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Views on Rel-19

5G-Advanced Evolution: Rel-19

3GPP RAN Release 19 Workshop, 15th – 16th June 2023, Taipei

Fraunhofer Views towards Release 19

Enhancements on new topics

- MIMO Evolution
- Integrated Sensing and Communication
- Network Energy Savings
- Improvements for Initial Cell Selection
- Study on Ambient IoT
- Enhancements to NR-NTN
- AI/ML
- Enhancements for Positioning
- Sidelink
- Normative work for (sub band) Full Duplex xx

Views on MIMO Evolution for Rel.-19 NR

Enhancements for 64T64R

- ❑ **Increasing interest of 64Tx massive MIMO deployments by network operators for urban scenarios, first deployments are planned or available.**

- ❑ 64Tx at gNB offers potential gains and increased beamforming flexibility over 32Tx.
- ❑ Current NR reference signals do not support 64Tx at gNB.

- ❑ **Proposal:**
 - ❑ Study enhancements on CSI-RS to support 64 ports at gNB.
 - ❑ Study related enhancements on precoding, CSI reporting and measurements.

Views on Rel.-19 Topics

Enhancements for Integrated Sensing and Communication (ISAC)

- ❑ **3GPP SA has investigated 5G-based sensing services which are beneficial for many use cases.**
- ❑ **Sensing-assisted communication uses existing radio signals for environment sensing and exchange of observations.**
- ❑ **Proposal:**
 - ❑ Study ISAC enhancements for 5G NR systems to enable sensing services, including
 - ❑ Channel modelling analysis and extensions for ISAC
 - ❑ Enhancements on CSI reporting including feedback of raw channel information instead of precoder for sensing
 - ❑ Enhancements on waveform and frame design

Network Energy Saving for Rel-19 - Overview

Motivation

Considerably more improvements are needed as only few features from TR38.864 are covered in Rel-18

- ❑ Spatial domain is widely addressed in Rel.18, but further gains can be achieved on time and power domain
- ❑ Most energy saving techniques promising a higher degree in energy saving were not considered in Rel-18
- ❑ Common signals remain the limitation for NES
- ❑ Impact on user performance needs to be studied and any identified issues should be mitigated

Topics to be considered for Rel-19

- ❑ Time domain: Common signal adaptation (dynamic SSB adaptation, cell wake-up signal)
 - ❑ Improved initial access, e.g., during initial cell selection
- ❑ Further study on more effective techniques power domain adaptation
- ❑ Impact of NES techniques on user performance to be evaluated / reduced
- ❑ Access restrictions of R18 UEs to R19 network as general approach for all releases

Improvements for Initial Cell Selection in Rel-19

Motivation

Initial Cell Selection may become unacceptably slow over time because of:

- ❑ Sparser common signals for NES
- ❑ Ever-increasing number of bandwidths the UEs need to scan (more bands are standardized and more bands are implemented)
- ❑ Spreading of closed (NPNs) or non-backward compatible networks (e.g., NES-barred Rel-18 networks) → UEs spend time synchronizing and reading SIB of networks which can't be used.

Topics to be considered for Rel-19

- ❑ Cell Discovery and Initial Cell Selection without the legacy limitation of 20 ms SSB period
- ❑ Faster Initial Cell Selection
- ❑ Faster determination of barring status

Views on Ambient IoT

Motivation

- ❑ Support of battery-less devices with low data throughput for sensors or asset tracking applications

Scope

- ❑ Ambient IoT Study Item with focus on the following device-topology combinations (based on device categories and topologies from TR 38.848):
 - ❑ Topology 3 with all device categories (A, B, and C)
 - ❑ Topologies 1, 2 and 4 with device C, full-duplex is not viable with consumer price UEs
- ❑ Also study full-duplex cross-band operation as a possible alternative to backscattering (at least for Topologies 2 and 4)

Background Info to Ambient IoT Discussions (TR 38.848)

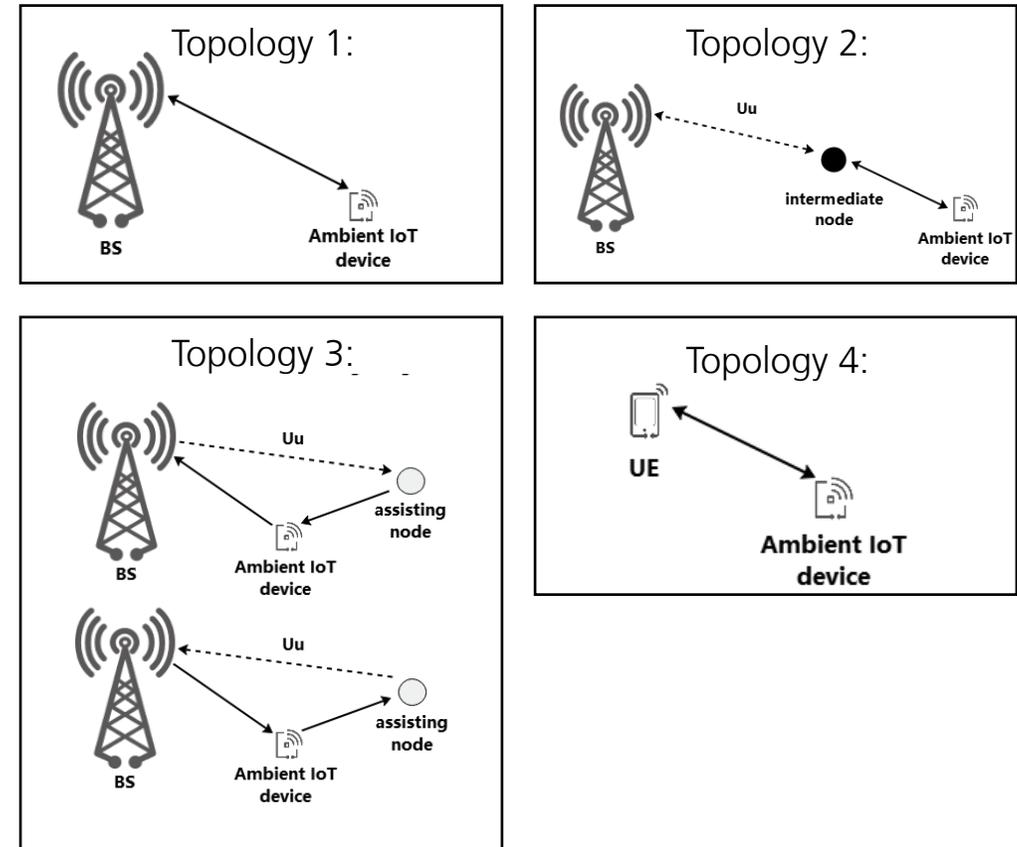
Set of Ambient IoT Devices (from TR 38.848)

Device A: No energy storage, no independent signal generation/amplification, i.e. backscattering transmission.

Device B: Has energy storage, no independent signal generation, i.e. backscattering transmission. Use of stored energy can include amplification for reflected signals.

Device C: Has energy storage, has independent signal generation, i.e., active RF components for transmission.

Connectivity Topologies (from TR 38.848)



NR-NTN Enhancements

Scope for Rel-19

Motivation

- ❑ Service experience improvement
- ❑ New capabilities to support new use cases and/or to optimize network operation
- ❑ Some of the topics are according to automotive requirements in 5GAA (NTN-RaS work item)

Scope:

- ❑ TN/NTN Mobility enhancements (e.g., left-over from Rel-18)
- ❑ Coverage Enhancement (e.g., DL, high power UE)
- ❑ GNSS independent operation
- ❑ Network based UE localization for improved reliability and flexibility
- ❑ Lower channel bandwidths
- ❑ Flexible spectrum access and interoperability (spectrum sharing)
- ❑ Flexible advanced system and satellite architectures (Regenerative payload, gNB(s) on board of a satellite, CU/DU split, Inter-Satellite Links & Satellite routing, interconnectivity between GEO, LEO, HAPS)

General AI/ML Framework

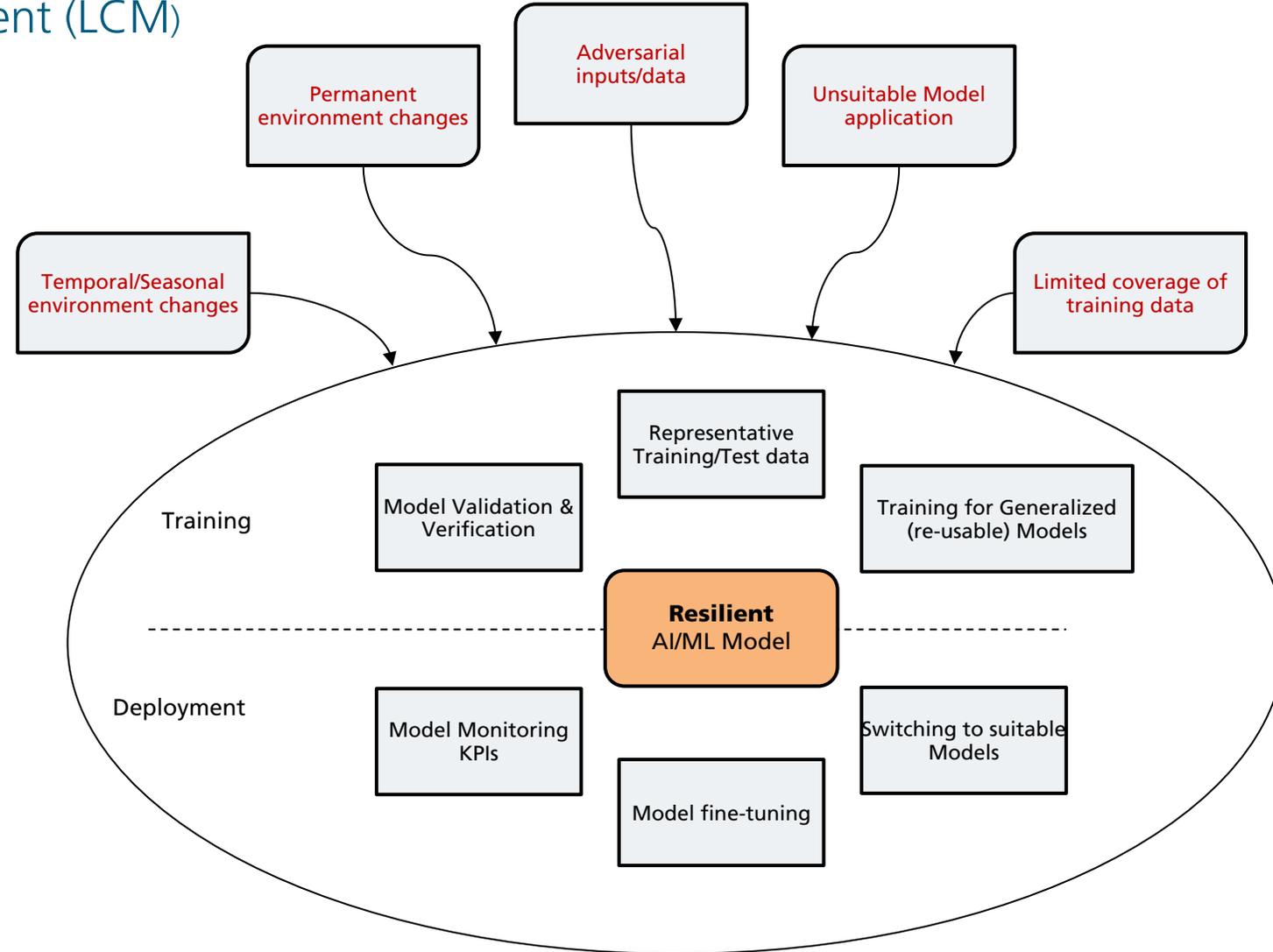
Resilient AI/ML Model Life Cycle Management (LCM)

Justification:

Resilient AI/ML Model Life Cycle Management (LCM) ensures reliable and robust models against in the face of data variability, environmental changes, and adversarial inputs

Objectives:

Ensure the 5G AI/ML framework supports resilient and robust models during training and deployment



AI/ML Use Cases

AI/ML for positioning

Justification:

Enable 5G positioning solutions for NLOS environments

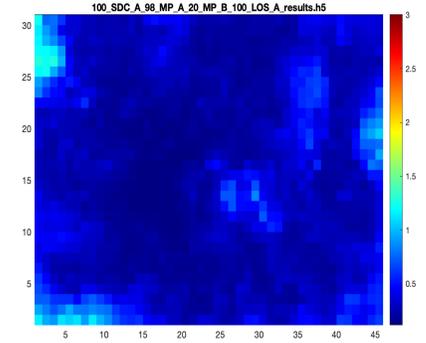
AI/ML can provide robust high accuracy positioning in challenging LOS environment

Objectives:

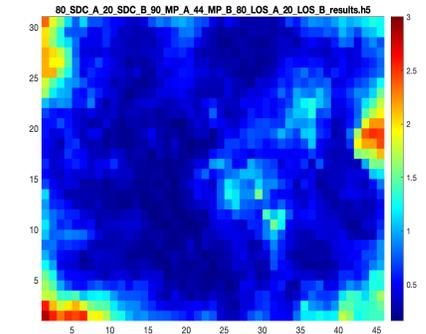
Focus on assisted and direct positioning for single sided AI/ML models

Consider positioning use-case specific requirements within the 5G AI/ML framework for resilient operation

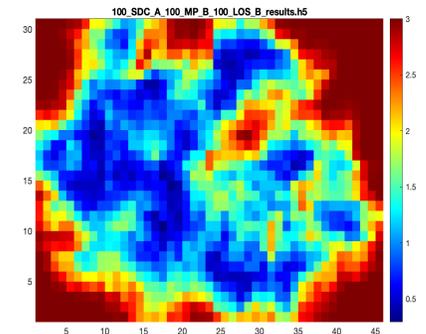
Minor environmental changes



Moderate environmental changes



High environmental changes



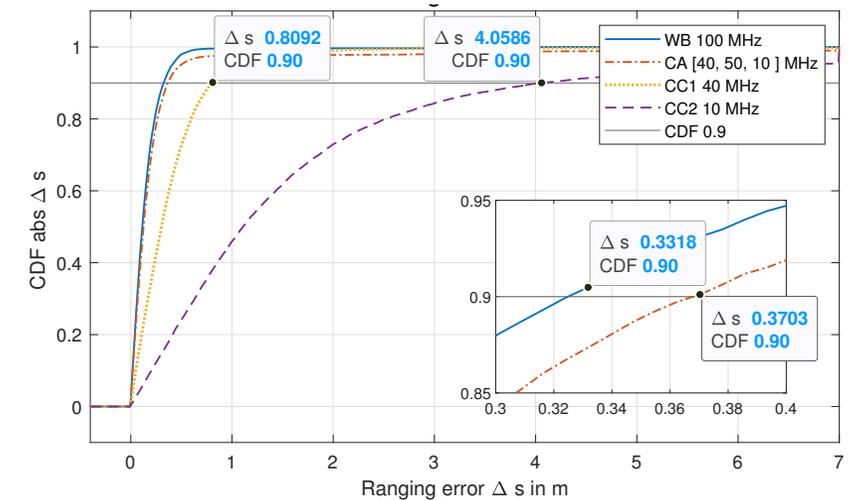
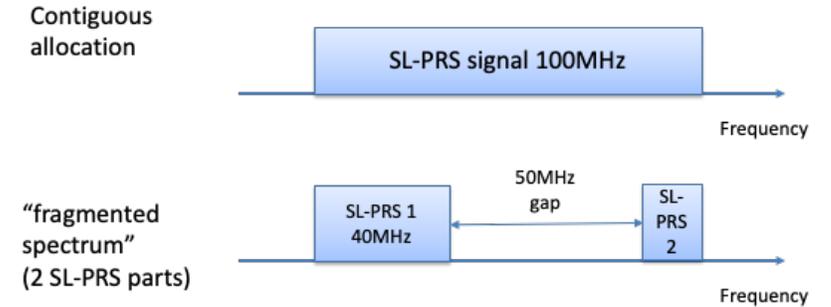
Impact of environment changes to the AI/ML direct positioning performance

Positioning in Rel-19

Consider non-contiguous (fragmented) allocation to enable 100MHz realization for SL-PRS

Support multi-port transmission for positioning reference signals (positioning SRS and DL-PRS) to mitigate non-ideal antenna effects and improve positioning performance.

Support mechanism to enable efficient and low-latency Round Trip Time (RTT) procedure by reducing communication overhead (e.g UE must not report Rx-Tx during an RTT LPHAP operation)



Sidelink and Sidelink Relay Enhancements for Rel-19

Motivation

- ❑ Support high data rate V2X / industrial use case, e.g., data sharing of high-resolution video streams
- ❑ Support wider bandwidth for V2X, e.g., to overcome fragmented 10 / 20 MHz channels on ITS band
Support increased reliability e.g., in case of critical data or poor channel conditions
- ❑ Support enhanced Power Saving
Existing SL power saving may not be sufficient for battery-limited devices, e.g., VRUs, and (non-)industrial nodes
- ❑ Increased coverage, improved throughput and reliability for industrial environment

Features proposed for Rel-19

- Enhancements on SL FR2: specification following Rel-18 SI
- NR SL Carrier Aggregation: fully featured as in LTE V2X, including e.g. packet duplication
- Further enhancements to SL power saving – additionally to R17, e.g., for sporadic traffic consider a SL wake-up signal
- Relaying: Multihop and multipath including QoS aspects and relay selection criteria

Full Duplex – Start of Normative Work

Topics of interest for Fraunhofer

Study on Subband Full Duplex during Release 18 almost finished

- Normative work to be started in release 19

- Focus on SBFD
 - SBFD capability mostly provided by gNB
 - Full transparent for legacy UEs in half duplex
 - Study of advanced sub-band interference measurements and feedback on CLI
 - Inside single component carrier
 - Across multiple component carriers