3GPP TSG RAN meeting #93e
Electronic Meeting
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Agenda Item: 9.0.2

RP-212427

Discussion on WUS/WUR for Release 18

Ericsson

Background

- The RedCap UE type specified in Rel-17 is designed with, e.g., the following use cases in mind:
  - Wearables
  - Industrial wireless sensors
  - Video surveillance

- A very energy efficient UE wake-up radio may be highly attractive for RedCap use cases where a very long battery life is important, especially when combined with low-latency requirements in downlink.
  - An improved UE energy efficiency will help improve battery lives and may even enable battery-less operation in some cases, which may be a highly attractive property, e.g., for many sensor applications.
  - A wake-up signal for waking up a low-power wake-up radio (at least in RRC_IDLE) would need to be specified to allow an extremely low power consumption in sleep mode, and possibly some extensions to the paging protocol to fully realize the potential gains.

Low-power WUS/WUR for RedCap UEs

- We support considering low power WUR/WUS in Rel-18 eRedCap as it matches well with the use cases of lower-end devices requiring low power consumption.
  - In some latency-sensitive applications, long DRX may not be a suitable solution for achieving the required battery life, e.g., industrial actuators for emergency stop.
  - Having a dedicated low power WUR with WUS can provide significant power saving gain.

- To maximize the power saving, we also see that cross-slot scheduling for paging message should also be considered as a complementary enhancement to maximize the benefit of WUR.

- For further discussion on our Rel-18 RedCap proposals, see:
  - RP-212424, "Motivation for Rel-18 WI on Enhanced RedCap", Ericsson
  - RP-212425, "New WID on enhanced support of reduced capability NR devices", Ericsson

Applicability for non-RedCap UEs

- Regarding whether this topic should be discussed in general and applicable to normal NR UEs as well, technology-wise, it may be argued that low power WUR can be useful in general.
- However, in our view, the gain for regular eMBB use cases may not be clear due to more frequent data activity and charging of MBB. We are open for the discussion on this.

- Therefore, we would like to see a strong emphasis on RedCap use cases.
  - In particular, the solution should enable an ultra-low power consumption WUR that enables devices to operate on harvested ambient energy, e.g., vibrational energy, photovoltaic energy, thermal-electric generated energy, etc.
  - If the WUR/WUS feature is specified within another SI/WI, our concern is that the work might not focus on RedCap use cases, and as a result, the solution might not be good enough for RedCap use cases.
  - Our view is that it is the best to keep WUR/WUS in RedCap and make sure the solutions are suitable for RedCap use cases, e.g., for enabling devices to operate on harvested ambient energy.

- We believe if the solutions are good enough for RedCap use cases, they can also be considered for non-RedCap use cases.

Study objective

- Considerations:
  - Rel-16/17 NR wake-up signal (WUS) mainly targets eMBB devices
    - The main receiver may be needed for detecting the WUS
  - Rel-18 WUS should target low-end IoT use cases
    - The solution should enable an ultra-low power consumption wake-up radio that enables devices to operate on harvested ambient energy, e.g., vibrational energy, photovoltaic energy, thermal-electric generated energy, etc.
  - It is preferred to put a strong emphasis on RedCap use cases.
    - When the solutions are good enough for RedCap use cases, they can also be considered for non-RedCap use cases.

- Objective: Study, and if found beneficial, specify techniques to enable ultra-low-power UE wake-up radio for RedCap UEs
  - Use cases, evaluation methodology & KPIs, and compatibility with other UE power saving solutions [RAN1, RAN2, RAN4]
  - Wake-up signal designs to support ultra-low-power wake-up receivers [RAN1, RAN2, RAN4]
    - The solutions may not be based on existing signals.
  - Protocol enhancements needed to support ultra-low-power wake-up receivers [RAN2, RAN3]
  - Potential network impact, such as network and other UE's power consumption, coexistence with Rel-17 RedCap and non-RedCap UEs, network coverage [RAN1, RAN2, RAN4]