3GPP TSG RAN Rel-19 workshop
Taipei, June 15 - 16, 2023

RWS-230232

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Agenda Item: 5

Views on Rel-19 MIMO evolution

Apple

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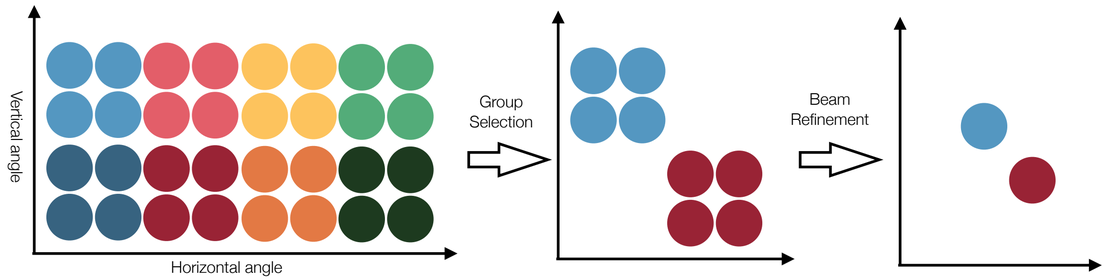
Rel-19 NR MIMO | Enhancement on Beam Management

- Justification
  - Lack of information at NW side for configuring efficient and robust beam management due to the unpredictable nature of beam change, e.g., UE rotation/movement
  - Lack of information at UE side about the detailed information of the beam structure/correlation, UE has to perform independent beam tracking operation for each SSB/CSI-RS
  - Lack of resources or latency impact for UE to perform beam tracking/refinement when UE has large number of beams

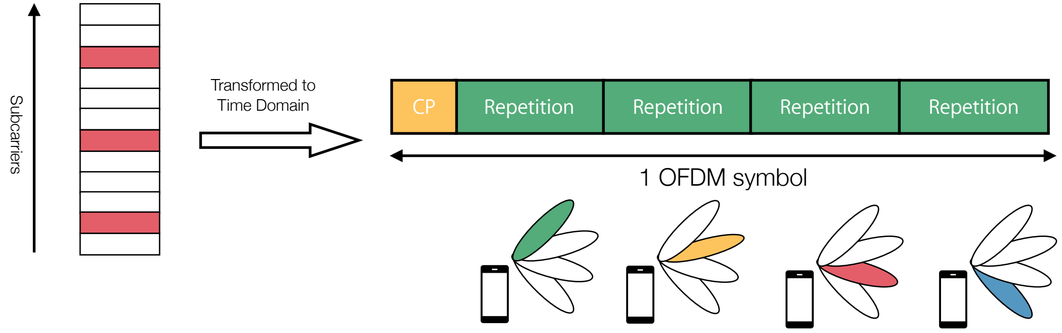
- Objectives
  - Enhancement on UE assisted beam management
    - UE requested beam management procedure
    - UE initiated beam reporting
  - Enhancement to provide assisting information on beam structure to facilitate hierarchical beam tracking
  - Enhancement on CSI-RS configuration to facilitate intra-symbol beam tracking

UE assisted beam management

NW assisted hierarchical beam tracking



Intra-symbol beam tracking

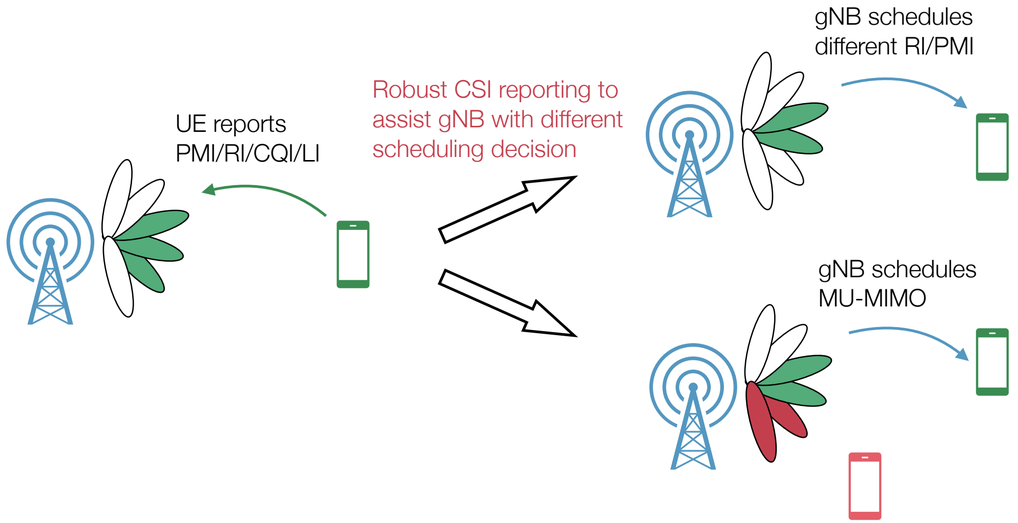


Rel-19 NR MIMO | Enhancement on CSI

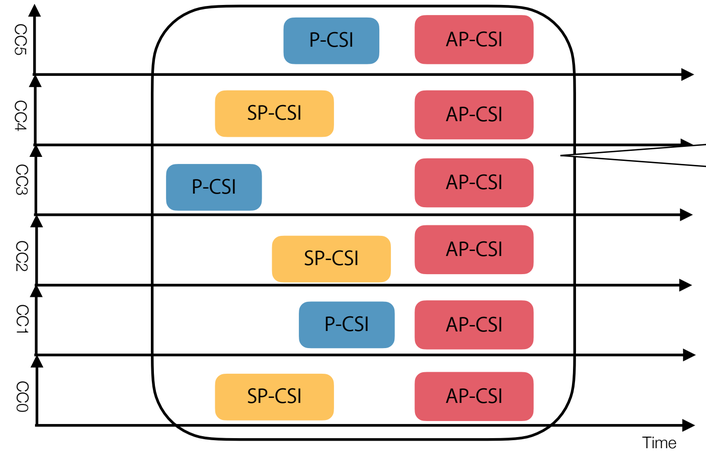
- Justification
  - Current CSI reporting limits to one PMI/RI/CQI/LI reporting per TRP, provides gNB with limited scheduling suggestions
  - Current CSI reporting provides limited support of MU-MIMO scheduling, especially lacking PMI/RI/CQI for different co-scheduled UE hypothesis
  - Current CSI reporting does not fully address UE dynamic CSI processing load/condition in deployment
    - CPU/active RS rule is defined semi-statically
    - It is very costly for UE to store the staled CSI report

- Objectives
  - Enhancement on CSI reporting with multiple hypothesis
    - To assist NW with different scheduling needed, e.g., new transmission vs. retransmission, different rank, MU-pairing, etc.
  - Enhancement on CSI reporting to accommodate UE with dynamic CSI processing load/condition

CSI enhancement with multiple hypothesis



CSI enhancement to accommodate UE dynamic processing load



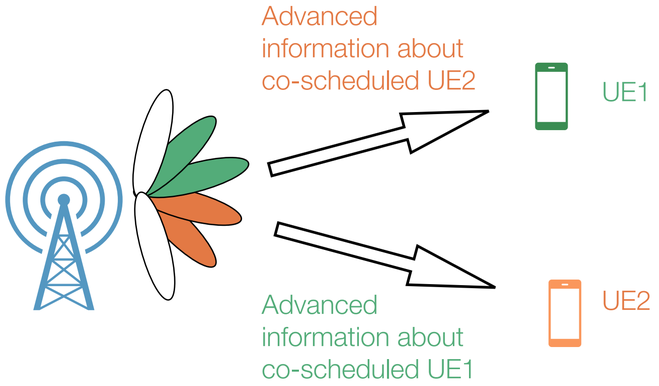
- UE CSI processing timeline is complicated and dynamic, e.g., pipeline, parallel, etc.
- CSI reporting enhancement should be considered to adapt to UE dynamic CSI processing load, e.g., without requiring UE to report explicit staled CSI

Rel-19 NR MIMO | Enhancement for UE with Advanced Processing

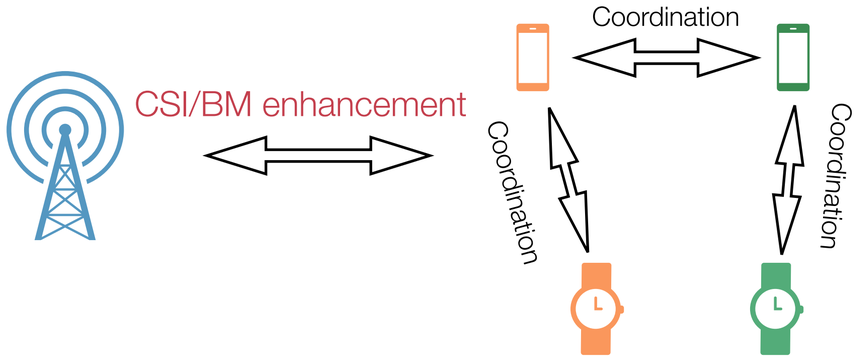
- Justification
  - UE has limited information about the co-scheduled UE for MU-MIMO operation,
    - UE is only aware about the “antenna port” configuration, i.e., CDM groups without data for rate matching purpose
    - This restricts the performance of MU-MIMO detection and/or significantly increases the receiver
  - Current NR focuses on single user performance, without considering any UE coordination for CSI feedback, beam selection, etc.

- Objectives
  - Enhancement to facilitate more advanced UE reception, e.g., MU detection,
    - e.g., co-scheduling information enhancement
  - Enhancement for MIMO operation with UE coordination
    - UE coordination based beam-management, e.g., beam report, beam indication and beam failure recovery
    - UE coordination based CSI feedback

CSI enhancement with multiple hypothesis



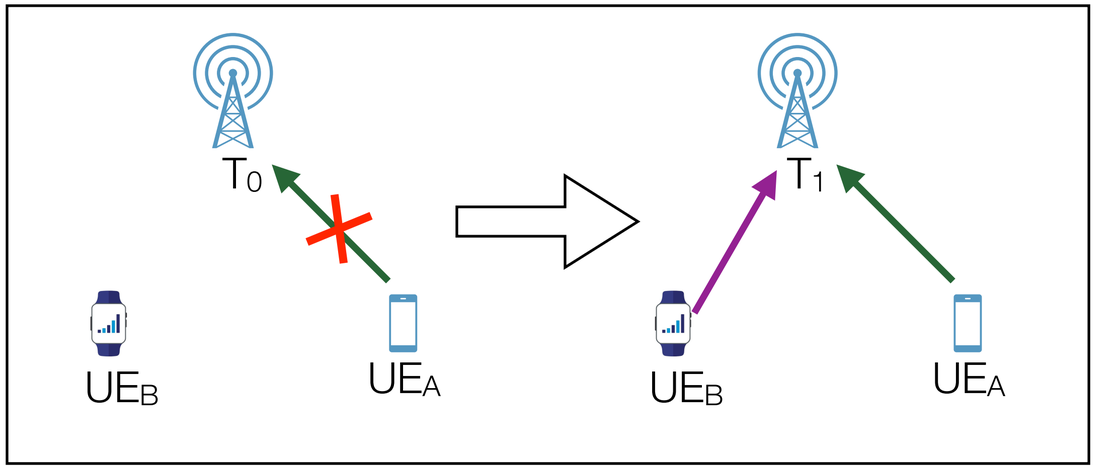
Enhancement for MIMO operation with UE coordination



Rel-19 NR MIMO | Enhancement for UE with Advanced Processing

- Justification
  - In general and in comparison with DL, UL performance is limited by lower Tx power, fewer number of antennas/RF chains, etc
  - User may have different devices e.g. wearables, mobile phones, laptops, etc.
  - Aggregation of different devices provide more antenna diversity, and power accumulation

- Objectives
  - Enhance UL/DL system throughput via power aggregation, BW aggregation, antenna diversity
  - User assisted on available distributed antennas



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