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Views on Release-19 Network Energy Savings

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Excerpts from summary document RP-232615

Summary of the main directions proposed at RAN#101

- **One direction was proposed by almost all sources, with a few open questions**
 - On-demand SSB transmission and on-demand SIB1 transmission (documented in TR38.864)
 - Focus:
 - On-demand SIB1/[SSB] for idle UEs
 - On-demand SSB ([and possibly other DL signals]) for Scell for connected UEs
 - Possible triggering methods to be considered:
 - Based on UE uplink wake-up-signal (e.g. non-CA case), if so whether the WUS can be based on an existing signal (as a starting point, if possible) or a new signal
 - Based on cell on/off indication via backhaul
 - Based on Scell activation/deactivation signaling
 - Whether to target the design of a simplified SSB

Summary of the main directions proposed at RAN#101

- **Another group (G1) of proposals were contributed by nearly half of the sources (12~13)**
 - > [SSB]/SIB1-less operation in multi-carrier scenario for (documented in TR38.864)
 - [SSB]/SIB1-less for non-anchor NES cell for UEs in IDLE/INACTIVE state, where it is assumed that another carrier (an anchor cell) is available for the UE
 - Some discussion may be useful for the schemes when compared with on-demand SSB/SIB transmission, in terms of targeting scenarios, benefits etc.
 - Some concerns were expressed on this proposal in the offline drafting session
 - > Adaptation of common signal/channel transmissions (documented in TR38.864)
 - Proposals are fragmented between skipping transmission occasions, adapting periodicities/patterns, simplified/compact design of some channels
 - Proposals are fragmented on channels to target (e.g. SSB, SIB1, common PDCCH, paging, PRACH occasions)
 - Proposals are fragmented between dynamic or semi-static adaptation

Summary of the main directions proposed at RAN#101

- **A second group (G2) of proposals was contributed by 5~10 sources**
 - > Cell DRX/DTX for UEs in idle/inactive modes (as an extension of Rel-18 cell DRX/DTX)
 - Only 2 sources proposed to further identify additional physical channels to be turned off during non-active time of cell DTX/DRX in RRC Connected mode
 - Only 2 sources proposed dynamic switching among multiple cell DTX/DRX configurations. Note that there are still on-going Rel-18 discussion on this aspects.
 - Some concerns were expressed on this proposal in the offline drafting session
 - > Multi-TRP adaptation mechanisms
 - Proposals are fragmented and the scope could be very broad
 - Details could include measurements, CSI feedback, power control, PDCCH/PUCCH/PUSCH/PDSCH repetition, single-DCI based scheduling, multi-DCI based scheduling, SRS transmission, TCI configuration, beam management, beam failure recovery, radio link monitoring, cell (re)selection, handover, initial access, etc.
 - > Aspects discussed but not specified in Rel-18
 - Proposals are fragmented and very generic, including BM/TCI enhancements, UE complexity/CSI payload reduction, PUCCH resource adaptation

Summary of other directions proposed at RAN#101

- **A third group (G3) of proposals was contributed by just one or two sources, in many cases such techniques were not studied in Rel-18:**
 - UE group-common or cell-specific BWP configuration, adaptation and/or switching.
 - Group cell switch
 - Power domains studied in R18 (techniques D-2 ~ D-5)
 - Low-power SSB/SIB1/Paging
 - Extension of spatial and power domain techniques in 1) high load scenarios 2) Type-II codebook types
 - Semi-static beam-specific broadcast channel configuration
 - Scenario 2a for SSB-less
 - It was also mentioned that some proposals for multi-carrier enhancements may be beneficial for network energy savings (e.g. cross-carrier HARQ, fast DL carrier switch, multi-carrier CSI)
 - Extensions to network-controlled repeaters (NCR), e.g. backhaul/control link behavior for efficient interaction between NES-capable gNB and associated NCR, to consider the case where the gNB would operate with S/P-domain adaptation or cell DTX/DRX adaptation for NW energy saving

On-demand SIB1 transmission for idle UEs

- To reducing power consumption, gNB would transmit on-demand SIB1
 - On a camp cell, Idle UEs transmit on-demand SIB1 trigger. Then, gNB starts to transmit SIB1.
 - Specify procedures for on-demand SIB1 trigger.
 - e.g. if PRACH is used for the trigger, how RACH Occasion is determined without SIB1
 - Decide physical signal structure of on-demand SIB1 trigger (e.g. using PRACH or new signal).

On-demand SSB transmission for Scell for connected UEs

- Support on-demand SSB on Scell for SSB-less scenarios that have not been supported so far (e.g., FR1 non-collocated cells and FR2).
 - Specify mechanism for transmitting On-demand SSB trigger in another cell
 - On-demand SSB enables further power saving compared with the R18 NES which can deactivate only UE dedicated channels/signals.

Adaptation of common signal/channel transmissions

- The adaptation of common signals/channels allows gNB to increase sleep opportunity which achieves power consumption reduction based on the network load/UE traffic in a cell.
 - Identify the common signals/channels which can be adapted (e.g. SSB, SIB1)
 - Specify the adaptation schemes (e.g. periodicity, pattern) and triggering mechanism

On-demand SIB1 transmission for idle UEs

- Specify procedures for on-demand SIB1 trigger
- Decide physical signal structure of on-demand SIB1 trigger

On-demand SSB transmission for Scell for connected UEs

- Focus on developing mechanism for transmitting On-demand SSB trigger in another cell

Adaptation of common signal/channel transmissions

- Support adaptation of periodicity/pattern of common signals/channels

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