



**3GPP TSG RAN Rel-18 Workshop**

**RWS-210161**

**Electronic Meeting, June 28- July 2, 2021**

# Mobility enhancements in Rel-18

**Source: vivo**

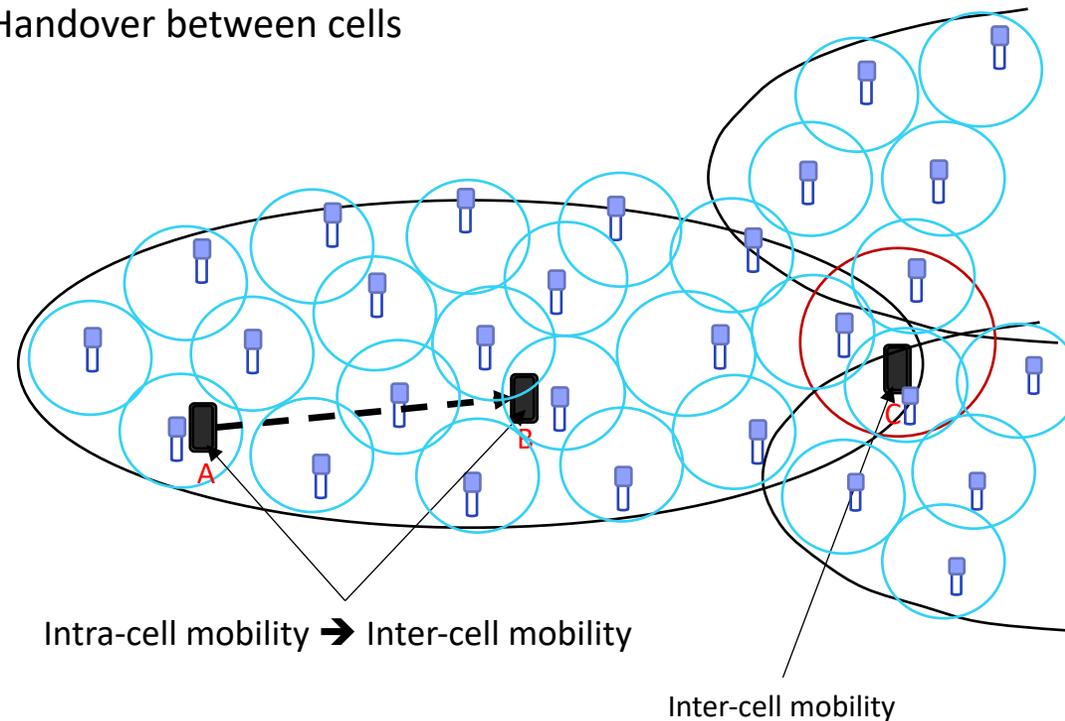
**Document for: Discussion & Decision**

**Agenda Item: 4.1**

# Mobility enhancements

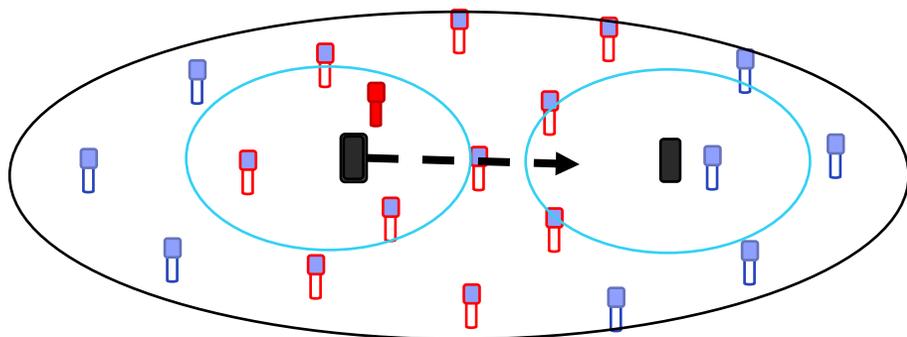
## Scenario: Dense 5G deployments

- 5G deployment is expected to be much denser in the future (cell/TRP to UE ratio is higher)
  - For coverage purpose in high frequency, e.g. FR2
  - For capacity purpose
- Mobility performance and/or UE power consumption could be an issue
  - UEs perform more frequent cell (re-) selection/Handover between cells



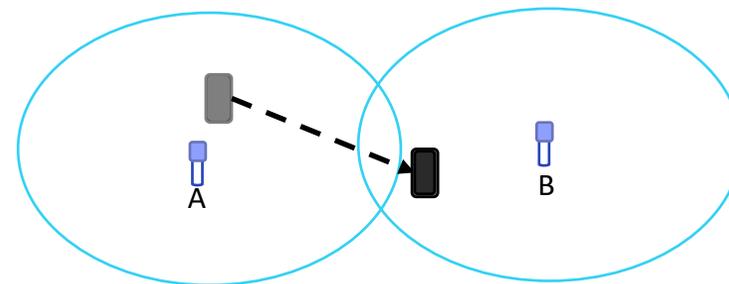
# Mobility enhancements

## Issues and potential solutions



### High UE power consumption

- UEs perform frequent cell search/ measurement for cell (re)-selection in idle mode
- UEs perform frequent measurement and report for handover in connected mode



### Degraded UE mobility performance

- UE already moved to cell B, but due to the L3 filtering of current mobility procedure
  - UE still receive paging from cell A → cell reselection delay, **paging miss**
  - Too late handover → **Handover failure**

- The above issues are similar to what is currently observed in high speed train deployment
- Potential solutions for Rel-18 study
  - SFN based cell camping for UE IDLE mode
    - ✓ UE IDLE mode measurement are performed on SFN based signals -> **for power saving**
    - ✓ SFN-based paging monitoring (and potentially SFN-based SI) -> **for mitigating the paging miss issue**
  - UL signal based mobility procedure
    - ✓ UL signal based mobility procedure in connected mode to **mitigate the handover failure rate**
    - ✓ UL signal based mobility procedure in idle mode to **reduce NW paging load and NW energy consumption**

# Evaluation on paging miss rate

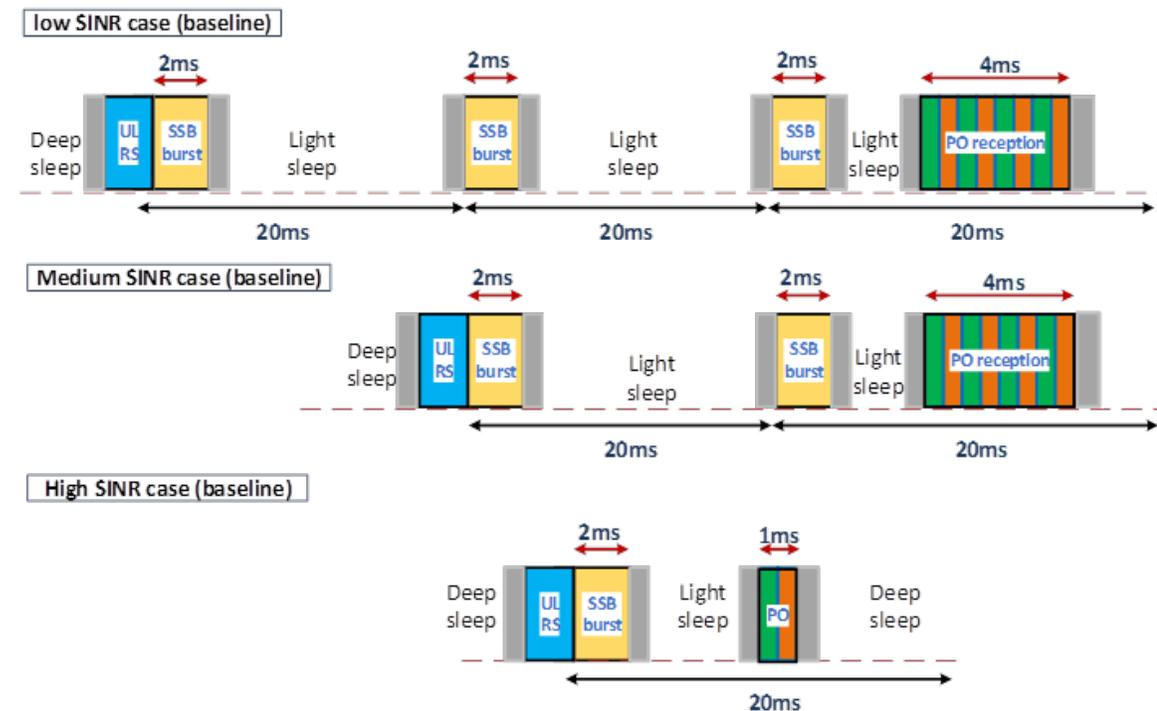
- Evaluated cases:
  - **Baseline case:** UE paging is sent on all cells (57cells). Cell reselection is performed based on DL measurement with L3 filter.
  - **Case 1:** Paging is sent in SFN manner within a cell cluster, paging miss rate is significantly reduced due to SFN gain.
  - **Case 2:** Cell resection based on UL signaling between clusters. NW is aware of the UE location so that paging is sent on the “best cell” only -> lower paging miss rate, lower NW overhead and energy consumption.
- Detailed simulation results (i.e. [miss rate for initial transmission of paging](#)) as below:

Simulation assumption	values
ISD	200m
UE speed	30kmh
Alpha in L3 filter	0.5 <sup>1</sup>
DRX paging cycle	1.28s
UL signaling period	1.28s
MCS for paging	MCS 0

		Cluster size=3	Cluster size=9	Cluster size=14	Cluster size=19	Cluster size=28	Cluster size=57
<b>Baseline</b>	0.1573	N/A	N/A	N/A	N/A	N/A	N/A
<b>SFN based paging (Case 1)</b>	N/A	0.1185	0.0446	0.0359	0.0299	0.0172	0
<b>Paging from the best cell (Case 2)</b>	N/A	0.0905	0.0396	0.0336	0.0306	0.0197	6.9726e-4

# Evaluation on UE power saving gain

- Power model in TR 38.840 is assumed, UE processing timeline (along with UL signaling) as shown in Fig.
- Baseline:** Serving cell measurement is always performed. Neighboring cell (intra-f/inter-f) measurement is controlled by S-measure mechanism.
  - Assuming: 50% High SINR+20% Middle SINR+30% Low SINR
- In SFN mode (**Case 1**),
  - Serving cell measurement is always performed on the SFN layer
  - UEs only need to measure intra-f/inter-f neighboring cell in SFN edge, e.g. controlled by S-measure mechanism.
- Detailed simulation results:

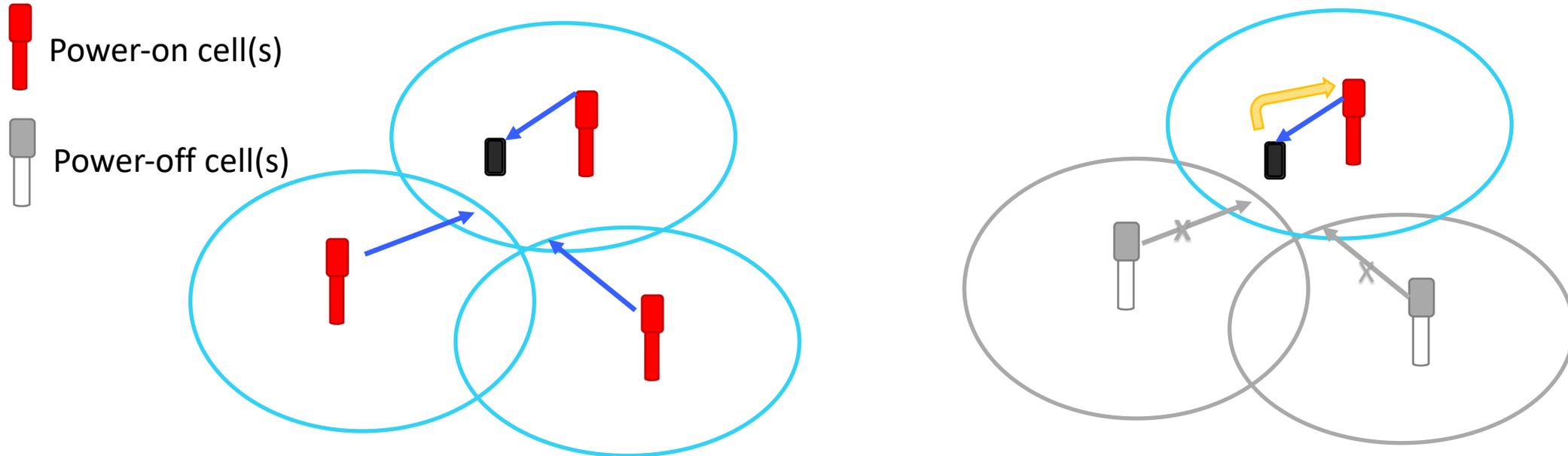


Power saving gain over baseline for SFN	SFN size=3	SFN size=7	SFN size=19	SFN size=57
All UEs	9.44%	14.14%	18.85%	28.28%
Middle & Low SINR UEs	14.72%	22.05%	29.4%	44.1%

Assuming tx power for UL signaling is 23dBm with 2ms duration, **addition 4.7%** power consumption will be increased for UL signaling tx.

# Network overhead reduction and energy saving

- With UL signaling in IDLE/INACTIVE state, network paging overhead and energy consumption can be saved:



## In legacy

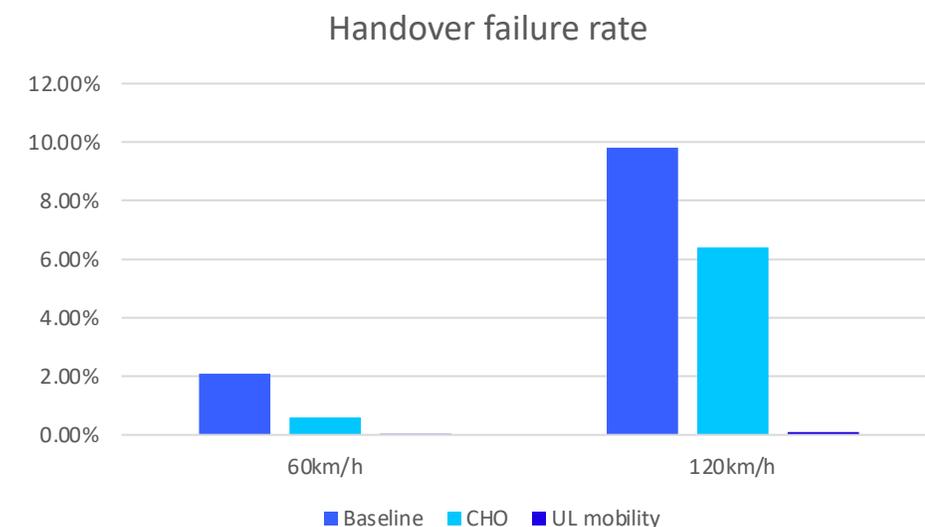
- All cells should be **always power on**
- Paging will be sent on **all cells** in area in idle/inactive

## With UL signaling

- Cells could be **on-demand power on**
- Paging could be sent **only on the cell where UL signal is detected**

# Handover failure rate in connected mode

- **Baseline:** Legacy handover procedure based on DL measurement with L3 filter.
  - Handover model and corresponding metrics on handover failure in TR 36.839 is assumed.
  - Assuming: [ISD=200m, Event A3 is adopted, L3 alpha=0.5].
- **CHO:** Handover is triggered based on DL measurement with condition A3.
- **UL based mobility:** handover is triggered by network side based based on UL measurement.
- UEs with different speeds (middle and high) are evaluated, e.g. 60km/h, 120km/h, 100% outdoor.
- It could be found handover failure rate is significantly reduced by UL based mobility.
- Comparison with CHO: **UL mobility could reduce the overhead between gNB and save reserved resource**
  - CHO will reserve resource and perform (early) data forwarding for all candidate cells



# SID objectives

The following areas could be studied in Rel-18 for mobility enh.

- Study IDLE/INACTIVE mode UE power saving and paging performance improvement by SFN based NW transmission, including:
  - How to model SFN, e.g. Configuration of SFN, and impact on RS, SI, Paging, RACH, etc.
  - Cell (re-)selection enhancement including inter-SFN switch, and intra-SFN cell/TRP switch
  - Impact to NW overhead should be carefully considered
- Study UL-based mobility for IDLE/INACTIVE and CONNECTED states, including:
  - Suitable UL signal for UL-based mobility
  - Procedure for mobility enhancement by UL signaling in idle/inactive/connected mode
  - Inter- and intra-cell L1 measurement and reporting based on DL/UL signaling configuration
  - Paging overhead saving and NW energy saving based on UL signaling in IDLE/INACTIVE state
  - Impact to UE power consumption should be considered

**THANK YOU.**

**谢谢。**