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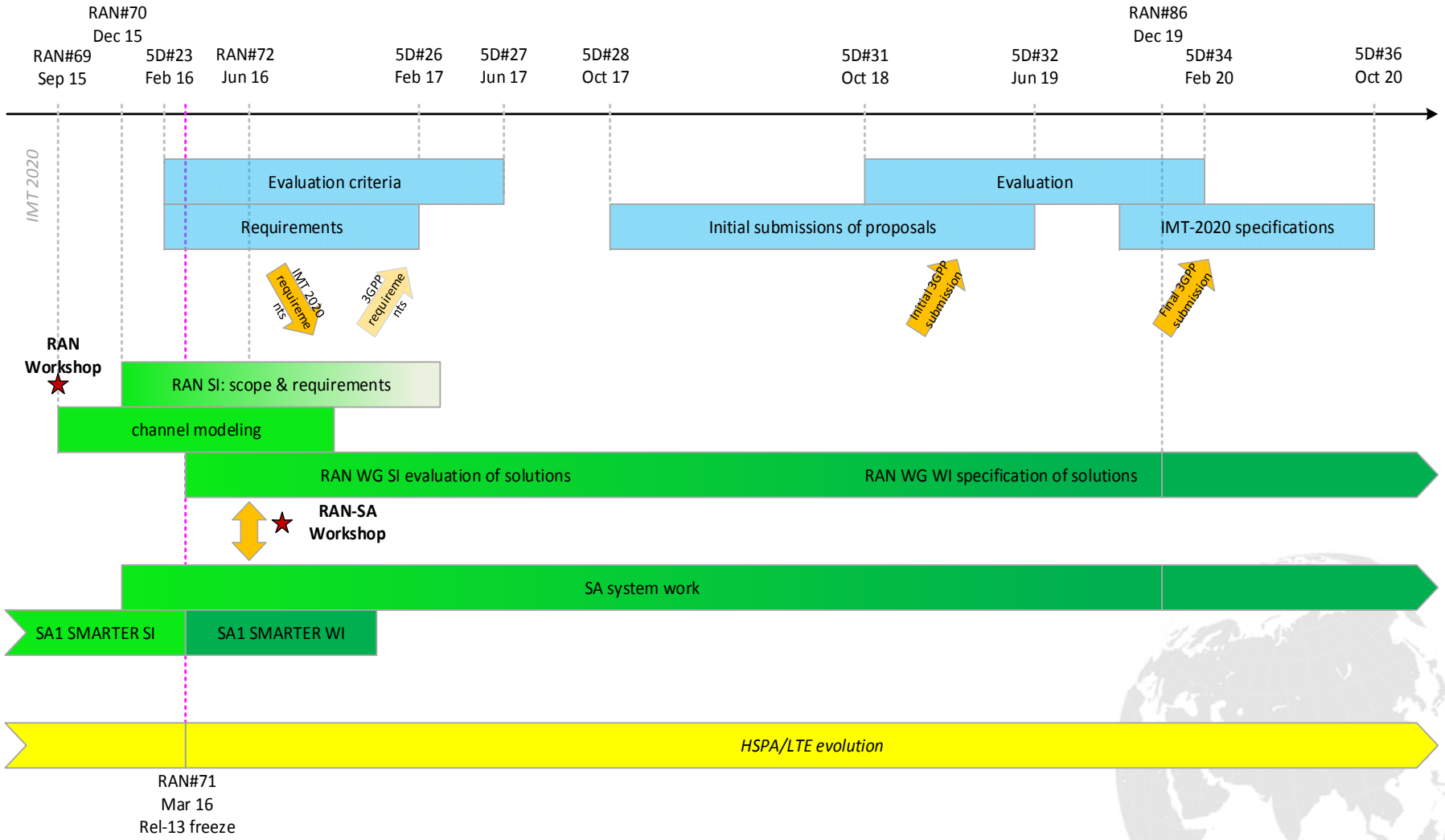
RWS-150031

Views on 5G Technologies

China Telecom , September 17-18, 2015

5G Timeline in 3GPP



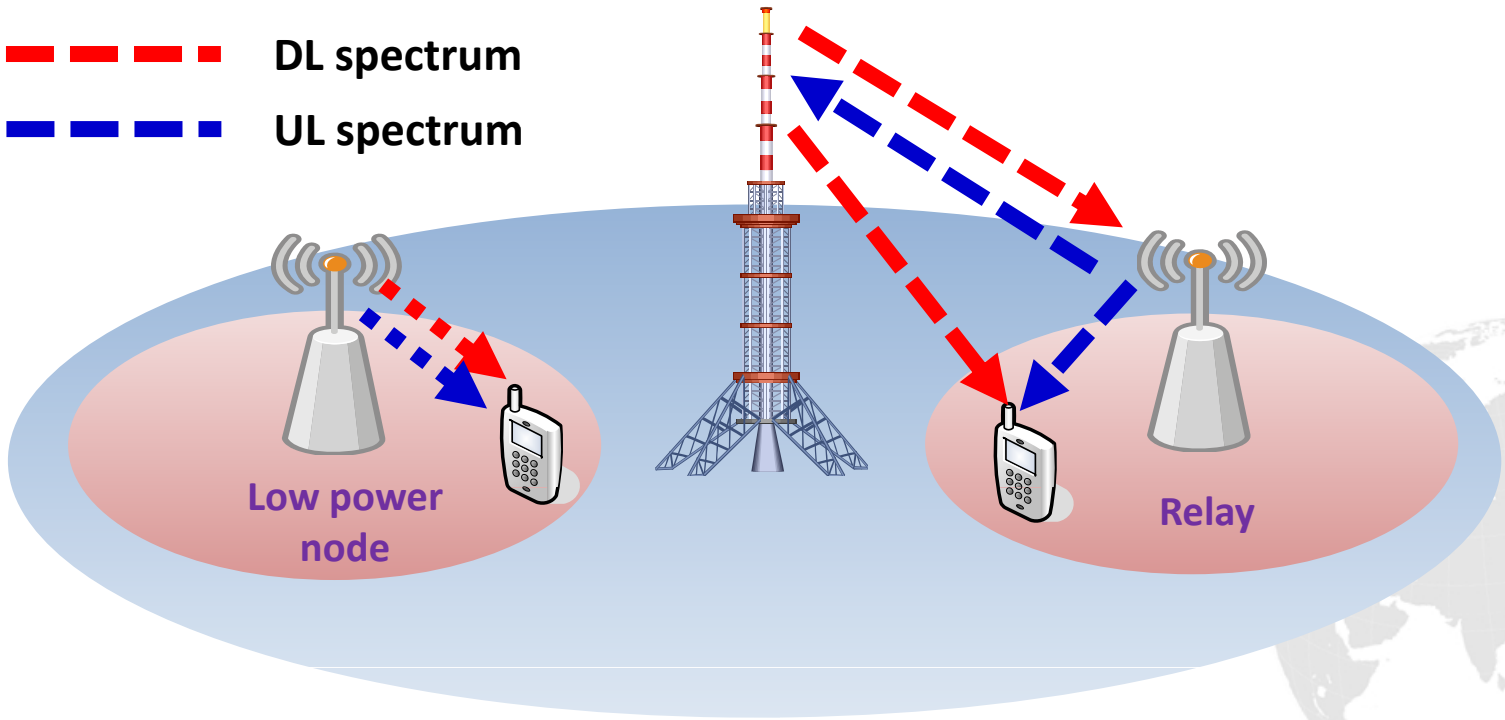
Ref: Dino Flore, "LTE Release 13 and road to 5G"

Flexible Duplex （1/2）

➢ Motivation

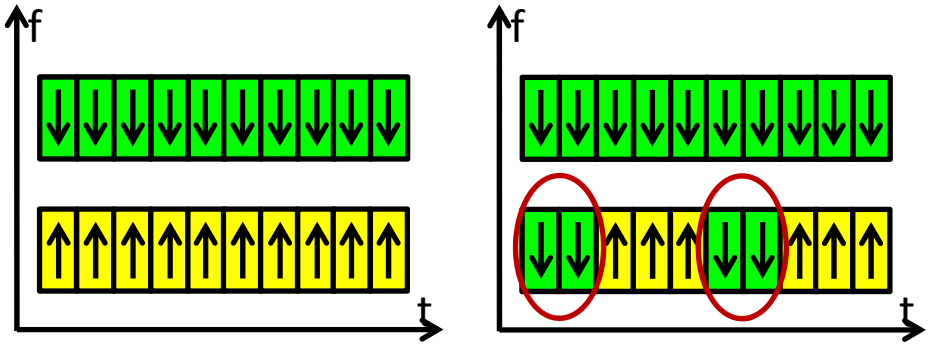
- UL resources vacant due to asymmetric DL/UL traffic for FDD
- Introduce flexibility for traffic adaptation for FDD

➢ Usage scenarios

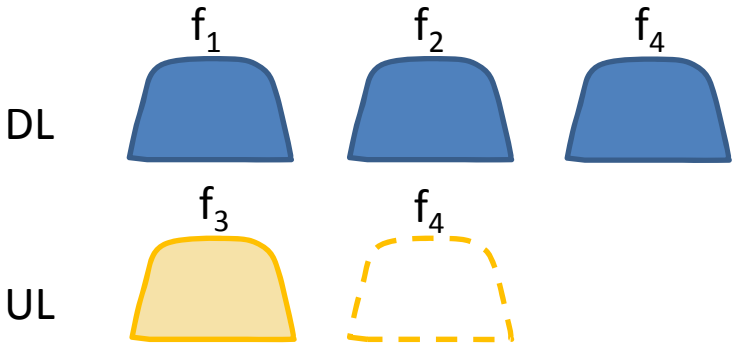


Flexible Duplex （2/2）

➢ Potential solutions for UL spectrum



Configuring a TDD cell in UL spectrum



Configuring a supplementary DL cell in UL spectrum

➢ Research points

- Co-existence issues of DL/UL for adjacent bands
- Interference management for DL/UL cross-link interference
- Mechanism in physical layer, e.g. frame structure, HARQ timing

UDN （1/2）

➢ Motivation

- UDN is the most effective method to meet the requirements of ultra-high traffic volume density in 5G

➢ Challenges of UDN

- Inter-cell interference becomes more severe
- The handover frequency increases and may result in higher handover failure
- It is not possible to deploy high-speed wired backhaul for all the cells

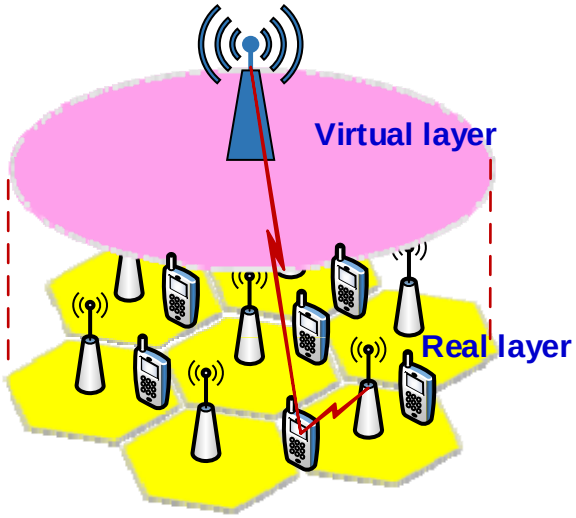
➢ Potential research points

- Interference mitigation schemes such as more advanced CoMP, advanced receiver
- Virtual layer technology to reduce handover frequency
- Hierarchical backhaul structure combing wired backhaul and wireless backhaul

UDN （2/2）

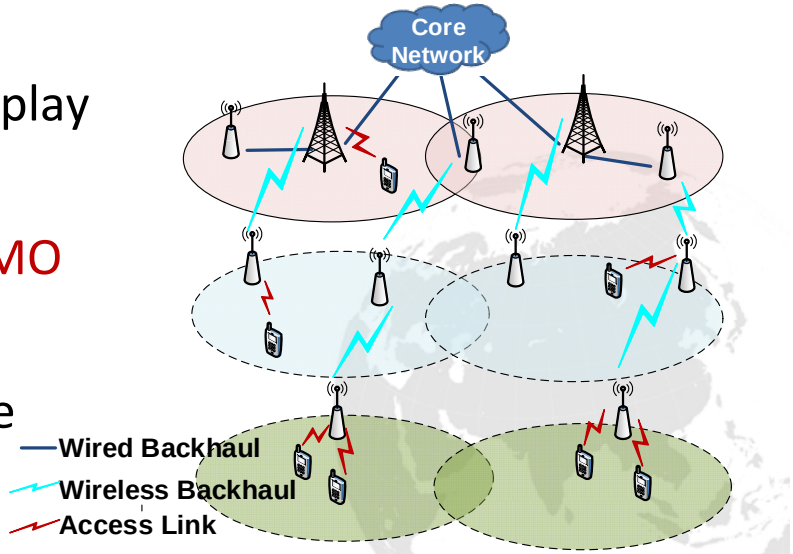
➢ Virtual layer

- C/U split, C-plane in virtual layer, U-plane in real layer
- No cell reselection or handover for the mobile users within the same virtual layer



➢ Hierarchical backhaul structure

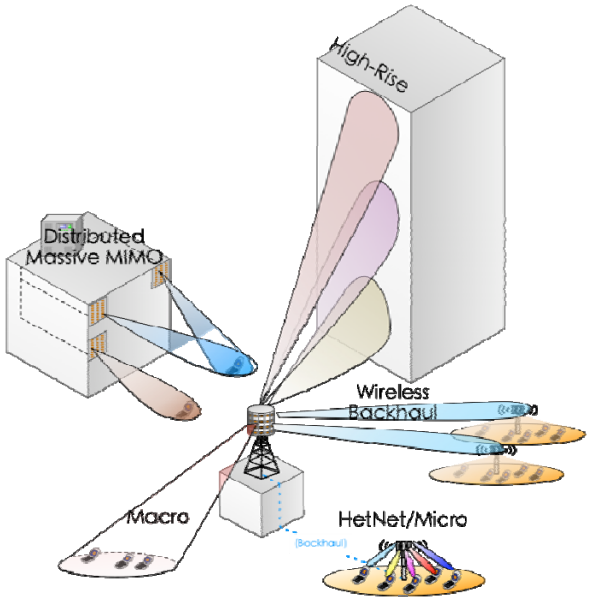
- Small cells can be deployed in a plug-and-play manner through wireless backhaul
- Wireless backhaul with high order SU-MIMO and MU-MIMO
- Joint backhaul/access design and resource allocation



Massive MIMO

➢ Further extension based on Rel-13

- More antenna ports
- Extended scenarios, e.g., distributed MIMO and wireless backhaul
- Higher frequency
- Support of higher UE mobility



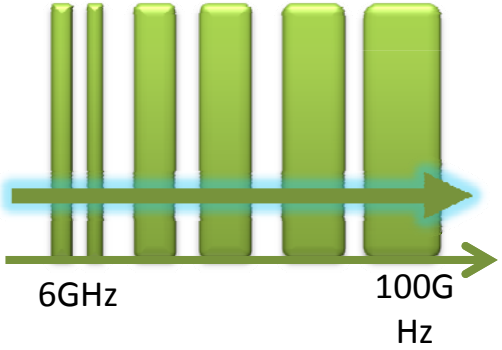
➢ Potential research points

- Channel modeling, e.g., support of more scenarios
- Potential unified design for various deployment scenarios
- Enhancement of RS and control channel design
- Enhancement of channel information acquisition, including CSI feedback and channel reciprocity based scheme

High Frequency

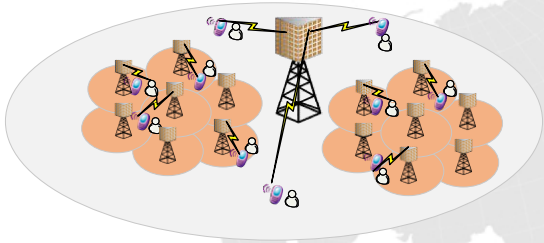
➢ Motivation

- High frequency band (6-100GHz) can provide an abundant frequency spectrum to provide a larger capacity and a higher data rate required by future 5G system



➢ Potential research points

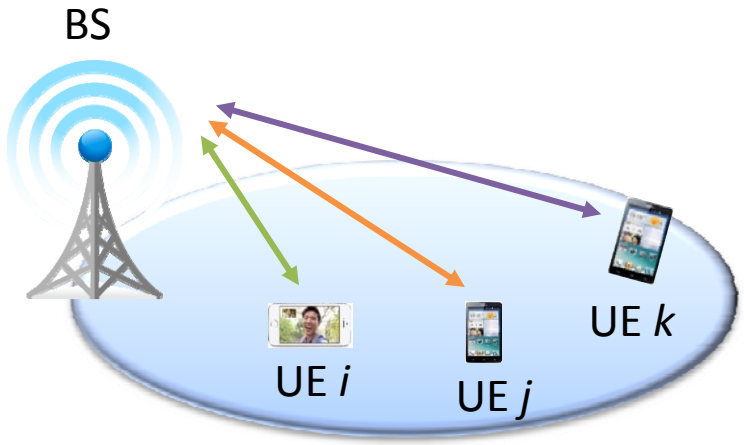
- High frequency spectrum and channel
  - ✓ Potential allocation of high frequency
  - ✓ Typical use cases and scenarios
  - ✓ Channel modelling for high frequency
- Key technologies and system design
  - ✓ New air interface, e.g., frame structure, waveform and coding
  - ✓ Joint design with other technologies, e.g., massive MIMO and UDN
  - ✓ Hybrid networking of low and high frequency



Multi-user Superposition Transmission

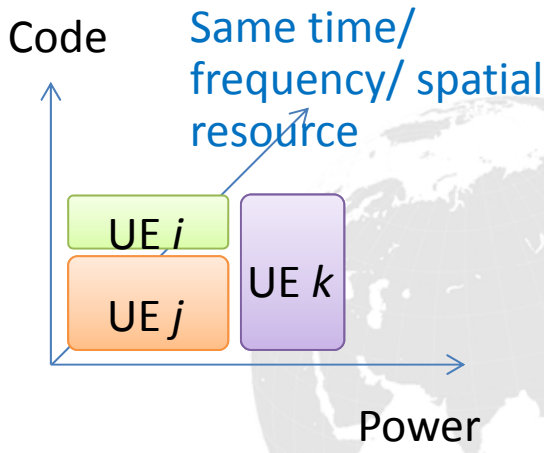
DL multi-user superposition

- Follow-up WI in Rel-14 based on candidate MUST schemes in Rel-13 SI
- Potential further enhancement



UL multi-user superposition

- **Transmitter:** the information of multiple users can be delivered in the same resource by power-domain superposition and/or code-domain superposition
- **Receiver:** the information of different users can be recovered by BS interference cancellation or iterative detection



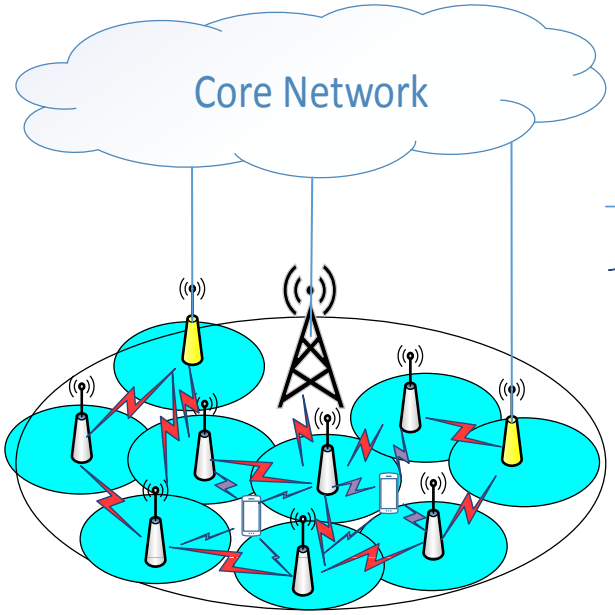
Wireless Mesh

➢ Challenges for 5G network

- High cost to deploy huge numbers of wired backhauls in UDN
- Inconvenient to deploy wired backhauls for some base stations in UDN
- High latency for data transmission and signaling coordination btw base stations

➢ Motivation and research points

- The wireless mesh networks aim to construct high-speed, high efficient wireless transmission networks between base stations



Wired backhaul

Wireless backhaul

Gateway base stations

Wireless backhaul base stations

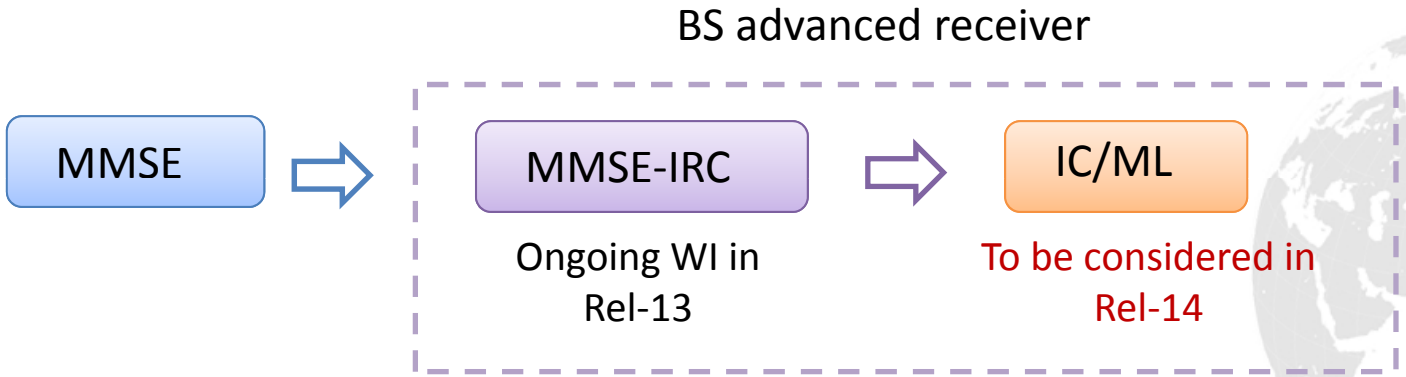
Enhance the coordination capability and efficiency between base stations

Reduce the latency of data transmission and signaling exchange

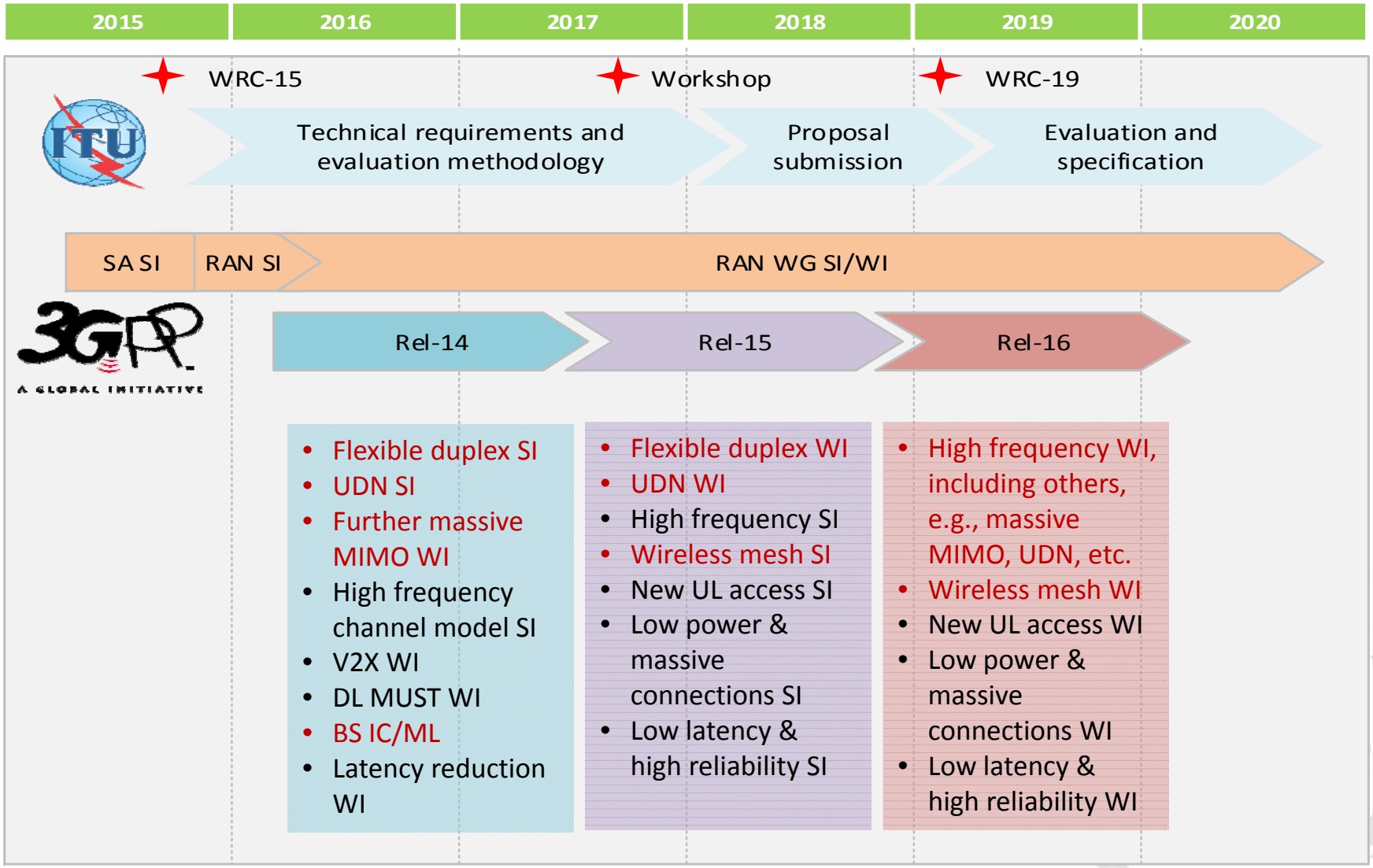
Provide backhauls dynamically and flexibly and enable plug-and-play

BS Receiver Evolution

- The WI on “Performance requirements of BS MMSE-IRC receiver” is ongoing in Rel-13
- Consider the further evolution of BS receiver, such as interference cancellation and maximum likelihood receivers, in Rel-14
  - In intra-cell (MU/SU-MIMO), intra-site inter-cell and inter-site with ideal backhaul scenarios, BS has full knowledge of interference parameters, thus BS code-word IC and ML receivers are feasible
  - BS has more powerful processing capability than UE, which can be used to cancel bigger number of interferers / layers and implement more times of IC iterations



5G Roadmap in 3GPP



Thanks !

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