

5G

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Discussion

# Views on Rel-19

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# + Considerations for Rel-19 package approval

- RAN WG1/WG2 overloaded with multiple Rel-18 features unlikely to complete on time
- Rel-19 first of 2 pre-6G releases
  - Plan for appropriate studies to facilitate 6G standardization
  - AI/ML, Full Duplex, ISAC, new spectrum expected to play significant role in 6G
    - Define Channel modeling for new spectrum (7 to 24 GHz), ISAC and RIS
    - Study additional use cases for AI/ML in RAN1
    - Study additional enhancements for SBFD
- Critical to right-size Rel-19 to ensure completion of Rel-19 and follow-up Rel-20 on time to meet ITU deadlines and 6G first deployment plans with Rel-21
  - Avoid maintenance-only quarter for RAN1 Rel-19 completion

# + Overview of RAN1 R19: Enhancement of R18 topics and New Features

## Further Enhancement of R18 Topics

- Multi-Carrier enhancement
- MIMO
- Network Energy Saving
- Coverage enhancement
- Sidelink evolution
- Positioning enhancement

## R18 SI → R19 WI

- AI/ML for air interface
- Duplex

## R19 New Features

- TSC enhancement for Sidelink
- AI/ML for air interface – new use case
- Duplex enhancement – MPUE
- Ambient IoT
- ISAC – channel modelling
- RIS

# + Overview of RAN2 R19: Enhancement of R18 topics and New Features

## Further Enhancement of R18 Topics

- NR/IoT NTN enhancement
- Mobility enhancement
- Sidelink Relay
- XR
- MBS
- MUSIM
- UAV

# + Overview of RAN3 R19: Enhancement of R18 topics and New Features

## Further Enhancement of R18 Topics

- Enhancements on AI for NG-RAN
- SON related enhancements
- QoE related enhancement

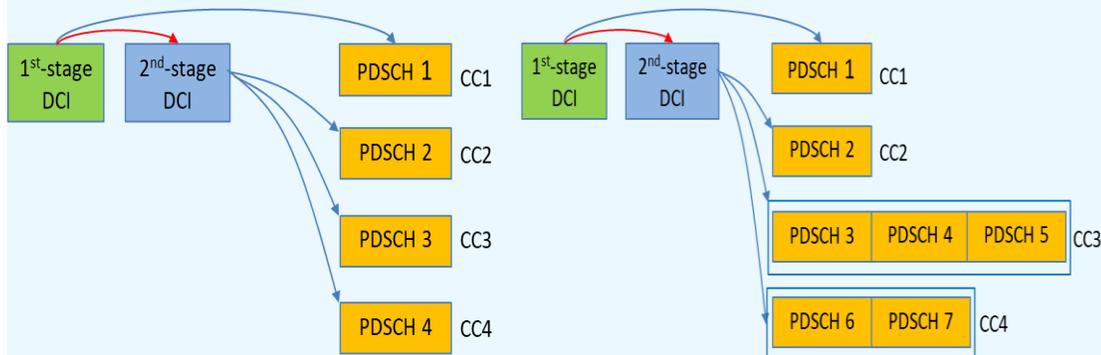
## R19 New Features

- Distributed AI
- Mobile-IAB/VMR enhancements

# + R19 RAN1: Multi-Carrier Enhancements, WI

## Motivation

- Many important use cases are down-scoped for multi-cell scheduling in R18 due to limited TU
- Two codewords can't be supported in case of more than 2 cells scheduled by one DCI in R18
- Two-stage SCI has been specified since R16 V2X and further enhanced in R17/R18
- With two-stage DCI for multi-cell scheduling, more use cases can be supported.



## Objectives

- Study and specify two-stage DCI in R19 for providing larger payload size to support below cases:
  - Max 4 cells co-scheduled by one DCI and up to max 2 CWs per cell
  - Max 8 cells co-scheduled by one DCI with 1 CW per cell
  - Max 4 cells co-scheduled by one DCI with up to 8 PDSCHs or PUSCHs per cell
  - Optimize single-stage DCI size alignment procedure
- Support of different SCS among co-scheduled cells
- Support of different carrier types (licensed/unlicensed, FR1/FR2/FR2-2) among co-scheduled cells
- Support more than one scheduling cell for each scheduled cell
- HARQ-ACK codebook enhancement to support multi-PDSCH scheduling and multi-cell scheduling
- HARQ-ACK codebook enhancement to support CBG-based transmission and multi-cell scheduling
- Enhancement of unlicensed spectrum

# + R19 RAN1: MIMO, WI

## Motivation

- Analyze trade-off between CSI reporting overhead, performance and latency
  - On-demand CSI/beam reporting based on variations in channel conditions
  - Faster CSI reporting mechanism for more robust link adaptation against channel variations
- Address synchronization issues in practical multi-TRP deployment scenarios
  - Achieve improved performance under multi-TRP deployments
  - Enable CJT operation under realistic assumptions of Delay/Doppler offset values
- Further enhance UL coverage and capacity by UE collaboration
  - Collaboration between UEs enabled by PC5 interface

## Objectives

### UE-triggered BM, CSI reporting:

- Event-triggered beam, CSI reporting based on channel conditions
- UE initiated beam reporting based on changes in corresponding beam RSRP/SINR values
- Partial CSI reporting, e.g., dynamic reporting of CQI value(s) based on prior PMI, RI value(s)

### Enhanced calibration for multi-TRP deployments:

- Improved Delay/Doppler domain synchronization for inter-site multi-TRP deployment scenarios
- UE-assisted calibration based on Delay/Doppler synchronization information feedback reporting
- UL RS-based pre-compensation of Delay/Doppler offset values via exploiting UL/DL channel reciprocity

### Collaborative UL transmission:

- Enhance coverage and battery life for cell edge UE
- Improve UL capacity with high rank in MU-MIMO

# + R19 RAN1: Network Energy Savings, WI

Motivation	Objectives
<ul style="list-style-type: none"><li>• Optimizing tradeoff between network performance and energy savings<ul style="list-style-type: none"><li>– Reduce performance loss due to lack of corresponding channel measurements due to RS muting during cell DTX and/or DRX inactive periods</li><li>– Enable simple fallback from multi-TRP DL transmission to single-TRP transmission with minimal impact on configuration, performance</li><li>– Enable dynamic common channel/signal transmission/reception to achieve BS light/deep sleep</li></ul></li></ul>	<ul style="list-style-type: none"><li>DL/UL RS enhancements<ul style="list-style-type: none"><li>– RS configuration enhancements to reduce performance loss due to DL/UL RS muting during cell DTX and/or DRX inactive periods</li></ul></li><li>DL Multi-TRP based enhancements<ul style="list-style-type: none"><li>– Dynamic activation/deactivation between multi-TRP and single-TRP transmission for energy saving purposes</li><li>– Study corresponding impact on e.g., TCI configuration, BFD/BFR, CSI framework and EPRE variations</li></ul></li><li>UE wake up signal (WUS) for gNB<ul style="list-style-type: none"><li>– Specify uplink wake-up signal to request transitioning among between reduced transmission/reception activity and active transmission or reception</li></ul></li><li>Adapting transmission/reception of common channels/signals<ul style="list-style-type: none"><li>– Specify adapting transmission pattern (when applicable) of downlink common and broadcast signals</li></ul></li></ul>

# + R19 RAN1: Coverage Enhancements, WI

Motivation	Objectives
<p>Potential technical benefits of below PRACH coverage enhancements areas were identified in Rel.18 but may not be specified,</p> <ul style="list-style-type: none"><li>– Latency reduction for multiple PRACH transmission with same transmission beam.</li><li>– Multiple PRACH repetition with different transmission beams.</li></ul> <p>Rel18 SI→ Rel19 WI conversion for power domain enhancement for coverage enhancement.</p> <p>Per-TRP dynamic waveform switching is beneficial to enhance per-TRP coverage, but it was not discussed in Rel.18.</p>	<p>Study and specify following for PRACH coverage enhancements</p> <ul style="list-style-type: none"><li>– Latency reduction techniques including SSB to RO (group) association, dense starting RO for PRACH repetition, etc.</li><li>– Multiple PRACH repetition with different beams, including identification of UEs using different beams, determination of transmission beams for UL messages e.g., Msg3.</li></ul> <p>Specify power domain enhancements</p> <ul style="list-style-type: none"><li>– FDSS-SE, TR, enhancements to the PHR report, if supported.</li></ul> <p>Study and specify following for DWS for coverage enhancements</p> <ul style="list-style-type: none"><li>– DWS for multi-TRP, including single DCI based multi-TRP and m-DCI based multi-TRP, etc.</li></ul>

# + R19 RAN1: Sidelink Evolution, WI

Motivation	Objectives
<ul style="list-style-type: none"><li>• FR2 Sidelink over licensed spectrum is studied in R18 with focus only on beam management procedure and can be converted to WI in R19.</li><li>• Sidelink CA in R18 is supported with quite limited scope and fully reuse legacy LTE approach. More enhancements in R19 are needed with consideration of different SCS and different carrier types.</li><li>• New use cases to support e.g., wearable devices, are considered in R19 with narrow bandwidth and stringent power saving</li></ul>	<ul style="list-style-type: none"><li>• Specify FR2 licensed spectrum for high data rate transmission<ul style="list-style-type: none"><li>– Specify initial beam pairing procedure, beam maintenance procedure, beam failure detection/recovery procedure, and necessary reference signals/channels for sidelink unicast transmission between UE1 and UE2</li></ul></li><li>• Sidelink CA enhancements<ul style="list-style-type: none"><li>– Support of same or different carrier types (licensed/unlicensed, FR1/FR2) among aggregated cells</li><li>– Support of cross-carrier scheduling in Mode 1</li><li>– Special handling of limited TX capability</li></ul></li><li>• Sidelink communication for RedCap devices<ul style="list-style-type: none"><li>– SL UE complexity reduction</li><li>– SL UE power saving via DRX enhancements, SCI monitoring reduction</li></ul></li></ul>

# + R19 RAN1: Positioning Enhancements, WI

Motivation	Objectives
<ul style="list-style-type: none"><li>• Target following KPIs for SL Positioning Enhancements:<ul style="list-style-type: none"><li>– Enhanced Accuracy</li><li>– Power Efficiency</li><li>– Reliability</li></ul></li><li>• Leverage the unlicensed spectrum as a key enabler for Positioning<ul style="list-style-type: none"><li>– Expand Positioning framework for Unlicensed Bands (NR-U, SL-U)</li><li>– Enabler for V2X positioning due to bandwidth limitation of ITS band</li><li>– Enabler for positioning using Frame based equipment for IIoT</li></ul></li><li>• Expansion of the NR-RAT independent framework for using UWB positioning measurement</li></ul>	<ul style="list-style-type: none"><li>• SL Positioning Enhancements:<ul style="list-style-type: none"><li>– SL-PRS carrier bandwidth aggregation (e.g., ITS band)</li><li>– SL-U positioning</li><li>– Support RAT-dependent integrity for SL positioning</li><li>– Support leveraging SL DRX framework for SL positioning</li><li>– Support SL RAT-independent positioning</li></ul></li><li>• NR-U Positioning<ul style="list-style-type: none"><li>– Study procedures to perform positioning over unlicensed bands using NR-U channel access mechanism - Frame based equipment, Load based equipment</li></ul></li><li>• Extend RAT-Independent NR Positioning Framework<ul style="list-style-type: none"><li>– Support of extending the 3GPP NR positioning RAT-independent framework by including UWB measurement</li></ul></li></ul>

# + R19 RAN1: AI/ML for Air Interface, WI

Motivation	Objectives
<ul style="list-style-type: none"><li>• Specify the relevant procedures to support AI/ML functionality/models</li><li>• Specify the AI/ML-related operations on the selected sub use cases with representative model deployment and observed enough gains from Rel-18 study.</li></ul>	<ul style="list-style-type: none"><li>• Specify signaling and procedures to support AI/ML functionality-based/model-ID-based LCM<ul style="list-style-type: none"><li>– LCM operations, e.g., functionality/model identification, switching, activation/deactivation, selection, etc.</li></ul></li><li>• Specify the below representative sub use cases:<ul style="list-style-type: none"><li>– Spatial-Frequency domain CSI compression with two-sided model</li><li>– Spatial domain beam prediction with single-sided model</li><li>– Both Cases 2 and Case 3, including direct AI/ML and AI/ML-assisted Positioning</li></ul></li><li>• Specify the support on relevant AI/ML operations, at least including<ul style="list-style-type: none"><li>– Efficient methods for data collection, e.g., training and monitoring data</li><li>– Performance monitoring procedure, e.g., configuration, trigger and report and potential fallback.</li><li>– Model inference, e.g., configuration of model input for different conditions</li></ul></li></ul>

# + R19 RAN1: Duplexing Enhancements, WI

Motivation	Objectives
<ul style="list-style-type: none"><li>• Rel18 SI → Rel19 WI conversion<ul style="list-style-type: none"><li>– gNB-side Subband non-overlapping full duplex with 'SBFD-aware' half-duplex UE</li><li>– Dynamic/flexible TDD enhancements –inter-gNB, inter-UE CLI handling to provide additional flexibility for DL/UL resource allocation</li></ul></li><li>• New Study item:<ul style="list-style-type: none"><li>– gNB side overlapped DL&amp;UL transmission</li><li>– Multi-panel full duplex UE</li></ul></li></ul>	<ul style="list-style-type: none"><li>• SBFD: Specify the following:<ul style="list-style-type: none"><li>– gNB side non-overlapping SBFD with semi-static and dynamic sub-bands</li><li>– UE-UE CLI, gNB-gNB intra/inter-subband CLI</li><li>– L1/L2/RRC, backhaul information exchange</li></ul></li><li>• Dynamic/flexible TDD: Specify the following:<ul style="list-style-type: none"><li>– Enhancements for spatial CLI measurement and handling</li><li>– Intra-cell and inter-cell UE-UE CLI, gNB-gNB CLI</li><li>– Coordinated beamforming and scheduling</li><li>– L1/L2/RRC, backhaul information exchange</li></ul></li><li>• Study feasibility and potential solutions for<ul style="list-style-type: none"><li>– gNB overlapped SBFD</li><li>– Multi-Panel full duplex UE</li></ul></li></ul>

# + R19 RAN1: TSC enhancement for sidelink, SI

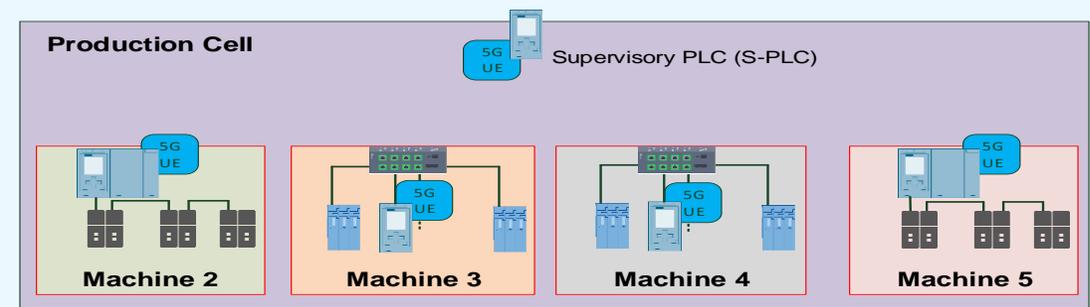
## Motivation

- Challenging requirements on high reliability and low latency in factory scenarios (e.g., motion control, wireless link replacement, control-to-control comm., mobile robots, cooperative carrying)
  - Existing Rel-16/17/18 sidelink not adequate
- 5G-ACIA interested in TSC enhancement for sidelink
  - 5G-ACIA working on wp on sidelink for URLLC/IIOT – Tentative: Sept 2023 & LS sent to TSG RAN/SA
- Use case includes IIoT & advanced driving



## Objectives

- Feasibility study for supporting direct sidelink timing communication such as to support of Time Sensitive Communication Assistance Information (TSCAI) and survival time enhancements for functional safety
- Evaluate accurate time distribution over PC5 for working clock synchronization, including accurate reference timing delivery and time synchronization with propagation delay compensation
- Feasibility study on improvements to physical layer reliability and latency of Sidelink control/data channel communications for various IIoT use cases, taking into account R16/17 URLLC/IIoT as baseline targeting



# + R19 RAN1: AI/ML for Air Interface, SI

Motivation	Objectives
<ul style="list-style-type: none"><li>• Remaining issues from Rel-18 SI<ul style="list-style-type: none"><li>– E.g., model transfer, online training and two-side training.</li></ul></li><li>• More potential use cases can be further studied to explore more potential benefits from AI/ML<ul style="list-style-type: none"><li>– CSI feedback compression with multi-TRP</li><li>– Mobility enhancement</li><li>– Interference management.</li></ul></li></ul>	<ul style="list-style-type: none"><li>• Study the specification impacts to support more potential AI/ML functions<ul style="list-style-type: none"><li>– Enhancement to support model transfer, online training, two-side training and tuning</li><li>– Collaborative/distributed model training and inference</li></ul></li><li>• Further study the performance and specification impact of new use cases in Rel-19<ul style="list-style-type: none"><li>– CSI feedback compression for multi-TRP scenario</li><li>– Mobility enhancement, e.g., assist parameter adjustment, reduce RLF/HO failure, target cell prediction</li><li>– Interference management, e.g., interference prediction and interference avoidance through intelligent resource allocation</li></ul></li></ul>

# + R19 RAN1: Ambient IoT, SI

## Motivation

- Ambient IoT SA1 use cases described in SA1 TR 22.840
  - Indoor: Inventory, positioning
  - Outdoor: smart grid, agriculture
  - Indoor/outdoor: Medical instrument
- Device type discussion in RAN:
  - Device A: No energy storage, no independent signal generation, i.e. backscattering transmission.
  - Device B: Has energy storage, no independent signal generation, i.e. backscattering transmission.
  - Device C: Has energy storage, has independent signal generation, i.e. active RF component for transmission
- Device complexity:
  - Device A: comparable to UHF RFID
  - Device B: Device A < Device B < Device C
  - Device C: order of magnitude lower than NB-IoT

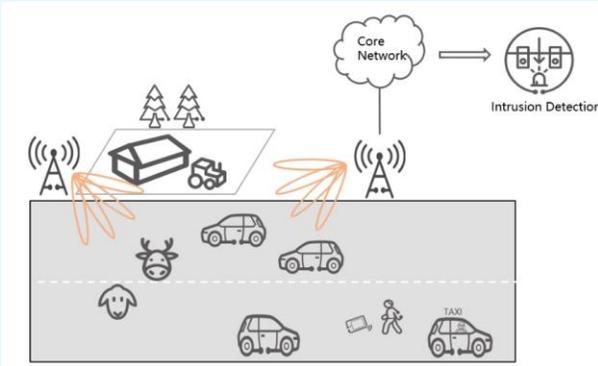
## Objectives

- One of the use case should be prioritized, depending on the interest from the vertical industry and the operator. No need to include all use cases within the study
- Study in R19 one category of Ambient IoT Device type according to the selected use case:
  - Device A, Device B (OR) Device C as the receiver architecture and air interface design of each device category could be different
- Priortizing Topology:
  - BS <-> Ambient IoT (Indoor factory)
  - BS <-> Intermediate node <-> Ambient IoT (outdoor)

# + R19 RAN1: ISAC Channel modelling, SI

## Motivation

- Integrated Sensing and Communication (ISAC) use cases described in SA1 TR 22.837
  - Indoor: Intruder detection, factory hall
  - Outdoor: V2X, environment, tracking of a moving target



- Relevant sensing modes:
  - Network based, UE-assisted and UE-based sensing
  - Monostatic and bistatic sensing
- Observation:
  - Specified channel model in TR 38.901 does not support modeling of a sensing target and does not support different relevant sensing modes

## Objectives

- Identify the UCs and associated modes of operation for channel modelling requirements
- Enhance TR 38.901 with the channel model needs of the selected UCs, which shall at least address
  - Validity of the model for both FR1 (including new upper mid band spectrum) and FR2 bands
  - Validity of the model for both mono-static and bi-static sensing modes
  - Validity of the model for network-based, UE assisted and UE-based sensing modes
  - Consistency with characteristics of a sensing target

# + R19 RAN1: RIS, SI

## Motivation

- Study the feasibility of RIS deployment in RAN to efficiently improve communication performance
  - E.g., coverage enhancement, energy saving.



## Objectives

- Discussion on use cases and RIS operation modes
  - E.g., gNB-controlled or UE-controlled to improve coverage
- Propagation channel modeling with RIS involved
  - Extend the channel model in TR 38.901 to support the reflection/refraction and near/far field
- Potential air interface enhancement with RIS-assisted communication
  - E.g., initial access, beam management
- KPI and evaluation methodology
  - E.g., cell throughput, coverage and energy efficiency
- Side control information
  - E.g., content and transmission scheme

# + R19 RAN2: NR/IoT NTN Enhancement, WI

## Motivation

- R18 NR NTN enhancements have been focused on limited scopes and cases:
  - Coverage enhancements are for UL, not DL.
  - Network verified UE location only considers multi-RTT with single satellite.
  - No mobility enhancement to guarantee NTN-TN service continuity.
- R18 IoT NTN enhancements have limited progress:
  - HARQ enhancements reusing most of Rel-17 NR NTN.
  - How to handle the GNSS gap configuration and the data interruption during gap.
  - Mobility enhancements considering UE power consumption.
- Support of new SA1 requirements studied for Rel-19
  - Store & forward satellite operation for delay-tolerant service.
  - GNSS independent operation
  - Positioning requirements and enhancements
  - UE-Satellite-UE communication without ground network

## Objectives

### For NR NTN

- Study the potential issues for DL coverage enhancements.
- Study on enhanced beam management methods, e.g., polarization-based techniques and macro-diversity
- Study on network verified UE location including multiple satellite or multi-connectivity scenarios.
- Study mobility enhancements for service continuity, including support of DAPS, DC or multi-connectivity between NTN and TN/NTN.
- Study on GNSS independent operation and possible impact on time and synchronization methods.

### For IoT NTN

- Study issues and signalling enhancements to support GNSS operation in CONNECTED state.
- Study on mobility enhancements based on Rel-18 NR NTN solutions.
- Study on enhancements for discontinuous coverage focusing on UE power saving, e.g., reduction of measurements and support of PUR.
- Study on GNSS independent operation and possible impact on time and synchronization methods.

# + R19 RAN2: Mobility enhancement, WI

## Motivation

### Interruption/latency time reduction

- R18 LTM focuses on Intra-gNB case. Namely, two cases of Intra-DU or Inter-DU & Intra-CU case are included. Both MCG switching and SCG switching are supported in Rel-18 LTM. It is natural that LTM feature can be extended to Inter-CU case.
- Only SSB based L1 measurement is supported for LTM and early CSI acquisition as well as TRS tracking are not supported for early data transmission with refined beam in new target cell in LTM.

### Reliability Improvement

- In legacy, CHO is introduced to address the issue that UE misses the reception of L3 handover command due to mobility and channel change. Therefore, condition based LTM can be supported to ensure the robustness of LTM switching.

### Others:

- Leftover issues e.g NW-triggered selective activation of MCG.

## Objectives

- Specify mechanism/procedures of Inter-CU LTM for MCG and SCG.
  - Xn interface for candidate cell configuration
  - Early TA (Re)acquisition with Xn involvement
  - Security enhancement in subsequent LTM
- Specify CSI-RS based L1 measurement for LTM:
  - CSI-RS based candidate cell measurement.
  - Event-based L1 beam report for LTM.
  - Early CSI acquisition and TRS tracking.
- Specify mechanism/procedures of condition-based LTM:
  - At least Intra-gNB case can be supported for condition-based LTM.
  - Both MCG switching and SCG switching can be supported.
  - L1 condition can be specified.

# + R19 RAN2: Sidelink Relay enhancement WI

## Motivation

### Multi-path Enhancement

- More indirect paths can be configured in multi-path case. Specifically, A In-coverage UE is connected to the same gNB using one direct path and multiple indirect paths. A Out-of-coverage UE is connected to the same gNB using multiple indirect paths

### Mobility for single-hop L2 U2N relay

- Inter-gNB mobility configured with multi-path configured by target side should be supported if it is not supported in Rel-18.
- Condition based mobility for remote UE can be supported e.g condition based i2d/d2i/i2i path switching.
- Condition based mobility for relay UE e.g CHO based relay handover can be supported.
- Rel-16 DAPS mechanism can be extended to cover above inter-gNB path switching.
- Group based mobility.

## Objectives

- Specify mechanism/procedures of Multi-path.
  - Multiple indirect path e.g two indirect paths can be supported.
    - Case 1: One direct path and more than one indirect path.
    - Case 2: More than one indirect path.
- Specify mechanism/procedures of mobility enhancement:
  - Multi-path configuration can be configured by target gNB for Inter-gNB mobility.
  - Condition based mobility for remote UE can be specified for e.g i2d/d2i/i2i path switching.
  - Condition based mobility for relay UE e.g CHO based relay handover can be specified.
  - DAPS-like mechanism can be extended to cover inter-gNB path switching e.g i2d/d2i/i2i path switching.
  - Group based mobility can be specified.
    - One relay UE and the corresponding serving remote UE(s) can be switched via a single procedure.

# + R19 RAN2: XR Enhancements, WI

Motivation	Objectives
<ul style="list-style-type: none"><li>• Challenging timing requirements for coordinated Tx of multi-modal flows, e.g. delivering related tactile and multi-modal data for application to user at similar time<ul style="list-style-type: none"><li>– Coordinated Tx of multi-modality flows for single UE</li><li>– To balance power saving gains and Tx performance, enhancement of DRX operation for multi-modal flows</li></ul></li><li>• Applying AL-FEC for XRM services allows successful decoding of corresponding unit of information at receiver</li><li>• Increasing Tx resource efficiency by considering dependencies between different PDU sets e.g. loss of an IRAP(Intra Random Access Point) frame makes transmission of dependent frames unnecessary</li></ul>	<ul style="list-style-type: none"><li>• Specify procedures to efficiently support multi-modal applications in RAN:<ul style="list-style-type: none"><li>– Provide information on multi-modal traffic to assist RAN scheduling<ul style="list-style-type: none"><li>- Information which allows network to associate group of traffic flows/DRB(s) that constitute multi-modal service together and delay requirements for a group of associated flows/DRB(s), e.g. maximum tolerable delay differences</li></ul></li><li>– Specify L2 mechanisms leveraging provided information for resource efficient support of multi-modal traffic<ul style="list-style-type: none"><li>- UE assistance information for efficient scheduling of UL multi-modal traffic and enhanced discard operation considering dependencies within group of associated bearers</li><li>- Efficient DRX operation for support of multi-modal traffic</li></ul></li></ul></li><li>• Specify mechanism to provide AL information to AS for improved resource utilization<ul style="list-style-type: none"><li>– improve discard operation by considering AL-FEC information without negatively impacting the receiver operations</li></ul></li><li>• Support discarding based on inter-PDU set dependencies in RAN</li></ul>

# + R19 RAN2: MBS enhancement, WI

## Motivation

- MC-PTM across gNB-DUs within one CU:
  - R17 MBS only supports SC-PTM or MC-PTM within one gNB-DU by implementation.
  - A multicast session may be served by a small area but multiple cells across gNB-DUs, e.g., for mission communication in a certain area.
  - Using MC-PTM across gNB-DUs within one CU increase spectrum efficiency and reliability with less std. impact
  - ECP for MC-PTM across gNB-DUs is not necessary.
  - Specify necessary signalling and content sync over F1
- Mobility enhancement for multicast
- Extend MBS deployment in NR-DC SCG
- Power Saving
  - R16/17 UE power saving schemes can be applied
- Reliability enhancements for PTM transmission in RRC\_CONNECTED

## Objectives

- Specify necessary signalling and content sync over F1 to support MC-PTM across gNB-DU within a gNB-CU.
- Support CHO and CAPS for multicast session/MRB to further enhance mobility robustness and reduce the service interruption during mobility.
- Support MBS in NR-DC SCG to extend MBS deployment.
- Support power saving enhancement for MBS reception, e.g., PEI extension for multicast group paging for multicast UEs in IDLE/INACTIVE, WUS approach extension for multicast DRX and etc.
- Specify reliability enhancements e.g., L2 reliability enhancements (e.g., ARQ for PTM)

# + R19 RAN3: Enhanced AI for RAN, WI

Motivation	Objectives
<ul style="list-style-type: none"><li>• R18 AI for NGRAN is progressing slowly<ul style="list-style-type: none"><li>– focused on three use cases, i.e., load balancing, network energy saving, and mobility optimization</li></ul></li><li>• Enhancements can be specified in R19 for AI for RAN to address R18 leftover/deprioritized issues due to limited time.</li></ul>	<ul style="list-style-type: none"><li>• Specify mechanisms/procedures to support AI based dual connectivity operation, e.g., (conditional) SN addition/change and prediction information sharing between MN and SN.</li><li>• Specify mechanisms/procedures to support source gNB to collect measured UE trajectory across multiple gNBs in the future.</li><li>• Specify mechanisms/procedures to support AI/ML for slicing and AI/ML for QoE taking the outcome of R18 WI as baseline [Could also be included in the Distributed AI SI if companies want to study first]</li></ul>

# + R19 RAN3: SON/MDT, WI

## Motivation

- In Rel18, SON/MDT enhancements are specified for:
  - inter-RAT SHR, SPR
  - inter-system handover for voice fallback, CPAC, fast MCG recovery
  - RA report
  - NPN
  - NR-U
  - signaling based logged MDT override protection
- In Rel19, we need to further enhance SON/MDT framework to improve network performance or deployment
- In R19, SON/MDT enhancements should mainly focus on new features introduced in Rel17 and Rel18

## Objectives

- Support SON/MDT enhancements for following features [RAN3, RAN2]:
  - enhanced mobility, e.g. LTM, selective activation of SCG, CHO with candidate SCGs
  - NTN
  - SDT
  - Multi-SIM
- (maybe) Continue Rel18 leftovers:
  - MRO for NR-U in MR-DC scenarios (currently R18 mainly focuses on NR-U in single connectivity)
  - MRO for (NG)EN-DC CPAC (currently R18 mainly focuses on CPAC in NR-DC)

## + R19 RAN3: QoE Enhancement, WI

Motivation	Objectives
<ul style="list-style-type: none"><li>• Extend QoE to sidelink e.g., to improve user experience and optimize radio resource allocation for sidelink communication</li><li>• R18 leftovers</li></ul>	<ul style="list-style-type: none"><li>• Support (RVQoE) QoE measurement configuration and report for Sidelink.</li><li>• R18 leftovers:<ul style="list-style-type: none"><li>• Support QoE measurement in RRC_INACTIVE state for multicast MBS.</li><li>• Support QoE and MDT alignment in case of RRC_IDLE/INACTIVE and NR-DC.</li></ul></li></ul>

# + R19 RAN3: Distributed AI, SI

## Motivation

- R18 AI for NGRAN
  - focused on three use cases, i.e., load balancing, network energy saving, and mobility optimization
  - not support multi-vendor operability w.r.t. model training/transfer deployment.
  - not support AI/ML capability at gNB DU
  - not support collaboration with CN
- A R19 SI AI for RAN can be helpful to address:
  - Multi-vendor operability w.r.t. model training/transfer/deployment, especially using distributed learning method
  - AI/ML capability at gNB DU
  - Collaboration with CN

## Objectives

- Study network functionality and interface procedures in NGRAN split architecture to support
  - AI/ML training/inference at DU
  - CU and DU collaboration for AI/ML training/inference
    - AI/ML training at CU and inference at DU
    - Distributed/Federated training among CU and DU
- Study network functionality and interface procedures between different NGRAN nodes to support
  - Distributed/Federated training among NGRAN nodes
- Study integration and collaboration with 5GC to reach global optimization,
  - Input/feedback from 5GC for model training/inference.
  - Distributed/Federated training among NWDAF and NGRAN.
- Study new use cases for NG-RAN (e.g., AI/ML for slicing, AI/ML for QoE, and other potential use cases) taking the outcome of R18 WI as baseline  
[Could be Included in a separate AI for RAN WI]

# + R19 RAN3: Mobile-IAB/VMR Enhancement, SI

## Motivation

- Deploying mobile edge computing at mIAB/VMR node can speed up data processing, reduce latency and improve the experience of served UEs

## Objectives

- Study architecture and signaling to support deploying mobile edge computing in mIAB/VMR

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