3GPP TSG RAN Meeting #93-e **RP-212465**
Electronic Meeting, September 13-17, 2021

Agenda Item: **9.0.2**

Source: **Lenovo, Motorola Mobility**

Title: **On scope of network energy savings in Rel-18**

---

1 Introduction

In RAN Rel-18 workshop, we proposed study on network power savings in Rel-18 [1]. During RAN#93-e Rel-18 preparation email discussions, RAN discussed potential scope of a study on network energy savings, which includes network energy consumption models, evaluation methodology with potential KPIs, deployment scenarios to be considered, and potential techniques and features to enable network energy saving.

This contribution provides our views on how 3GPP RAN can successfully enable network energy saving features in Rel-18.

2 Discussion

To enable semi-static and/or dynamic adaptation of transmissions and receptions by gNB in time, frequency, spatial, and power domains, following example areas were mentioned by companies during email discussions:

- Spatial domain
  - Dynamic TX/RX port/panel/beam adaptation including ON/OFF
  - Radiation shaping patterns, on-demand beamforming
  - CSI-RS enhancement
  - CSI measurement/report enhancement
- Time domain
  - Micro Tx OFF, dynamic symbol or subframe switch off
  - Reduced number of active symbols including for beam training
  - Wake-up signal for gNB, gNB/TRP/beam dormancy and efficient offloading
  - Broadcast/common signal periodicity adaptation
- Frequency domain
  - CA/DC adaptation, including with UE assistance information
  - Reduce SIB/paging transmission in some carriers
  - Dynamic TX/RX bandwidth adjustment
- Power domain
  - Improving PA efficiencies at gNB and related processing at gNB/UE

- Improving PA efficiencies at UE
- Dynamic DL power control

One approach to trigger dynamic and/or semi-static adaptation is based on measurements/reports on RAN signals and channels and RAN based communications. For examples, proposals of CSI-RS enhancement, CSI measurement/report enhancement, wake-up signal for gNB, and UE assistant information correspond to the RAN based adaptation triggering approach.

Another approach to trigger adaptation is to exploit non-3GPP means such as UE location identifications based on non-3GPP positioning technologies and various sensors, e.g. radar and camera, and UE movement and traffic prediction using artificial intelligence (AI) and machine learning (ML). We expect that these non-3GPP technology or network implementation-based adaptation triggering methods could be very powerful and allow 3GPP/RAN to enable network energy saving features quickly in a Rel-18 timeframe with less specification efforts. That is, Rel-18 NR RAN specs can simply provide a network with means to dynamically and/or semi-statically adapt transmission and/or reception settings without specifying many triggering mechanisms.

Observation: Non-3GPP technology or implementation-based adaptation triggering methods could be very powerful and allow 3GPP/RAN to enable network energy saving features quickly in a Rel-18 timeframe.

Proposal 1: Rel-18 network energy savings work focuses on allowing a network to dynamically and/or semi-statically adapt transmission and/or reception settings without specifying many triggering mechanisms.

For power domain adaptation, some companies proposed enhancing gNB and UE power amplifier (PA) efficiencies and studying how to achieve optimized power efficiency of transmissions. In our view, a network energy consumption model can take into account the gNB PA efficiency, and each company can include gNB PA characteristic-aware DL scheduling for network energy consumption evaluation. To study trade-off between network energy efficiency and UE energy efficiency, UE PA characteristic-aware UL scheduling can be further included in the evaluation, and evaluation results can be compared with network energy consumption evaluation results without considering the UE PA efficiency.

Proposal 2: Do not include gNB and UE PA efficiency enhancement in a work scope. Instead, take into account gNB and UE PA efficiencies in energy consumption evaluation.

3 Conclusion

In summary, we propose the followings for Rel-18 network energy savings work:

Observation: Non-3GPP technology or implementation-based adaptation triggering methods could be very powerful and allow 3GPP/RAN to enable network energy saving features quickly in a Rel-18 timeframe.

Proposal 1: Rel-18 network energy savings work focuses on allowing a network to dynamically and/or semi-statically adapt transmission and/or reception settings without specifying many triggering mechanisms.

Proposal 2: Do not include gNB and UE PA efficiency enhancement in a work scope. Instead, take into account gNB and UE PA efficiencies in energy consumption evaluation.

4 References

[1] RWS-210398, “Network power savings in NR”.