3GPP TSG RAN Meeting #84

RP-191159

MOTIVATION FOR NEW WID: ENHANCEMENT ON NR POSITIONING SUPPORT

Intel Corporation

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Background on NR Positioning Work

NR Positioning Study Item

- Successfully completed in Dec'18
- Demonstrated feasibility of NR Uu based RAT dependent solutions
  - Horizontal Positioning
    - Indoor Scenarios < 3m @ 80%
    - Outdoor Scenarios < 10m @ 80%
- Aims to address regulatory and selected commercial use cases

NR Positioning Work Item

- Approved in Dec'18
- To be completed in June'20
  - RAN1 scope by Dec'19
- Work scope:
  - Reference signals, measurements, reporting and signaling to support
    - DL solutions: DL-TDOA, DL-AoD
    - UL solutions: UL-TDOA, UL-AoA
    - DL+UL solutions: Multi-cell RTT, eCID

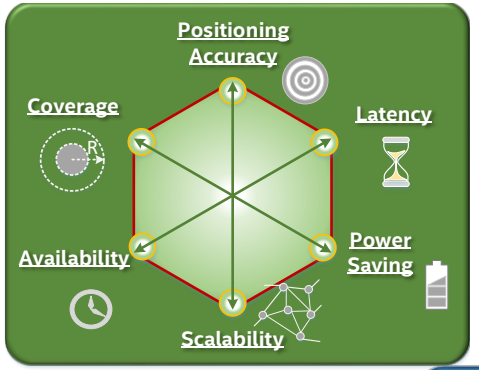
Overview

R16 Work Item on NR Positioning

- Basic Uu RAT dependent solutions for NR positioning in FR1 and FR2

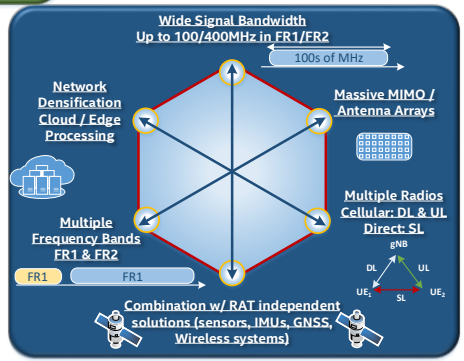
Additional Candidate Enhancements

- Sidelink based/assisted positioning
- Additional Uu enhancements
  - Enhancements from TR 38.855
  - RRC-Idle/Inactive UEs
  - Non-terrestrial network
  - Operation in unlicensed spectrum



Positioning applications have different KPIs that require support of different solutions

NR capabilities for RAT dependent positioning are not fully utilized yet



Emerging Vertical Segments

Emerging Technologies

- Strong interest in cellular system for communication / control / location

New Vertical Segments

- Drones (Unmanned Aerial Systems)
  - 3D Positioning
    - Vertical and horizontal positioning
    - Can be used to position other UEs
- Advanced V2X
  - Lateral & longitudinal positioning
  - Outdoor scenarios
- Industrial IoT (robotics)
  - Severe multi-path environment
  - Indoor factory scenarios
- Virtual / Augmented Reality
  - Indoor office scenarios

Emerging segments demand precise, reliable and low latency positioning

New/Additional Use Case

Additional Work Directions

- Support of NR positioning techniques in unlicensed spectrum
  - Wide free spectrum availability
- Support of NR RAT dependent positioning for non-terrestrial networks
  - Positioning reference signals integrated with communication protocol

New System Requirements

- Sub-meter level of horizontal and vertical accuracy of positioning
- Low latency positioning fix and frequent position update rate
- Accurate performance in severe multipath environments
- Mobile positioning targets

Work Item Scope and Objectives

Sidelink based positioning

- Define reference signals, measurements and signaling protocols to enable sidelink based ranging and positioning techniques
  - Relative and absolute positioning as well as proximity detection based techniques

Enhanced Uu based RAT dependent positioning technologies

- Enhanced measurements and reporting to facilitate more precise reliable positioning
  - Including support of super-resolution techniques
- Positioning support in RRC IDLE and INACTIVE states

Extension of NR positioning support in unlicensed spectrum

- Definition of gNB and UE behaviors for NR positioning support in unlicensed spectrum

Analysis and extension of NR positioning for non-terrestrial networks

INITIAL EVALUATION RESULTS

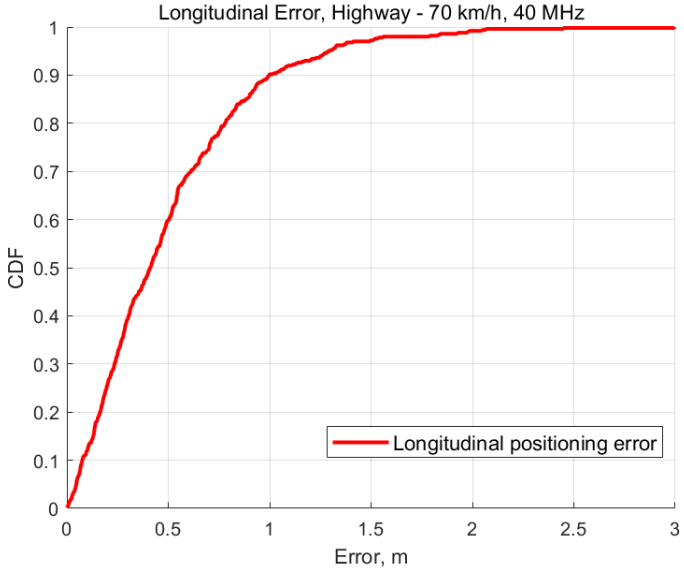
System Level Evaluation

Evaluation of Sidelink based NR Positioning in V2X Scenarios

Scenario Description

- Highway deployment scenario
  - NR V2X channel models
- RSUs deployed along road (100m)
  - Sidelink ranging w/ RSUs
- Numerology
  - FR1 5.9GHz, 40 MHz BW, one symbol, 15kHz SCS
- One shot positioning

Ranging w/ RSUs – Longitudinal Error



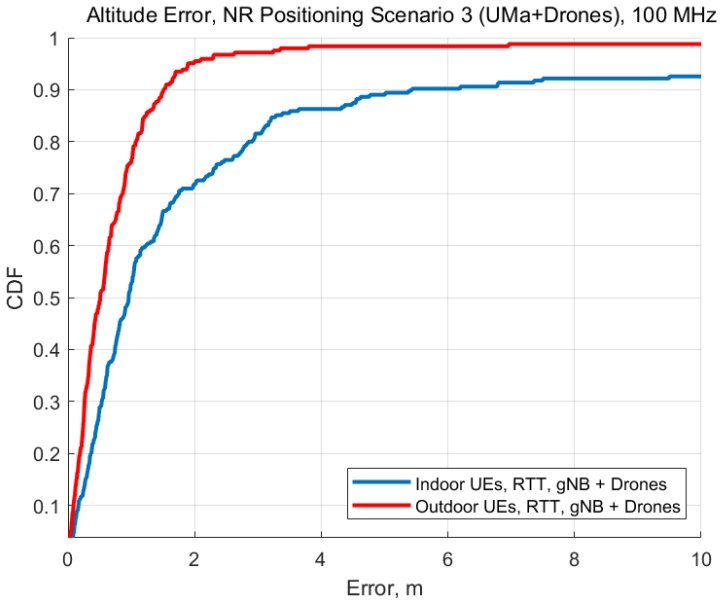
Further performance improvement is expected if tracking is applied and FR2 is used

Evaluation of Vertical Positioning UMa Scenario with Drones

Scenario Description

- NR Positioning - UMa Deployment Scenario 3
  - Additional nodes:
    - ~35 of drones are dropped per deployment w/ known coordinates [24-300]m
  - Drones assist UE positioning
- Numerology
  - FR1 4GHz, 100 MHz BW, one symbol, 30kHz SCS

Evaluation Results



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