Motivation of AI/ML for air-interface

RP-231920
Agenda item: 8A.2.1
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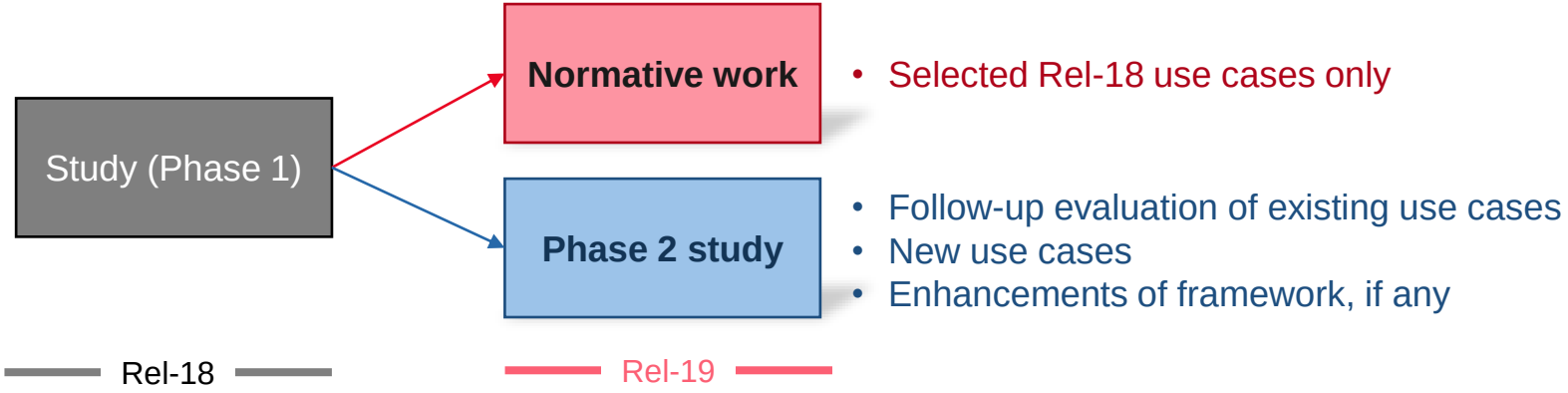
Motivation

- In Rel-18 AI/ML for air-interface, general framework including Model ID, LCM, data collection, performance evaluation methodology have made good progress.
  - The 3 use cases, CSI compression & prediction, Beam management and Positioning are being ~~were~~ evaluated.
- On the other hand, the number of use cases was kept to a minimum to ensure acceptable workload for the study.
- For Rel-19, one work item followed by a Phase 2 study item is one possible approach.



In Rel-19, a normative work and a follow-up study are considered for AI/ML for air-interface

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Normative work

Observations on evaluation results

- For CSI compression and prediction sub-use case has shown modest gain.
- For beam management use case, BM-Case1 has shown significant gains with respect to overhead reduction.
- For positioning, both Direct and Assisted have shown a much better accuracy than conventional positioning.
  - Beam management and positioning use cases are considered ready for normative work.
  - CSI use case may need more evaluation before normative work.

Observations on general framework

- For LCM, Model-ID based LCM and Functionality-based LCM were identified.
- For model transfer, there are many options, i.e., Solutions 1a, 1b, 2a, 2b, 3a, 3b and 4, depending on which entity provides the model (i.e., gNB, CN, LMF or OAM/OTT server) and which layer/signalling transfers the model (i.e., RRC, NAS, LPP or UP data).
- For data collection, there are many assumptions, and the conditions may be different in training or inference.
  - For LCM and model transfer, down-selection is needed to identify option(s) to be specified.
  - For data collection, it should be identified whether the existing measurements can be adequate input data to the model in each use case.

BM-Case1 and Direct/Assisted-positioning should be specified

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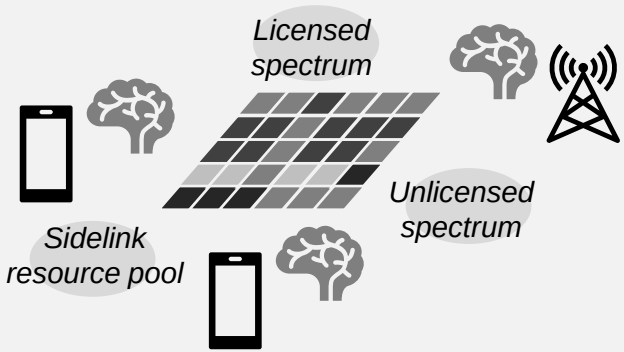
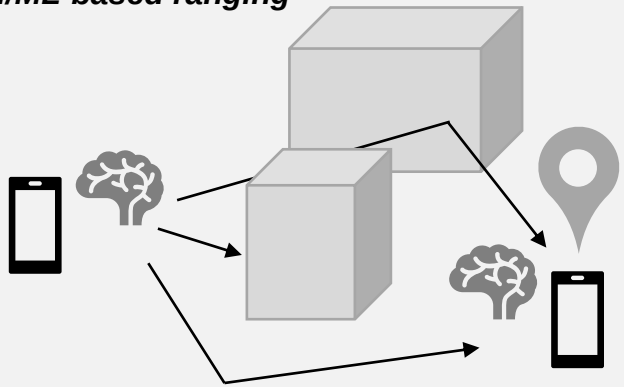
Phase 2 study – RAN1-led new use cases

- AI/ML is potentially applicable to other use cases, e.g.,:
  - Further investigation on CSI compression for higher number of antenna ports.
  - AI/ML-based Sidelink Mode 2 resource allocation, to avoid potential interference.
  - AI/ML-based Shared spectrum access, to select less victim resources in unlicensed spectrum.
  - AI/ML-based Ranging, like AI/ML-based positioning.

AI/ML-based dynamic resource utilization



AI/ML-based ranging



RAN1-led new use cases should be studied

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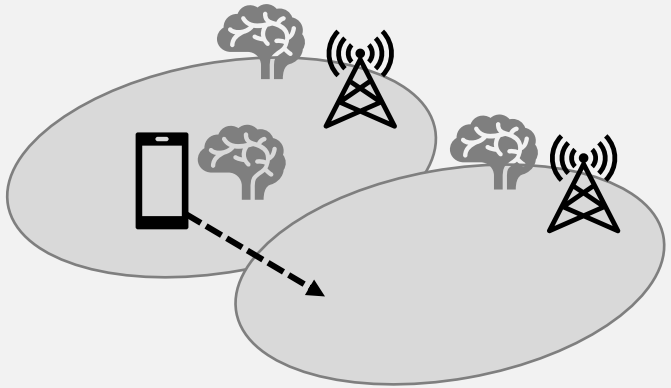
Phase 2 study – RAN2-led new use cases

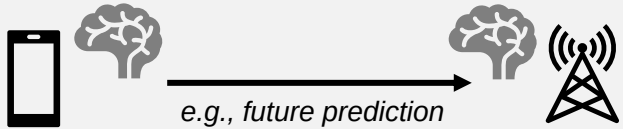
- AI/ML is potentially beneficial for higher layer functions, such as:
  - AI/ML-based robust handover, possibly adopted to traditional HO, CHO and LTM.
  - AI/ML-based adaptive C-DRX operation, for perfect alignment between OnDuration and real traffic.
  - AI/ML-based intelligent UAI (UE assistance information), for proactive gNB-controllability.
  - and so on…

AI/ML-based robust handover



AI/ML-based adaptive C-DRX operation

AI/ML-based intelligent UAI



RAN2-led new use cases should be studied

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Summary

Potential objectives of Rel-19 **normative work** are proposed as follows.

- Down-select and specify general framework for model management [RAN2, RAN1]
  - Life Cycle Management (LCM), model transfer, data collection, etc.
  - Fallback mechanism to legacy operation.
- Specify necessary mechanism to support the following use cases [RAN1, RAN2]
  - [CSI Prediction]
  - BM-Case1
  - Direct/Assisted-positioning
- The specification should take security and privacy concern, if any, into account.

Potential objectives of Rel-19 **Phase 2 study** are proposed as follows.

- Identify and evaluate physical layer use cases, beyond Rel-18 use cases [RAN1]
  - e.g., Sidelink Mode 2, Shared spectrum access, Ranging.
- Identify and evaluate higher layer use cases [RAN2]
  - e.g., mobility/handover, C-DRX, UAI.
- Continue evaluation of Rel-18 use case(s), if needed [RAN1]
- Study potential enhancements to each process in LCM and data collection.

AI/ML for air-interface normative work and Phase 2 study should be approved respectively

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