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Motivation for New WID: UE Positioning Accuracy Enhancements for LTE

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Background for new WI proposal:
UE positioning accuracy enhancements for LTE

- UE positioning is recognized as an important feature for LTE networks due to its potential for massive commercial applications (for example intelligent transportation, entertainment, industry automation, robotics, remote operation, healthcare, smart parking and so on), as well as its relevance to regulatory requirements.

- This WI aims to deliver positioning enhancements in LTE to meet these diverse service requirements with improvements in positioning accuracy, availability, reliability, scalability and latency, with low network complexity and UE complexity.

Objectives of new WI proposal:
PRS-Only Beacon enhancements (1)

RSRP/RSRQ reporting for PRS-only beacon

Motivation

- Support E-CID positioning
- Support solutions (for example fingerprinting/proximity) used by WiFi/Bluetooth
- High accuracy indoor positioning (m-level for both horizontal and vertical positioning)
- Lower deployment cost compared to dense small cell deployment
- Lower UE complexity compared to OTDOA positioning

Specification Impact

- LPP enhancement to support RSRP/RSRQ reporting for PRS-only beacon

Objectives of new WI proposal:
PRS-Only Beacon enhancements (2)

Network synchronization to support indoor positioning using PRS beacons

Motivation

- Support TDoA-based positioning when PRS beacons cannot synchronise via GNSS

Specification Impact

- Sending timing measurements via enhanced LPPa
- Details of possible solution: Base Station time offset tracking
  - Enables high accuracy tracking of timing offset among infrastructure nodes
    - Step 1: The transmission points transmit PRS and record the transmission time;
    - Step 2: Each transmission point listens to PRSs from other transmission points and records the receiving time;
    - Step 3: Location server collects the transmission time in step 1 and receiving time in step 2 for relative timing offset tracking.

Objectives of new WI proposal:
Support of Inertial Measurement Unit (IMU) based positioning

IMUs are sensor units for motion capture using accelerometers and gyroscopes

- Introduce support for IMU measurements into LTE for hybrid positioning
- Enable IMU measurement results reporting to E-SMLC by LPP

Motivation

- Hybrid positioning (for example OTDOA/IMU, E-CID/IMU)
- High accuracy indoor positioning (m-level, or less)
- High reliability and availability for indoor positioning
- Potential to support high-speed vehicle positioning
- Massive commercial applications (IMUs are already used in a wide range of applications including vehicle navigation and motion capture, for humans, animals, robotics, etc).
- IMUs were already recognized as potential indoor positioning enhancement technique during the Rel-13 Indoor Positioning Enhancement SI.

Specification Impact

- LPP enhancement to support IMU measurement request/report
  - Note: The basic procedure for IMU measurement request/report in LPP could be similar to the basic procedures for GNSS, WiFi, Bluetooth, barometric measurement request/report in LPP.

Objectives of new WI proposal:
Support for Real-Time Kinematic (RTK) Assisted GNSS

Motivation

- RTK A-GNSS has been shown to provide GNSS positioning accuracy improvements from metre level to decimetre or even centimetre level in real-time
  - Based on the relative carrier phase of the satellite signals rather than the much longer satellite code phase
- Low UE complexity
- Network needs to provide UEs with accurate relative timing assistance information

Specification Impact

- LPP enhancement to support assistance information exchange for RTK GNSS.

Objectives of new WI proposal:
Positioning with low latency

Motivation

- Low positioning latency is useful in the fields of intelligent transportation, entertainment, industry automation, robotics, remote operation, healthcare, smart parking, etc.
- However, in LTE currently:
  - The shortest measurement reporting periodicity from UE to location server is 1s. Faster updates are appropriate for IMU-based hybrid positioning.
  - Locations of transmission points are known at the location server but not at the UE

Note that latency in positioning includes time to first fix, update frequency and reporting latency. The motivation of the proposals here is for improved latency with minimal specification impact.

Specification Impact

Shorter periodicity for measurement reporting from UE to location server, e.g.160ms

- LPP enhancement to enable shorter measurement reporting periodicity configuration

Send position information of network node (e.g. PRS-only beacon) to UE

- LPP enhancement to support signalling of position information of network nodes from location server to UE
  - Enabling real-time OTDOA position calculation at the UE side

Summary: Scope of new WI proposal: UE positioning accuracy enhancements for LTE

Objective

- PRS-only beacon enhancement
  - Specify PRS-based RSRP/RSRQ reporting to support E-CID involving PRS-only beacons [RAN1, RAN2, RAN4]
  - Identify and specify the network synchronization solutions to support indoor PRS-only beacons [RAN1, RAN3, RAN4]
- IMU positioning
  - Specify the signalling and procedure to support IMU positioning (including both network-based and UE-based) and its hybrid positioning. [RAN1, RAN2]
- GNSS positioning enhancement
  - Specify the signalling and procedure to support RTK GNSS positioning with the considerations of both UE and network complexity. [RAN1, RAN2, RAN3, RAN4]
- Positioning with lower latency
  - Specify the signalling and procedure with shorter measurement reporting periodicity in LPP [RAN1, RAN2, RAN4]
  - Specify the signalling and procedure to support UE-based OTDOA positioning [RAN1, RAN2]
- In addition, other enhancements to improve positioning accuracy will be studied, and agreed techniques will be specified.


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