3GPP TSG RAN Rel-18 workshop
Electronic Meeting, June 28 - July 2, 2021
Agenda: 4.3
RWS-210153

NR network energy saving enhancement for Rel-18

China Telecom

Background

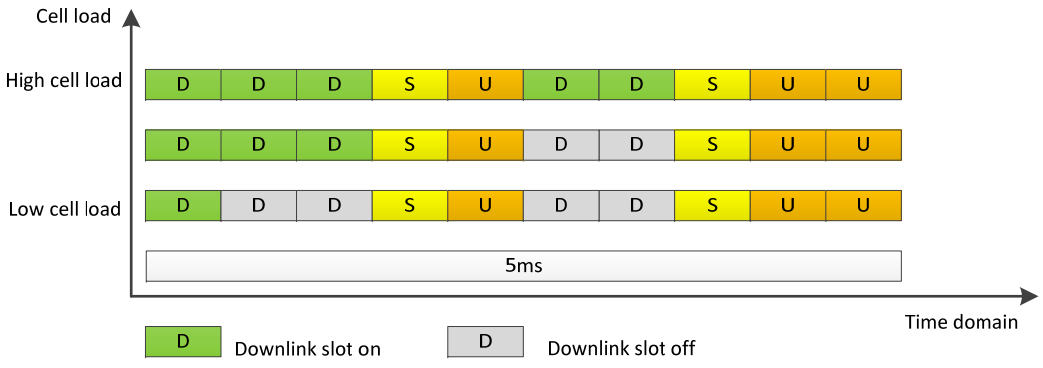
- Most of the power consumption of NR network comes from base stations, and 90% of the power consumption of NR base station comes from AAU.
- Power consumption of a single NR base station is 3+ times higher than LTE currently. Thus network energy saving in NR becomes more critical to achieve the big success of 5G.
  - Compared to LTE, higher power consumption in NR is due to higher band, wider bandwidth, more TRX, etc.
  - OPEX
    - According to 24 global operators' annual reports, the electricity bill of base stations is nearly 20% of overall network operating cost.
    - For operator A, the electricity cost is more than half of the total profit.

Estimation of power consumption and cost: LTE vs. NR

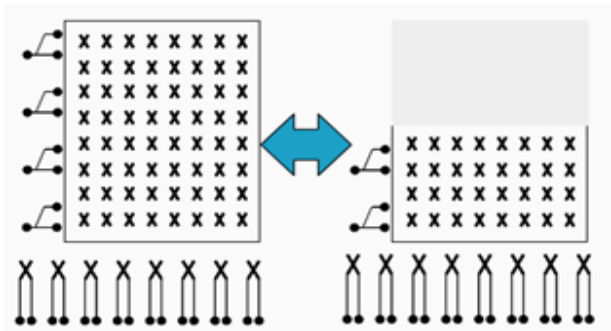
Parameter	LTE value		NR value		Note
1 BS	3 RRU	1 BBU	3 AAU	1 BBU	
Peak power (W)	840	170	3450	310	280W/RRU 1150W/AAU
Total power(W)	1010		3760		
Total cost (CNY)/year	**7.5k**		**28.5k**		0.85CNY/kWh

Background – Implementation based

- Implementation based base station energy saving solutions have been considered
  - Channel shutdown, carrier shutdown, slot shutdown, deep sleep and device shutdown, etc
  - Based on relative semi-static and statistical criteria, e.g., cell load over/under a certain threshold



Time-level



Spatial-level

Background – Standardization based

- Network energy saving solution specified in LTE
  - The cell switch-off/re-activation of capacity booster cell via X2 interface, was specified as the intra-system network energy saving solution.
  - The cell switch-off/re-activation of capacity booster cell via S1 interface, was specified as the inter-system network energy saving solution.

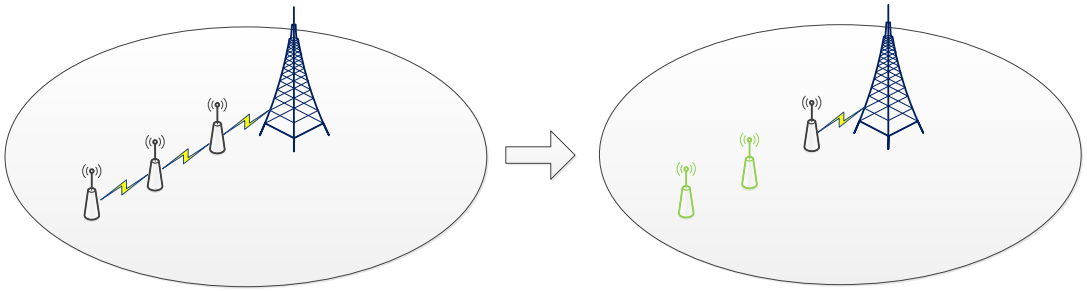
- Network energy saving solution specified in NR
  - The cell switch-off/re-activation of capacity booster cell via Xn/X2 interface, was specified as the intra-system network energy saving solution in NR R15, similar to LTE.
  - The inter-system network energy saving is being discussed as one issue of NR R17 WI “enhancement of data collection for SON/MDT in NR”.
  - AI based network energy saving is one of the use cases in NR R17 SI “Study on further enhancement for data collection”

Motivation for further enhancement in Rel-18

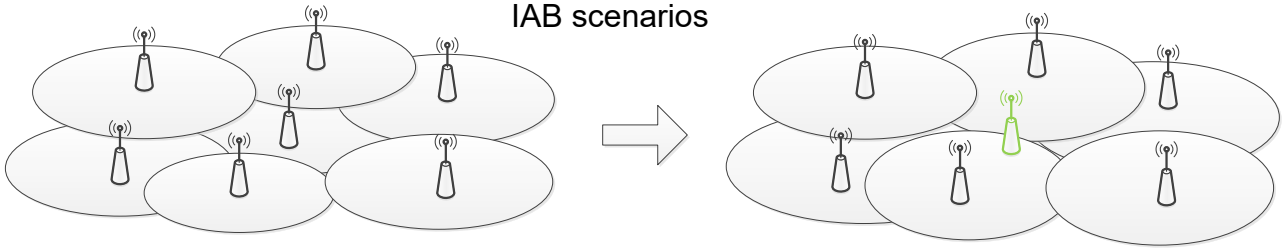
- Extension to more scenarios
  - Only single hop network is considered so far, and multi-hop network scenario, e.g., IAB, needs further study
  - Only capacity booster cell scenario is considered, and compensation cell scenario needs further study
- More flexible and dynamic energy saving management
  - Currently, the cell/module switch off/on decision
    - is based on coarse statistical cell load information, e.g., number of connected UEs
    - is controlled by preconfiguring sleep period manually, and can only be applied to the tidal case
    - is with the assumption of uniform traffic distribution, NOT the actual traffic distribution, in time domain/geographic area

Extension to more scenarios

- Identify and extend to more energy saving scenarios, e.g.,
  - Capacity booster cell scenario
  - Multi-hop network deployment scenario, i.e. IAB
  - Compensation cell scenario



IAB scenarios

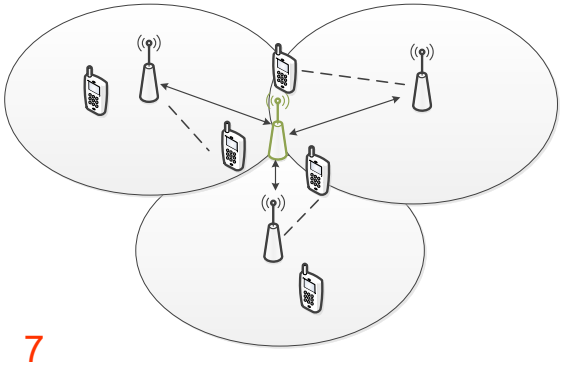


Compensation scenarios

Potential enhancements

- More flexible and dynamic energy saving management
  - To enable more accurate and flexible gNB/module level energy saving strategy decision, especially for non-tidal case and non-uniform traffic/UE distribution
  - To enable timely gNB wake-up mechanism as response to the upcoming traffic/connected UEs or the idle/inactive UEs of which the traffic is about to arrive

- Potential enhancements
  - Potential UE assistance information report, e.g., traffic prediction
  - gNB information exchange to support beam level operation coordination and transmission power adjustment coordination
  - UL/DL measurement enhancement



Potential Objectives

- Identify the potential energy saving scenarios, e.g. capacity booster cell, IAB node/donor, compensation cell.
- Study the potential enhancement to enable more flexible and dynamic network energy saving management, e.g.,
  - Potential UE assistance information report, e.g., traffic prediction
  - gNB information exchange to support beam level operation coordination and transmission power adjustment coordination
  - UL/DL measurement enhancement

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Thanks