions in Rel-18 AI/ML study should be used as baseline
  - Other impacts are further studied
- [UE RRM enhancement, RAN4]
- Note 1: no intention to change the existing framework for the mobility under connected mode
- Note 2: In the SID, target performance metrics and impacts should be clarified
- Note 3: Avoid overlap work with RAN3

There are significant support for RAN2-led study on AI/ML for mobility

© KYOCERA Corporation

Background (2/2)

- For RAN#102, chair provided early summary of Rel-19 projects [RP-232745]
  - It already indicated the target topics for down-scoping, i.e., yellow-highlighted parts.

AI/ML for Air Interface (Mobility) SI

- References: RWS-230488, RP-231540, RP-232622
- Potential objectives: possible down-scoping in RAN#102
  - Type of mobility
    - L3-based mobility and L1/L2-triggered mobility (LTM) are both considered
  - HO optimization in Network side ~~[/UE-side]~~, including
    - Candidate/target cell prediction in L3-based mobility, or, candidate/target beam(s) and cell(s) prediction in LTM
  - RRM measurement and event prediction, including
    - Beam-level measurement prediction
    - Cell-level measurement prediction, e.g., using intra-frequency measurement results to forecast the RRM measurement of inter-frequency/inter-RAT cells
    - HO failure/RLF prediction
    - Measurement events prediction
  - LCM framework and others
    - The conclusions in Rel-18 AI/ML study should be used as baseline
    - Other impacts are further studied
  - ~~[UE RRM enhancement, RAN4]~~
  - Note 1: no intention to change the existing framework for the mobility under connected mode
  - Note 2: In the SID, target performance metrics and impacts should be clarified
  - Note 3: Avoid overlap work with RAN3

Slide 30

Since this is initial study for AI/ML-based mobility, no strict restriction/down-scoping is necessary

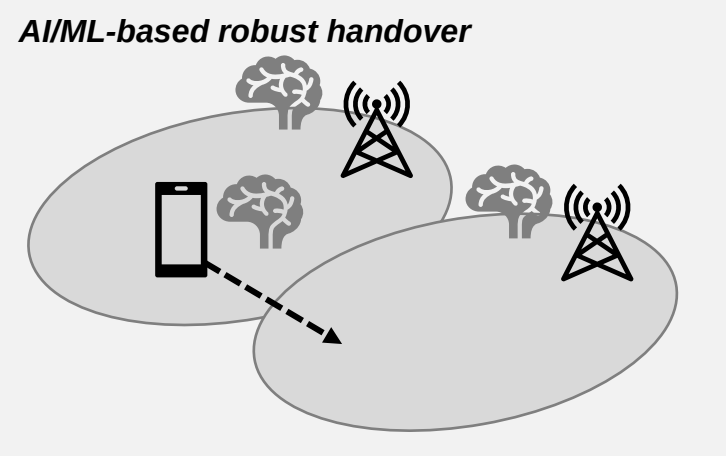
© KYOCERA Corporation

Type of mobility

- Type of mobility
  - L3-based mobility and L1/L2-triggered mobility (LTM) are both considered

Observations

- In our view, given this is the initial study for AI/ML-based mobility, no down-scoping is needed but rather extensive discussion is preferable, since both L3-based mobility and LTM would have potentials to be improved by AI/ML.



Both L3-based mobility and LTM should be in-scope of study

© KYOCERA Corporation

HO optimization in Network/UE side(s)

- HO optimization in Network side ~~[/UE side]~~, including

Observations

- In our view, these HO optimizations intend to use the NW-sided model and the UE-sided model, respectively.
- For HO optimization with NW-sided model, it's useful for the HO decision in the gNB. It's more like up to gNB implementation and/or rather handled by "AI/ML for NG-RAN" led by RAN3.
- For HO optimization with UE-sided model, the AI/ML model-aided measurement reporting and/or the UE assistance information are useful to help the gNB's HO decision.
  - In addition, the AI/ML model-aided CHO evaluation/execution in the UE is worth studying, e.g., the AI/ML model for CHO evaluation is transferred and activated by the gNB instead of the existing RSRP-based CondEvents.

- Therefore, the "HO optimization in UE side" should be kept in the objectives of SID.
  - In addition, TSG-RAN should discuss whether or not the "HO optimization in Network side" is conflict with "AI/ML for NG-RAN" led by RAN3.

HO optimization in UE side should be kept in SID, and to discuss if one in NW side is really needed

© KYOCERA Corporation

RRM measurement predictions

- RRM measurement and event prediction, including
  - Beam-level measurement prediction
  - Cell-level measurement prediction, e.g., using intra-frequency measurement results to forecast the RRM measurement of inter-frequency/inter-RAT cells

Observations

- In our understanding, these measurement predictions would involve RAN1 much more, which is not expected to this study item, i.e., the initial intention seems to focus on RAN2-related topics, according to the baseline TUs in [RP-232745].
- In our view, these measurement predictions are worth studying since it has potentials to improve UE power saving (e.g., if it reduces measurements) and/or NW energy saving (e.g., if it reduces reference signal transmissions.)
  - However, it's unclear the differences between these measurement predictions and the beam management enhancements in AI/ML for air-interface study led by RAN1.
- Therefore, the measurement prediction can be studied as a part of this SI, if more RAN1 TUs can be allocated.

The beam-level/cell-level measurement prediction may be studied, but TSG-RAN should discuss to increase RAN1's TU allocation

© KYOCERA Corporation

LCM framework

- LCM framework and others
  - The conclusions in Rel-18 AI/ML study should be used as baseline
  - Other impacts are further studied

Observations

- In our view, the existing LCM framework can be reused for this SI in general, but it's still worth discussing if any other issues specific to AI/ML for mobility, if any.

- Therefore, "Other impacts are further studied" is suggested to be rephrased by "Impacts on existing LCM framework can be discussed, if any issue is identified."

Impacts on existing LCM framework can be discussed, if any issue is identified

© KYOCERA Corporation

UE RRM enhancements

- ~~[UE RRM enhancement, RAN4]~~

Observations

- We don't have a strong view, but this topic would require much more RAN4 work, which is not expected to this study item, according to the baseline TUs in [RP-232745].

- Therefore, this SI should more focus on RAN2-related topics.

RAN4-led topic such as UE RRM enhancement should be out of scope

© KYOCERA Corporation

Potential objectives

- Type of mobility
  - L3-based mobility and L1/L2-triggered mobility (LTM) are both considered
- HO optimization in Network side ~~[~~/ UE side~~]~~, including
  - Candidate/target cell prediction in L3-based mobility, or, candidate/target beam(s) and cell(s) prediction in LTM
- RRM measurement and event prediction, including
  - Beam-level measurement prediction
  - Cell-level measurement prediction, e.g., using intra-frequency measurement results to forecast the RRM measurement of inter-frequency/inter-RAT cells
  - HO failure/RLF prediction
  - Measurement events prediction
- LCM framework and others
  - The conclusions in Rel-18 AI/ML study should be used as baseline
  - ~~Other impacts are further studied~~ Impacts on existing LCM framework can be discussed, if any issue is identified
- ~~[UE RRM enhancement, RAN4]~~
- Note 1: no intention to change the existing framework for the mobility under connected mode
- Note 2: In the SID, target performance metrics and impacts should be clarified
- Note 3: Avoid overlap work with RAN3

Study on AI/ML for mobility should be approved

© KYOCERA Corporation

THE NEW VALUE FRONTIER

KYOCERA

KYOCERA Corporation

© KYOCERA Corporation