3GPP TSG RAN #102

Edinburgh, UK, December 11 – 15, 2023

RP-233325

Discussion on Rel-19 Network Energy Saving Enhancements

Agenda Item:	9.1.1.5
Source:	Intel Corporation
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Motivation & Justification

- Extensive study on network energy saving was conducted during Release 18, and technical report TR38.864 [1] was published internally in 3GPP. Based on the technical report Release 18 work item for network energy saving was approved and work scope was defined [2].
- During Release 18 study item on network energy savings, several potential enhancements in time, frequency, spatial, and power domains were identified.
- However, only few potential enhancements were selected for Release 18 work item.
- The Release 18 work item for network energy saving was targeted to be complete in 9 months and because of this a limited number of potential enhancements identified from the study item were selected as part of the scope.
- For Release 19, it will be beneficial to pick up some of the potential enhancements that provided good energy saving gains that were unfortunately not selected as part of the Release 18 work item.
- We believe there is still significant interest in the industry to reduce network energy consumption. Therefore, we suggest focus to further work on enhancements in Release 19.

[1] TR38.864 v18.1.0, "Technical Specification Group Radio Access Network; Study on network energy savings for NR," 3GPP, March 2023.
[2] RP-223540 New WID: Network energy savings for NR

Guidance from RAN Chair

- RAN Chair has provided some guidance for further discussion on the scoping of the objectives [RP-232745]

- Following are the suggested baseline for further discussions:
  1. On-demand SSB transmission for Scell for connected UEs
     - Possible triggering methods (e.g., UE uplink wake-up-signal using an existing signal/channel, cell on/off indication via backhaul, Scell activation/deactivation signaling, etc.)
  2. On-demand SIB1 transmission for idle UEs
     - Possible triggering methods (e.g., UE uplink wake-up-signal using an existing signal/channel, cell on/off indication via backhaul, Scell activation/deactivation signaling, etc.)

- Other aspects was left for further discussions during RAN#102

General Direction for Rel-19 NES

- Objective 1 and 2 suggested by RAN Chair are basically intended for green-field deployments. However, being able to improve NES for deployments that also service legacy UEs is equally important, and arguably more important.
- Rel-19 enhancements for NES should support a set of objectives that target both green-field and non-green-field deployment.
- Given that Rel-18 NES focused on energy saving for connected mode UEs, the Rel-19 additional improvement beyond Objective 1 and 2 suggested by RAN Chair should be focused on IDLE mode UEs and potential leftovers from Rel-18.
- We strongly suggest to additionally consider the following aspects for Rel-19
  - Adaptation of common signal/channel transmissions (documented in TR38.864)
  - Leftovers from Rel-18

Adaptation of Common Signals/Channels

- As shown in Appendix, the adaptation of common signals/channels can enable further improvements in energy saving for networks.
- Techniques discussed for PRACH and paging enhancements during Rel-18 study can be applied to cells that support legacy UEs. Therefore, can be applied for non-green field deployments.
  - The potential energy saving benefit will increase as more UEs in the network support the Rel-19 NES enhancements.
  - Coupled with changes to SSB/SIB1 in proposed Objective 1 and 2, the adaptation of PRACH and paging will eventually enable much more bursty transmission and reception of the gNB, enabling greater energy saving opportunities.
- Suggest to additionally support the following objective:
  3. Support of common signal periodicity relaxation and enhancements that enable gNB to increase the non-activity periods, including enhancements to PRACH and paging for Release 19 [RAN1/RAN2]
     - Enhancements for PRACH and paging should be able co-exist with legacy PRACH and paging transmission/reception in the same cell.

Leftover from Rel-18

- In RAN1 #114-bis, it was agreed the cell DTX/DRX operation is only applicable for sTRP.
  - This agreement was after extensive debate of potential specification changes required to support mTRP, and time left for completion of NES features for Rel-18.
  - From our understanding, the exclusion of mTRP was not due to lack of interest to enable mTRP for cell DTX/DRX operations.
- Since multi-TRP are important cell deployment options for the network, we strongly suggest to complete the leftover from Rel-18 to enable support for cell DTX/DRX for mTRP.
  - To limit the scope, we additionally suggest that same cell DRX/DRX pattern apply to all TRPs, and first start with supporting single cell mTRP scenarios.
  - Support of multi-cell multi-TRP scenario could be further checked later.
- Suggest to additional support the following objective:

  4. Support of cell DTX/DRX operation in single cell multi-TRP operation [RAN1/RAN2]
     - Same cell DTX/DRX pattern applies to all TRPs within a cell.
     - Support of multi-cell multi-TRP scenario to be checked in September 2024.

Potential Scope & Objectives

- Suggested Objectives:
  1. On-demand SSB transmission for Scell for connected UEs
     - Possible triggering methods (e.g., UE uplink wake-up-signal using an existing signal/channel, cell on/off indication via backhaul, Scell activation/deactivation signaling, etc.)
  2. On-demand SIB1 transmission for idle UEs
     - Possible triggering methods (e.g., UE uplink wake-up-signal using an existing signal/channel, cell on/off indication via backhaul, Scell activation/deactivation signaling, etc.)

- Suggested Objectives (cont.):
  3. Support of common signal periodicity relaxation and enhancements that enable gNB to increase the non-activity periods, including enhancements to PRACH and paging for Release 19 [RAN1/RAN2]
     - Enhancements for PRACH and paging should be able to co-exist with legacy PRACH and paging transmission/reception in the same cell.
  4. Support of cell DTX/DRX operation in single cell multi-TRP operation [RAN1/RAN2]
     - Same cell DTX/DRX pattern applies to all TRPs within a cell.
     - Support of multi-cell multi-TRP scenario could be checked later, e.g. September 2024.

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