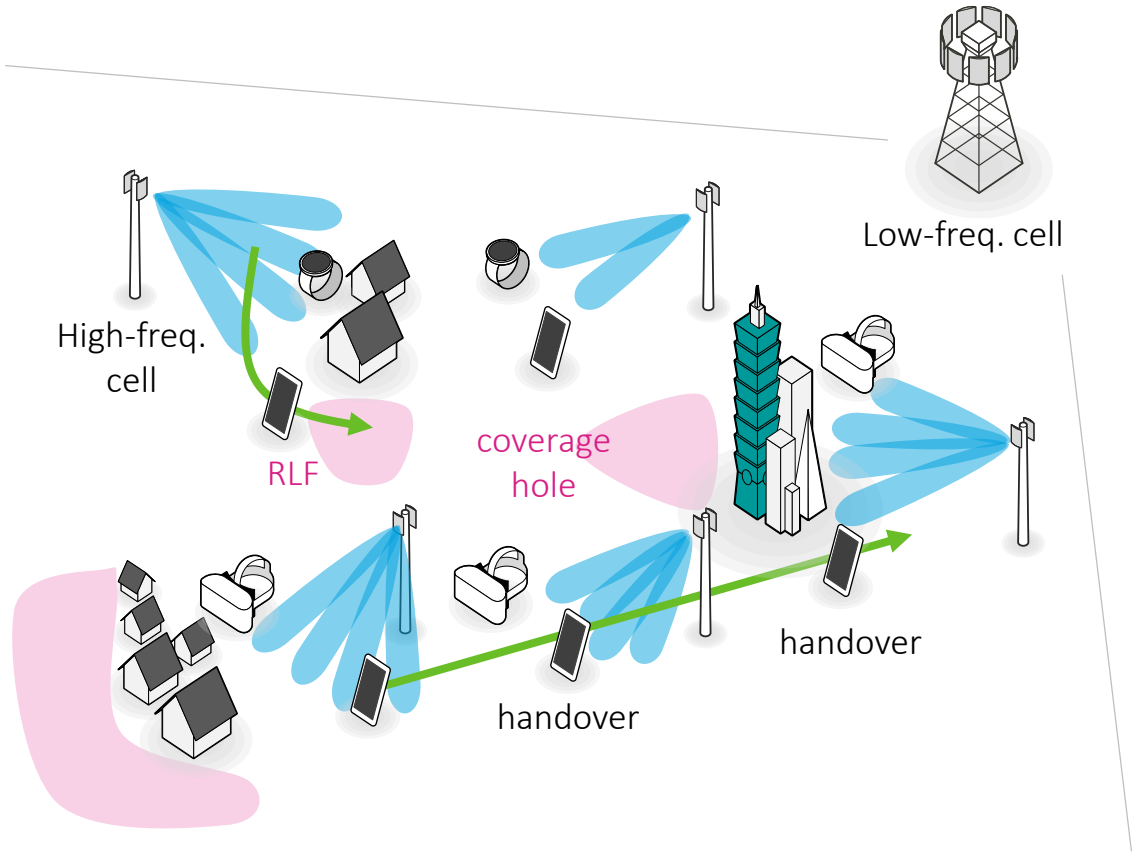
3GPP TSG RAN
September 13th – 17th 2021

RP-212328
Agenda Item 9.0.3

Rel-18 Mobility Enhancements

MediaTek Inc.

Moving UEs in high frequency range



- Observations
  - Narrower beams, more beams, denser deployment
  - No always-on cell reference signal
  - New challenges from High Data Rate Low Latency (HDRLL) applications
- Consequences
  - Channel fluctuation, coverage holes
  - Shorter beam/cell dwelling time
  - Longer measurement period
- Mobility performance impacts
  - More frequent cell switching, and thus user experiences longer overall interruption due to handover (~75ms for each cell change)
  - Poor robustness (< 1% in FR1, > 10% in FR2): Mobility failure brings even longer interruption

Problems with Current Mobility Procedures

- NR Rel-15 baseline handover suffers from both interruption and robustness problems
- NR Rel-16 conditional handover (CHO) improves robustness by allowing UE to execute handover when pre-configured conditions are met, but handover execution still brings interruption
- NR Rel-16 dual active protocol stacks (DAPS) handover achieves almost 0ms interruption by continuing source cell data after handover command
  - The latency before UE can access target cell is not reduced
  - DAPS cannot be configured together with CHO
  - DAPS does not work for FR2-to-FR2 mobility
- Rel-17 inter-cell beam management allows UE to use beams from non-serving cell, but it does not trigger serving cell change
  - Only for intra-DU, intra-frequency, dedicated channels
- Rel-18 Goal: Reduce overall latency/interruption of mobility procedures

Mobility Enhancements
RAN2-led

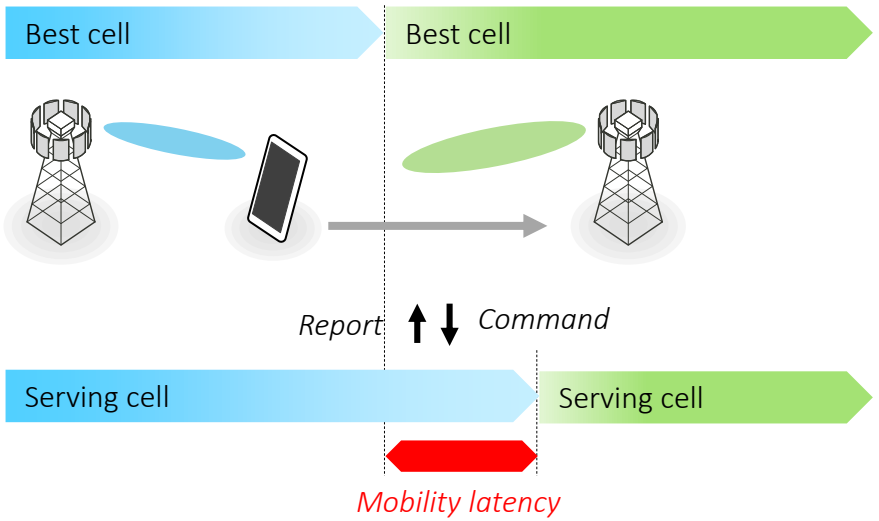
3GPP TUs (Total w/ 9 meetings)			
RAN1	RAN2	RAN3	RAN4
12	18	3	9

SA/CT Dependency: No

Low-performance FR2 mobility is a show-stopper for key services (capacity-hungry low latency): XR, CG. Latency and robustness to be improved.

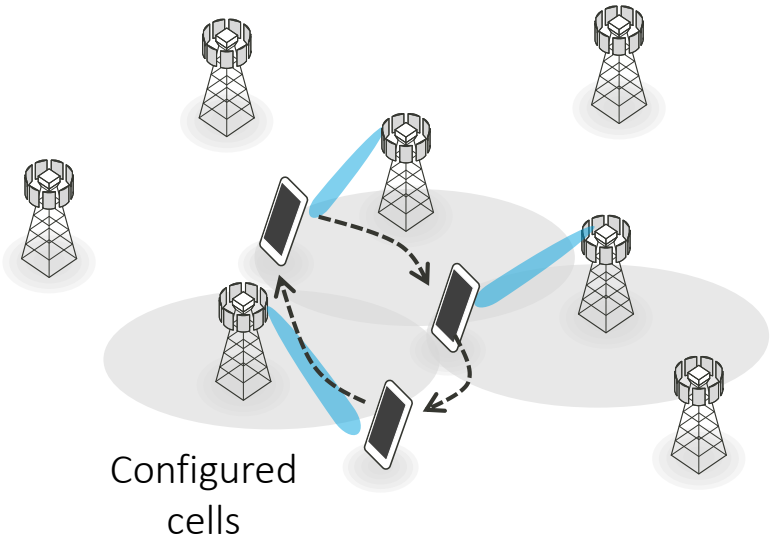
Objective I: Mobility between configured cells
- Configuration and maintenance for multiple candidate cells [RAN2, RAN3]
- Inter-cell beam management for extended scenarios [RAN1, RAN4]
- Dynamic switching among candidate serving cells, based on DL or UL indications [RAN2]
- DL/UL timing managements [RAN2, RAN1]
- Mobility delay requirements [RAN4]

Objective II: DAPS and CHO enhancements
- DAPS for FR2-FR2 [RAN4, RAN2]
- CHO with MR-DC [RAN2]
- DAPS with DC/CA [RAN2]



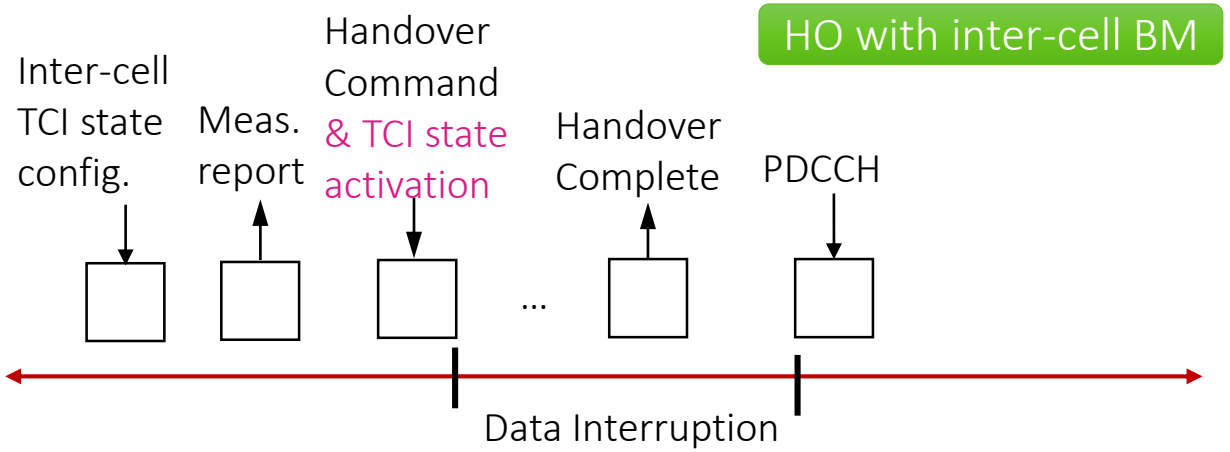
Objective I: Mobility between configured cells

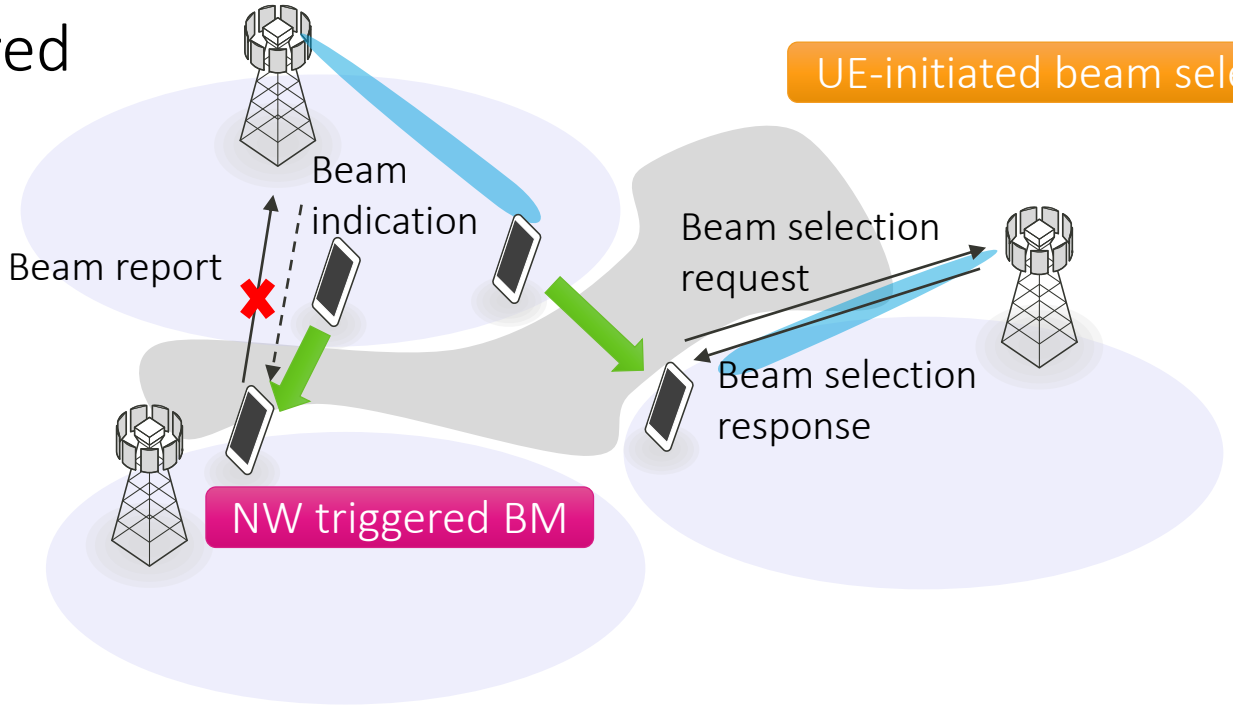
- Goal: Reduce overall mobility latency for UE to access a target cell
- Configured cells: A set of cells among which UE can do fast switching
  - Configured cells posses UE context
  - UE maintains the configurations, and may acquire timing/MIB, for multiple configured cells
- Cell change may be triggered by L1/L2 or L3 signaling
- May be considered for MN and SN mobility
- Mobility delay requirements will be updated accordingly



Objective I: Mobility between configured cells

- Extend scenarios for Rel-17 inter-cell beam management
  - Allowing UE to use common and dedicated channels of non-serving cell, and for inter-DU, intra-CU, or inter-frequency cells
- Dynamic switching among configured cells
  - HO with inter-cell BM
  - UE-initiated beam selection

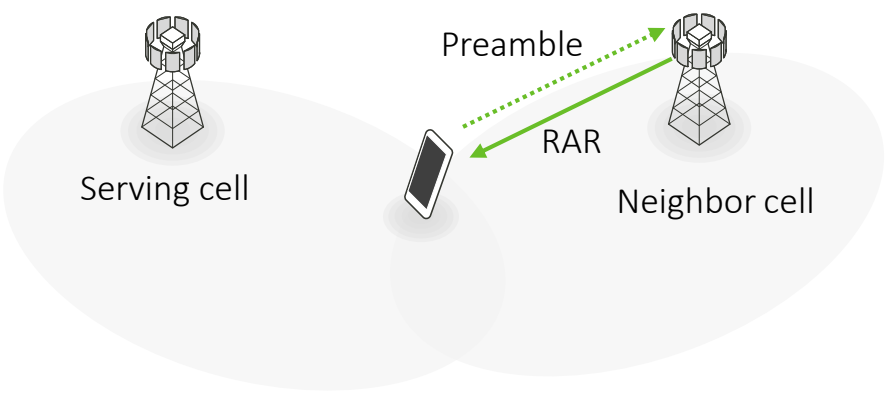


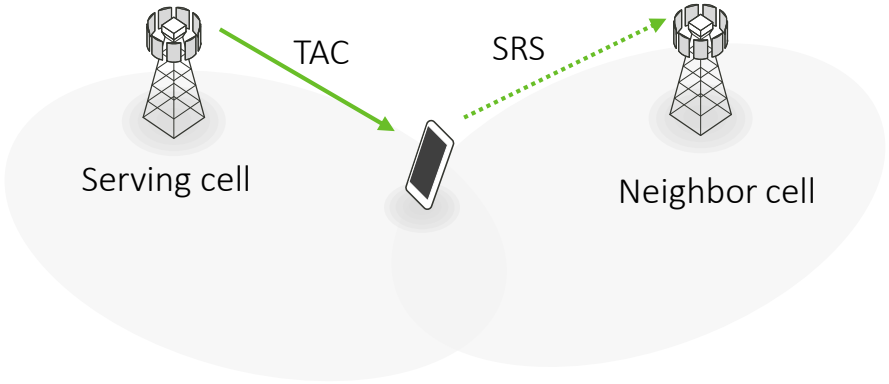


Objective I: Mobility between configured cells

Timing management

- Fine time-tracking for beams from configured cells
- Optimization for configured cell timing advance acquisition, e.g.
  - Perform RACH towards potential target cells before handover command
  - Leverage source TA, plus TA adjustment for neighbor cells based on UL signals (e.g. SRS)

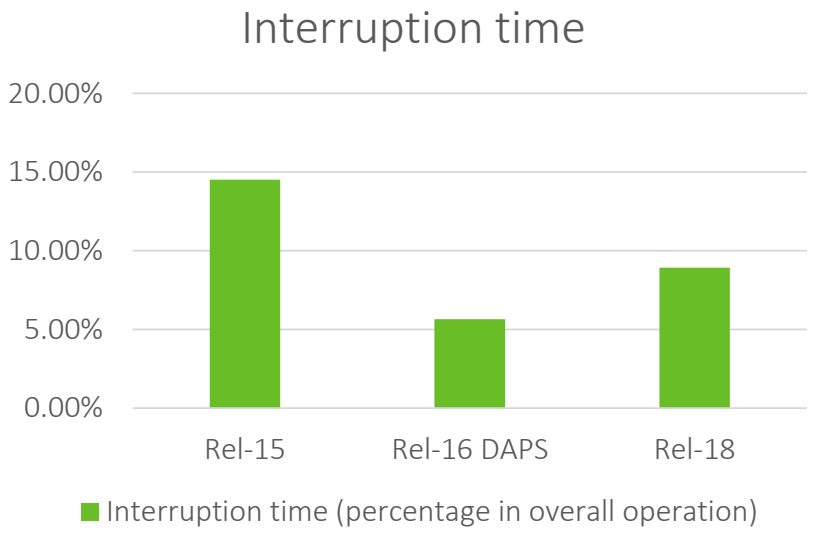


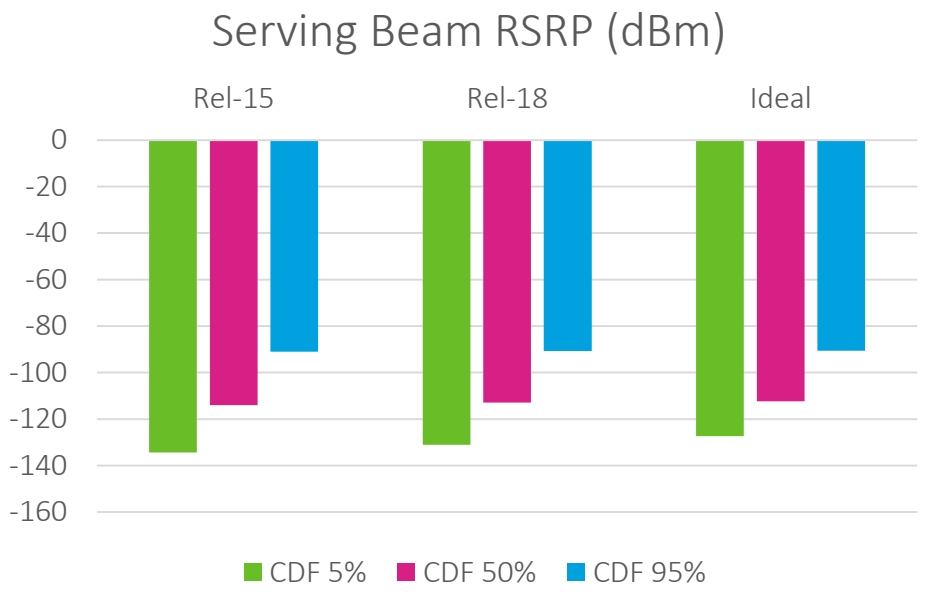


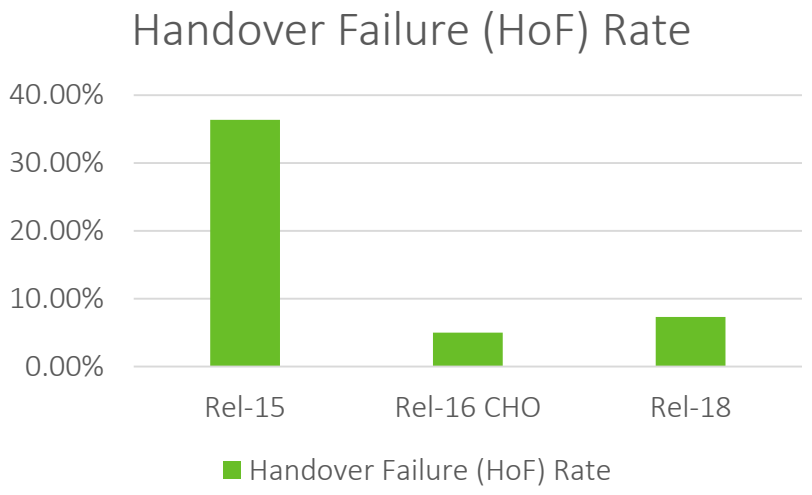
Objective I: Mobility between configured cells

Numerical results

- Reduced overall service interruption time even without DAPS
- Improved robustness even with network-initiated handover execution, for configured cells
- Better serving beam RSRP distributions, since UE switches to better cell/beam faster

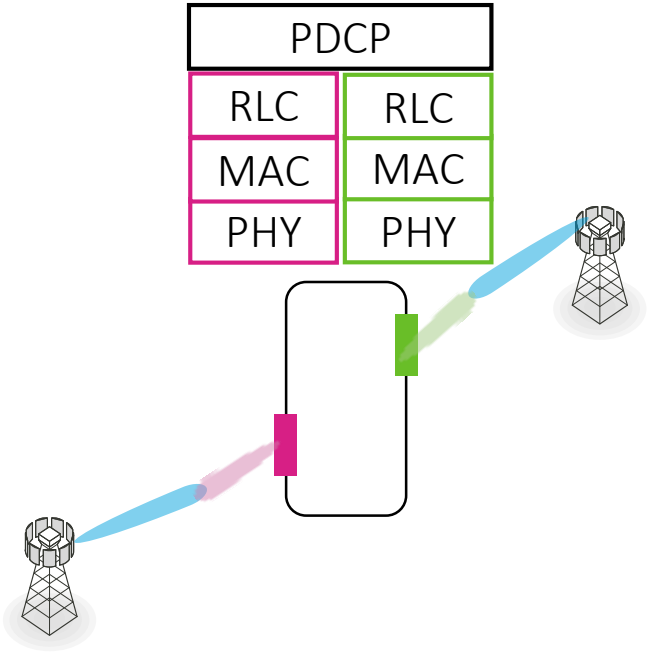






- Rel-18: Configured cells with timing management; no CHO, no DAPS
- Ideal: Always served by the best cell & beam
- Simulation @30GHz, 120 km/h

Objective II: DAPS and CHO Enhancements

- DAPS for FR2-to-FR2 handover
  - Rel-16 DAPS handover is not supported for FR2-to-FR2 mobility, mainly because UE is unable to form two receiving beams simultaneously
  - For multi-panel UEs, simultaneous reception from source and target cells may be possible, and thus enable DAPS for FR2 to FR2 mobility
  - If simultaneous reception is not possible, we may consider loosing interruption requirements
- DAPS with DC/CA
- CHO with MR-DC
- Conditional DAPS handover

DAPS handover with multi-panel UE