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3GPP TSG RAN Meeting #94e RP-213271

e-Meeting, December 6th – 17th , 2021

Discussion on Rel-18 positioning enhancement

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Agenda Item: 8A.1

Arrangement for overloaded work in RAN1

- **Observations: Current list of Items that need evaluations in RAN1 is far beyond capacity**
  - Sidelink positioning for commercial, public safety, and V2X scenarios
  - Error sources and failure modes identification for RAT dependent integrity
  - PRS/SRS aggregation for positioning accuracy enhancement
  - Carrier phase measurements for positioning accuracy enhancement
  - Positioning for LPHAP requirements
  - Redcap positioning requirements
- **Proposal: the following alternatives are considered and clarified in WID to control the scope for Rel-18 positioning:**
  - Alt1: Arrange the work in RAN1 with a staggered pattern, with a late start for some of the items
    - E.g., late start for evaluation on “Error sources and failure modes identification for RAT dependent integrity”, “PRS/SRS aggregation for positioning accuracy enhancement” and “Redcap positioning requirements”;
  - Alt2: the following items are changed from RAN1 leading to other WG leading:
    - Consider RAN2 to lead the work on identification for “Error sources and failure modes for RAT dependent integrity”, triggering RAN1 work when necessary;
    - Consider RAN4 to lead the work on “PRS/SRS aggregation for positioning accuracy enhancement” and “Redcap positioning requirements”, triggering RAN1 work when necessary
  - Alt3: Remove some of the items for Rel-18 positioning enhancement

Sidelink positioning

- Support to keep the bullet of scenario/requirement
  - Serve the purpose of clarifying the scope of R18 Sidelink positioning regarding coverage, use cases, requirement and spectrum.

- Rel-18 work focuses on sidelink positioning on licensed/ITS band as a baseline version
  - Unlicensed band sidelink positioning has strong dependency on Rel-18 sidelink work (e.g. SL-U).
  - Support sidelink positioning on licensed/ITS band in Rel-18 as a baseline version. Then, based on the outcome of SL-U in Rel-18, further study sidelink positioning on unlicensed band in Rel-19.

- Support to include study of power efficient solutions for sidelink positioning
  - At least for the UE type of VRU and public safety device, the battery capacity is limited and power consumption for this kind of UE type needs to be minimized.
  - Power efficient solutions for this kind of UEs are strongly required.

Different UE types may have different power supply limitations, for example, a UE used by a vulnerable road user may have limited battery capacity compared to other types of UE, e.g., a UE installed in a vehicle or a road side unit. (TR38845)

The 5G access network shall support an energy saving mode with the following characteristics:(TS22261)
- the energy saving mode can be activated/deactivated either manually or automatically;
- service can be restricted to a group of users (e.g. public safety user, emergency callers).

Sidelink positioning- cont.

- The **modified objectives** are shown in the following

Draft WID objectives(RP-212706): Study (for study phase of 9 months) solutions for sidelink positioning considering the following: [RAN1, RAN2]

- Scenario/requirements [Moderator comment: These could be moved to the justification section in the final WID]:
  - Coverage scenarios to cover: in-coverage, partial-coverage and out-of-coverage
  - Requirements: Based on requirements identified in TR38.845 and TS22.261 and TS22.104
  - Use cases: V2X (TR38.845), public safety (TR38.845), commercial (TS22.261), IIOT (TS22.104)
  - Spectrum: ITS, licensed
- Identify specific target performance requirements to be considered for the evaluation [RAN1]
- Define evaluation methodology with which to evaluate SL positioning for the identified uses cases and coverage scenarios, reusing existing methodologies from sidelink communication and from positioning as much as possible [RAN1].
- Study and evaluate performance and feasibility of potential solutions for SL positioning, considering: [RAN1, RAN2]
  - Relative positioning, ranging and absolute positioning
  - Study of positioning methods (e.g. TDOA, RTT, AOA/D, etc) including combination of SL positioning measurements with other RAT dependent positioning measurements (e.g. Uu based measurements) [RAN1]
  - Study of sidelink reference signals for positioning purposes, including signal design, phy layer control signalling, resource allocation, physical layer measurements, associated physical layer procedures, etc [RAN1]
  - Study of positioning architecture and signalling procedures (e.g. configuration, measurement reporting, etc) to enable sidelink positioning covering both UE based and network based positioning [RAN2, including coordination and alignment with SA2 as required]
  - Study of power efficient solutions for UEs with limited battery capacity [RAN1, RAN2]
  - Recommend solutions, if any, to be specified in the normative phase [RAN1, RAN2]

Improved positioning accuracy and power efficiency

- **Integrity**
  - RAN1's work load should be minimized, especially for the evaluation work load in SI.
  - It is better for RAN2 to study error sources, failure modes, methodologies, procedures, signalling first. Then, if necessary, send LS to RAN1 as a guideline for further evaluation (e.g. impact of error sources, failure modes).
- **PRS/SRS aggregation**
  - This topic should be led by RAN4.
    - This topic was studied by RAN1 with the following conclusion, however, the applicability and feasibility in the actual scenario were not identified.
    - In order to avoid duplication of study, it is better for RAN4 to study the feasibility first; if it is proved to be needed, other groups can further participate in the normative work.

      > Aggregation of NR positioning frequency layers for improving positioning accuracy were investigated. Evaluation results show that aggregation of NR positioning frequency layers improves positioning accuracy under certain scenarios, configurations, and assumptions on modelled impairments as outlined in Clause 8.4. (TR38857)
  - Aggregation of intra-band continuous carriers is preferred.
    - This is a continuation of the work of Rel-17 positioning, so based on the conclusion of Rel-17 positioning, in this release, 'intra-band continuous carriers' should be supported or prioritized.

      > Simultaneous transmission by the gNB and reception by the UE of intra-band one or more contiguous carriers in one or more contiguous PFLs can be studied further and if needed, specified during normative work. (TR38857)
- **LPHAP**
  - Sub-bullets are needed to clarify the work of RAN1 and RAN2.
    - Study the requirements on LPHAP as developed by SA1 [RAN1, RAN2]
    - Evaluate whether existing RAN functionality can support these power consumption and positioning requirements [RAN1]
    - Based on the evaluation, identify potential enhancements to help address any limitations [RAN2, RAN1]

Improved positioning accuracy and power efficiency- cont.

- The **modified objectives** are shown in the following

Draft WID objectives(RP-212706): Improved accuracy, integrity, and power efficiency:

- Study (for study phase of 9 months) solutions for Integrity for RAT dependent positioning techniques [RAN2, RAN1]:
  - ~~Identify the error sources, failure modes, [RAN1, RAN2].~~
  - Study error sources, failure modes, methodologies, procedures, signalling, etc for determination of positioning integrity for both UE-based and UE-assisted positioning [RAN2, RAN1]
- Study (for study phase of 9 months) and, if found beneficial, specify solutions for accuracy improvement based on PRS/SRS bandwidth aggregation for intra-band contiguous carriers[RAN4, RAN1, ~~RAN4,~~ RAN2, RAN3]:
  - RAN4 to consider implications of PRS/SRS bandwidth aggregation (e.g. timing errors, phase coherency, frequency errors, power imbalance, etc).
- Study (for study phase of 9 months) and, if found beneficial, specify solutions for accuracy improvement based on NR carrier phase measurements [RAN1, RAN4, RAN2, RAN3]
  - Reference signals, physical layer measurements, physical layer procedures to enable positioning based on NR carrier phase measurements for both UE-based and UE-assisted positioning [RAN1]
  - Focus on reuse of existing PRS and SRS, with new reference signals only considered if found necessary
  - Signalling for configuration and measurement reporting [RAN2, RAN3]
- Study (for study phase of 9 months) and, if necessary, specify solutions for LPHAP [RAN2, RAN1]:
  - Study the requirements on LPHAP as developed by SA1 [RAN1, RAN2]
  - Evaluate whether existing RAN functionality can support these power consumption and positioning requirements[RAN1]
  - Based on the evaluation, identify potential enhancements to help address any limitations [RAN2, RAN1]

Positioning support for RedCap UE

- From scope control perspective, we don't see the need for the following in Rel-18 positioning considering there are already a lot of work in sidelink positioning and improved accuracy/integrity/power efficiency. We can consider them in future releases when there are more commercial needs.
- The modified draft WID is following

Draft WID objectives(RP-212706): Positioning support for RedCap UEs, considering the following:

- ~~Evaluate positioning performance of existing positioning procedures and measurements with RedCap UEs[RAN1, RAN4]~~
- ~~Based on the evaluation, assess the necessity of enhancements and, if needed, identify enhancements to help address limitations associated with for RedCap UEs [RAN1, RAN2]~~
- Define core and performance requirements for positioning measurements performed by RedCap UEs [RAN4]

THANK YOU.
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