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

RWS-230169

ETRI's View on 3GPP NR Rel-19

Electronics and Telecommunications Research Institute

ETRI

Release 19: Consolidated Release of 5G-Adv.

Main Features

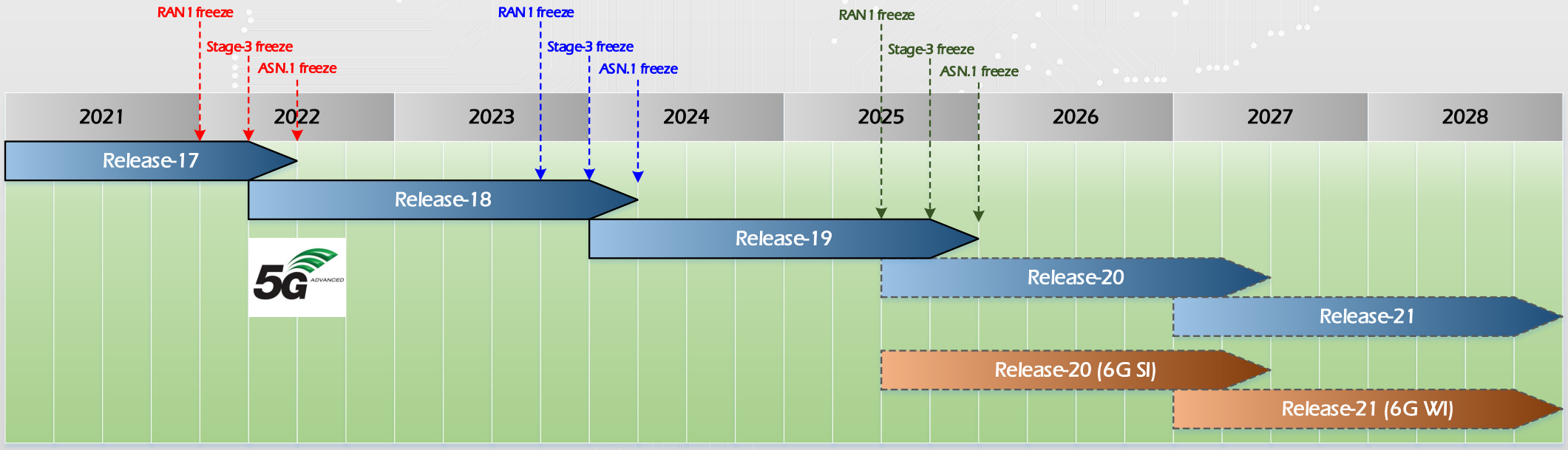
Stepping stone to the next generation, namely 6G

- Introduction of new features & long term potential demands
- E.g., AI, duplex, sensing, RIS, passive IoT, etc.

Accelerate the integration of various industries with 3GPP technologies

- Enhancements of existing features & short term market needs

(Exp.) Timeline



Enabling Technologies for 5G-Adv. and Beyond

Usage element	Emerging technologies
Ultra broadband (uBB)	• THz communication, mmWave evolution • Upper-mid band utilization • Ultra massive MIMO, full duplex, spectrum sharing • Waveform, coding/modulation, CA/DC+
Ultra high reliability & low latency (uHRLL)	• Multi-point, beam management, multi-connectivity, multi-coding • Edge computing/cloud, E2E TSC
Ultra precision positioning (uPP)	• Carrier phase, multi-carrier, UDN • Integrated sensing and communication
Ultra 3D coverage (u3DC)	• Smart surface, smart repeater, UDN • 3D spatial mobile comm., 3D spatial satellite comm. (NTN)
Ultra low energy (uLE)	• Zero-energy IoT - backscatter comm., energy harvesting • Green network - intelligent node/device on-off
Ultra massive connectivity (uMC)	• Ultra massive MIMO, cell-free massive MIMO, NOMA • Network slicing
Ubiquitous intelligence	• Intelligent radio access • Intelligent mobile core networks

AI/ML for Air Interface

SI&WI: AI/ML for Air Interface

Application of AI/ML to wireless communications has been limited to implementation-based approaches

Ongoing study on AI/ML for air interface in Rel-18

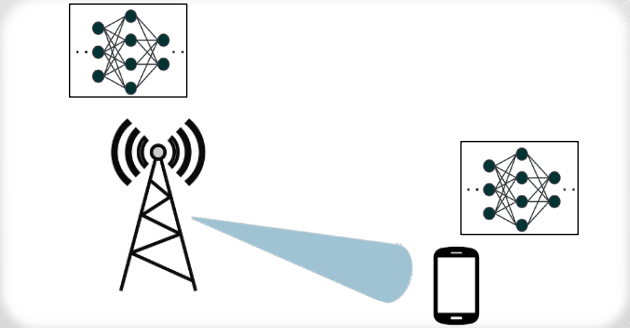
- General frameworks for AI/ML for air interface (Terminologies, collaboration level, and life cycle management)
- Feasibility study for CSI feedback, beam management, and positioning use cases

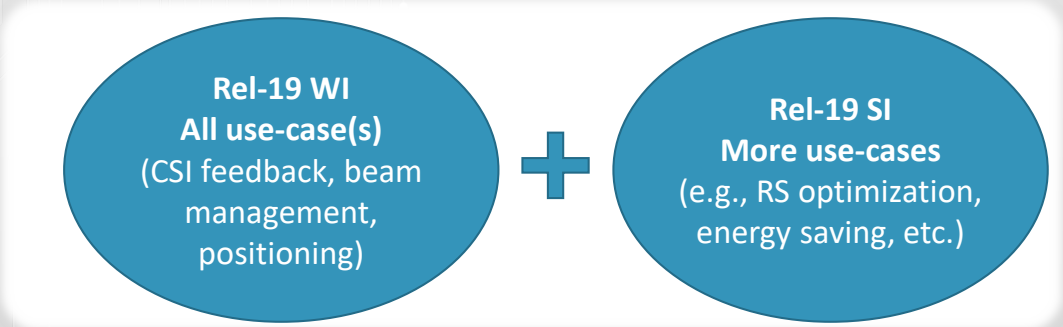
Need to standardize support of all studied use cases in Rel-19 WI

- Specify general frameworks for AI/ML for air interface
- Specify spatial-frequency domain CSI compression using two-sided AI/ML model and time-domain CSI prediction using one-sided AI/ML model
- Specify spatial/temporal-domain beam prediction using one-sided AI/ML model
- Specify direct AI/ML and AI/ML-assisted positioning using one-sided AI/ML model

Need to study continuously leftovers (if any) and new use cases in Rel-19 SI

- Feasibility study of new use cases (e.g., RS optimization, energy saving)





Duplex Evolution

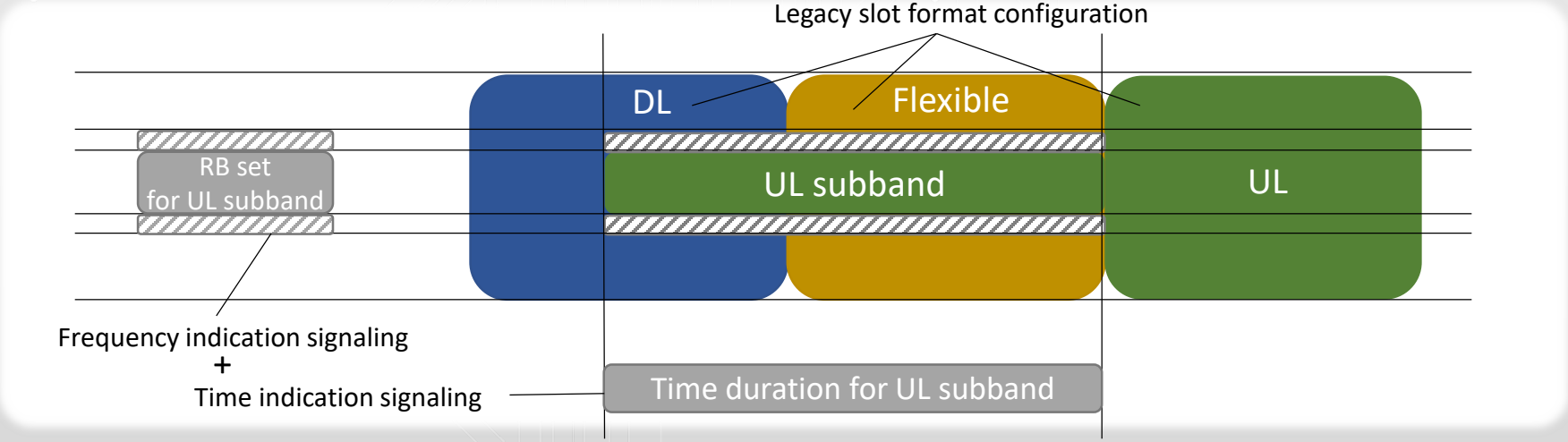
WI: Duplex Evolution

It is expected to successfully complete the ongoing study on NR duplex evolution with the following conclusions

- Viable operation scenarios and potential specification impacts to enable subband non-overlapping full duplex (SBFD)
- Possible enhancements on CLI handling for dynamic TDD

The following objectives are suggested for Rel-19 NR duplex evolution WI

- Specify subband DL/UL/guard band resource allocation methods for SBFD
- Specify transmission and reception of UL and DL channel/signals on UL and DL subbands
- Specify CSI reporting procedures for SBFD
- Study and, if needed specify, subband information, beam information, and/or RS ID exchange for CLI



Integrated Communication and Sensing

SI: Integrated Communication and Sensing

Future networks will open "eyes" to serve vision-based services → Sensing will play a crucial role

- To meet high QoE in various service areas inc. autonomous driving, UAV/aviation, XR, smart city/factory

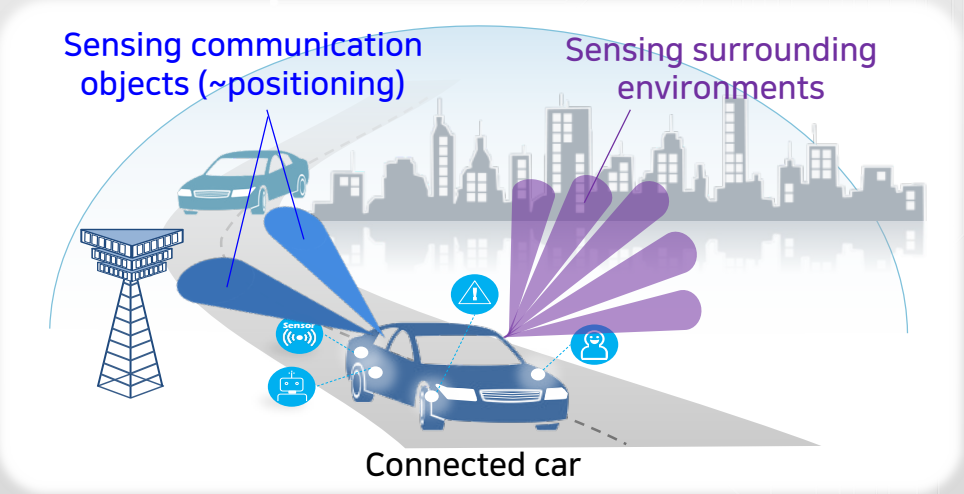
ICAS (Integrated Comm. And Sensing), and also positioning, into a single system benefits:

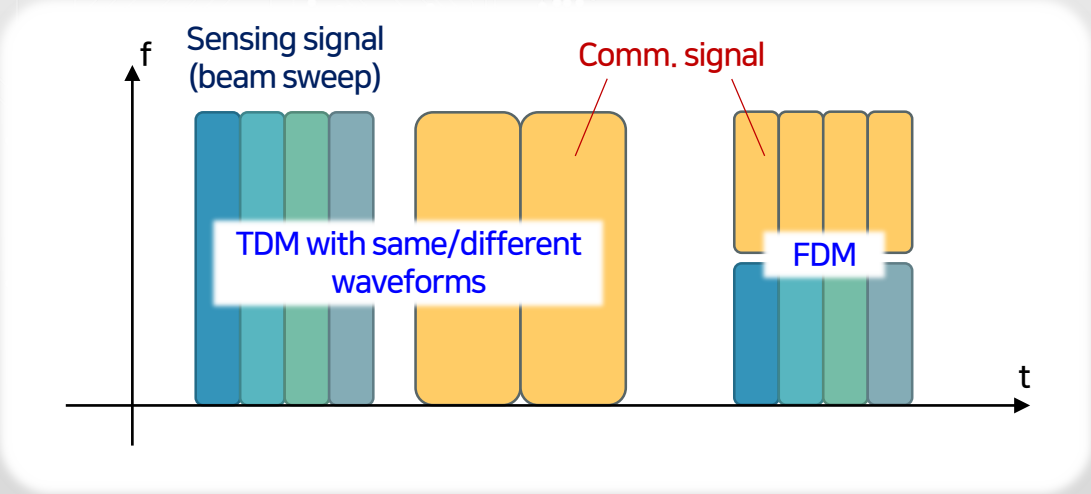
- Enhanced spectral & energy efficiency, reduced hardware costs
- Mutual performance enhancements: comm-assisted sensing, sensing-assisted comm.

Communication-assisted sensing: Sensing based on full utilization of 5G/Next-G spectrum & network infra.

- Technical issues inc. waveform & sensing signal design, resource multiplexing, monostatic/bistatic architecture

Sensing-assisted communication: UE location-based beam training/tracking, channel estimation





Reconfigurable Intelligent Surface

SI: Reconfigurable Intelligent Surface

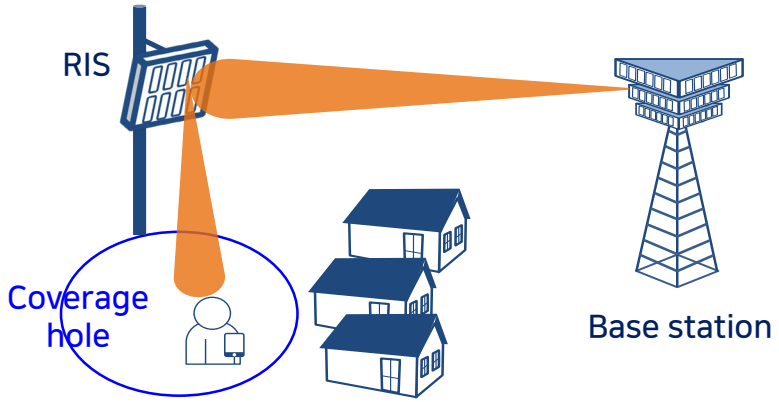
RIS (Reconfigurable Intelligent Surface): Cost-effective, energy-efficient, and spectral-efficient solution for:

- Coverage extension & capacity increase
- FR1 as well as FR2

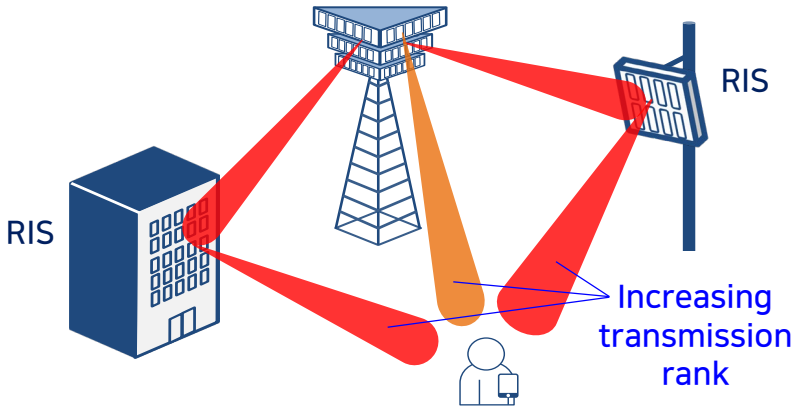
Reflection/absorption beamforming by controlling 100s~1000s of metamaterial elements

Technical areas inc. reflection channel measurement/modeling, phase-control beamforming, CSI mechanism, side control information & its signaling, interference handling (e.g., ACLR)

Coverage extension use case



Capacity increase use case



Channel Modeling for New Features

SI: Channel Modeling

Existing channel model cannot reflect channel properties for ICAS and RIS accurately

Prefer unified channel modeling for Sensing and RIS

- Scattering (e.g., local scattering, backscattering), reflections (e.g., specular reflection, anomalous reflection), multipath, physical electromagnetic characteristic, etc.
- Joint channel model between gNB-RIS-UE vs. separate channel models for gNB-RIS and RIS-UE, respectively
- RIS phase/amplitude control model

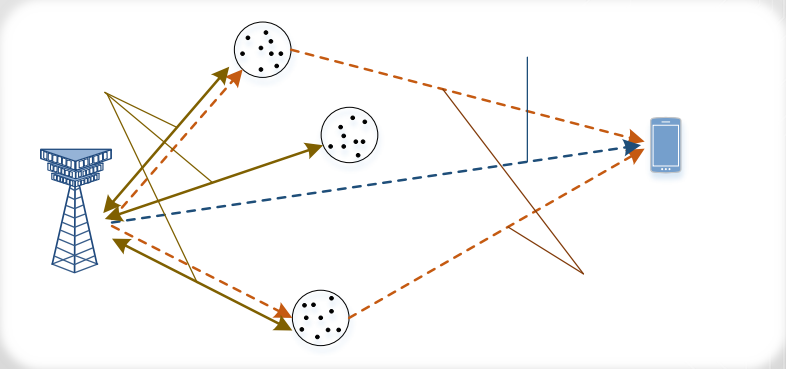
Study scenarios of channel modeling

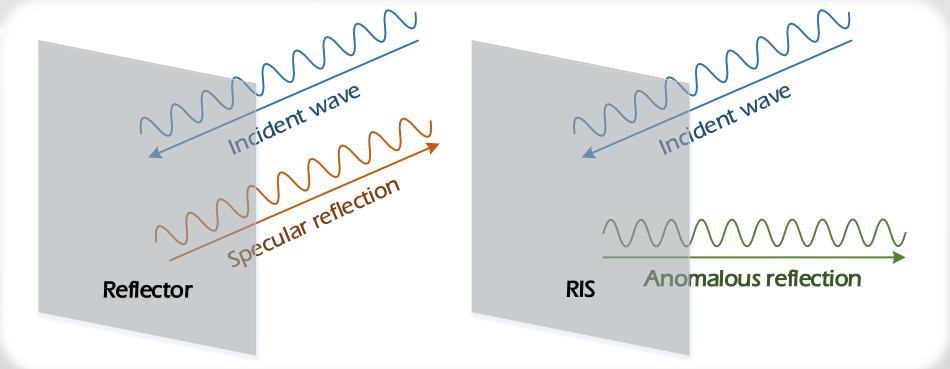
- New scenarios (e.g., open sky, crossroad w/ & w/o obstacle, parking lot, etc.) on top of existing ones

Study methodology for channel modeling

- Statistic based, Ray tracing, or Hybrid (according to use cases)

Can be individual item for channel modeling OR merged into a part of each item such as ICAS and RIS





Ambient IoT

SI: Ambient IoT

New industry and market requiring batteryless IoT solution

- Asset identification in logistics, ranging, automated factory, smart home/terminal/port

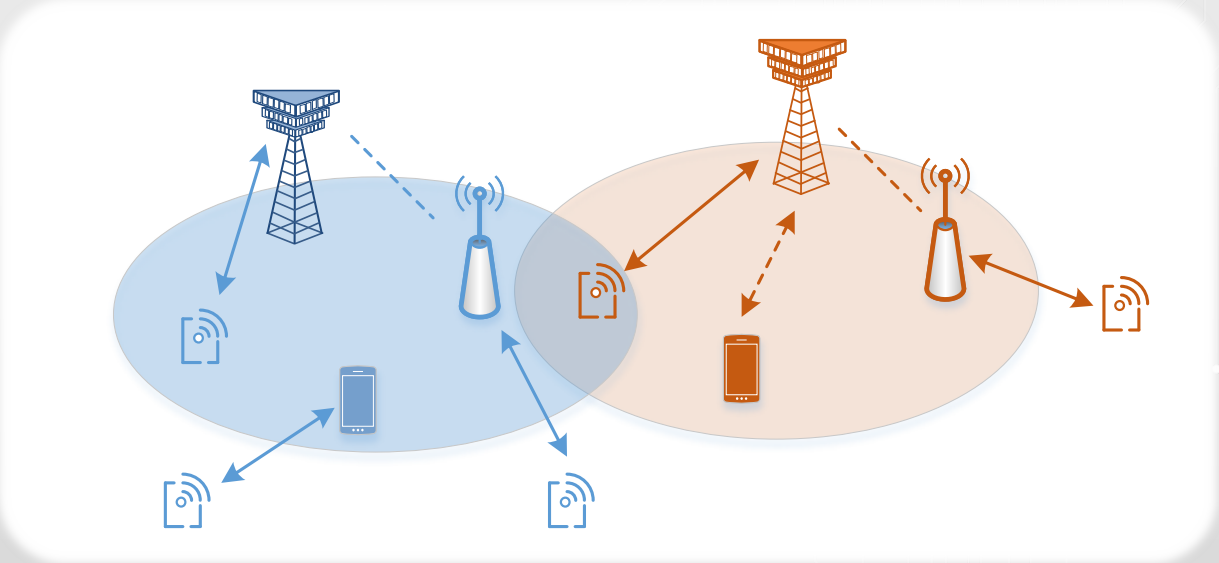
Energy harvesting from ambient energy sources and Better coverage/capacity than legacy techniques

Ongoing TSG study on ambient IoT in Rel-18

- Deployment scenarios, use cases/services, device categorization and RAN design targets

Need to study further details in Rel-19 WGs

- Enhancement of physical signals/channels, procedure, and higher layer protocol



<Ambient IoT in non-public network for logistics>
*Source: Draft TR 22.840 (3GPP SA1)

NTN Enhancements

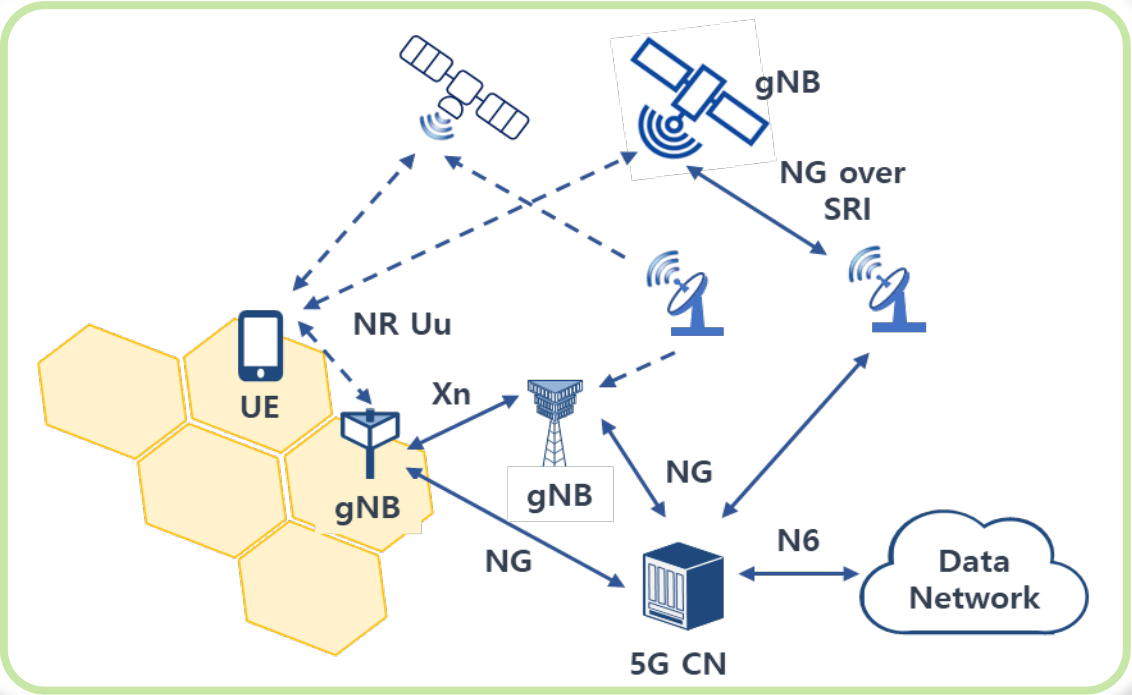
WI: Further enhanced NTN

Rel-18 NTN WI has been specifying the following topics

- Coverage enhancement, Network verified UE location, Disabling of HARQ feedback for IoT NTN, Improved GNSS operations for IoT NTN
- NTN-TN cell re-selection enhancements, NTN-NTN mobility enhancements

It is suggested to further support the following features through Rel-19 NTN WI

- Further enhancements based on Rel-18
  - DL/UL Coverage, Positioning
  - CA/DC between NTNs or between TN and NTN
  - Discontinuous coverage
- Additional scenarios
  - Regenerative payload
  - Non-GNSS UE
  - Ku band
  - L1/L2 Mobility enhancements
  - Power saving



NCR Enhancements

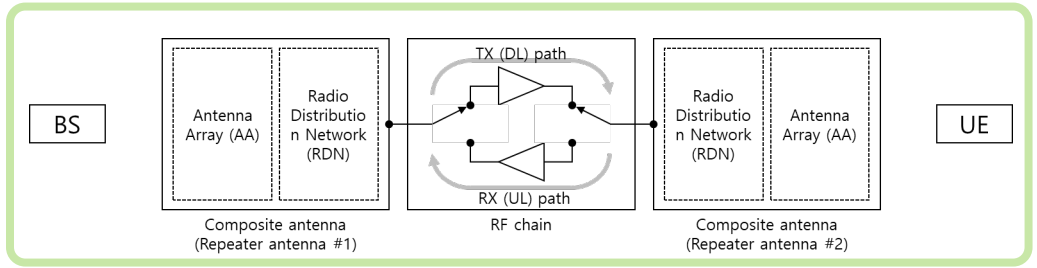
WI: NCR Enhancements

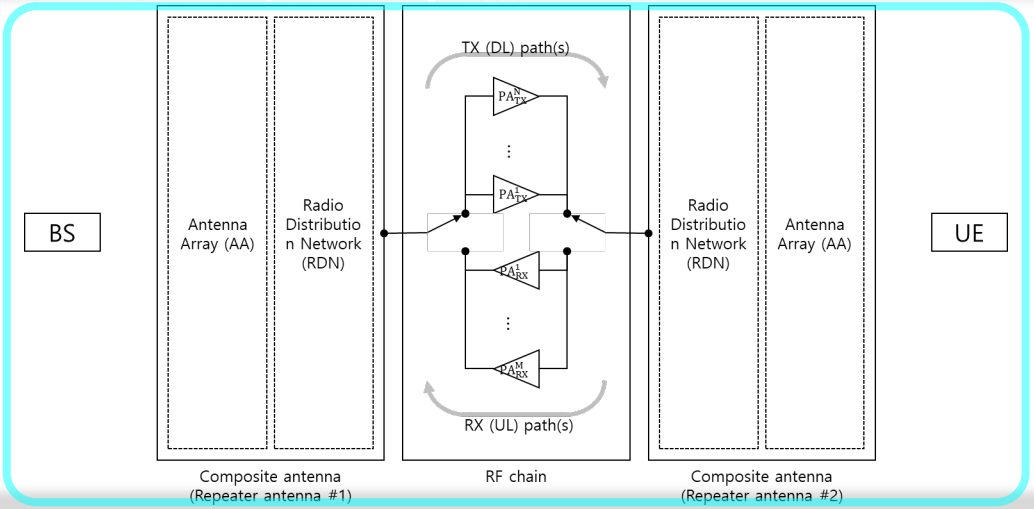
The first specification supports on NCR were completed in Rel-18

- Rel-18 NCR supports access link beam control (single beam at a given time), backhaul link and C-link beam control, and ON-OFF control assuming that the links above are in a same frequency band and do not utilize dynamic TDD
- Rel-18 NCR does not cover detailed uplink power control, including transmission power allocation for various types of NCR PA architectures

The following objectives are suggested for Rel-19 NR duplex evolution WI

- Specify enhanced duplex mode, i.e., dynamic TDD for NCR
- Specify multi-beam indication for NCR
- Specify uplink power control for NCR PA architecture that can be shared/separated between C-link and backhaul link





Further Enhancements of Existing Features

Rel-19 Scope

For successful delivery of new/enhanced features,

- Further enhancements of existing features
- Completion of leftovers from Rel-18

eMBB

- MIMO+
  - UL only reception, MTPR/MPUE enh., ···
- CA/DC+
  - Support >4 cells, ···
- Coverage+
  - PRACH rep. with different beams, long PRACH in FR2, ···

Non-eMBB

- Sidelink+
  - FR2 operation, CA enh., ···
- Positioning+
  - Carrier phase pos. enh., other use cases (e.g., XR), ···
- XR+
  - Power saving, mobility support, ···

Cross-Func

- NES+
  - Dynamic TRP on/off, on demand transmission, ···

Thank you!

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