



3GPP TSG RAN Meeting #77
Sapporo, Japan, September 11 - 14, 2017

RP-171815

Motivation for SI: Study on NR Positioning Support

Agenda Item: 9.1

Source: Intel Corporation

Document for: Discussion

Introduction

Location Based Services

Location is one of the most demanded and popular services nowadays

Modern mobile applications utilize location information to provide their services

Demand for accurate and fast location in indoor and outdoor scenarios is growing

Large number of application areas / industries where location is demanded

- Navigation systems and intelligent traffic routing
- Map and tourism applications
- Advertisement based on geo-location
- Tracking, delivery, logistics
- Public safety and regulatory



Large number of location services with diverse set of positioning requirements

Higher Accuracy Positioning – Requirements

Service requirements for the 5G (3GPP TR 22.862)

Higher Accuracy Positioning - TR 22.862 (5.4)

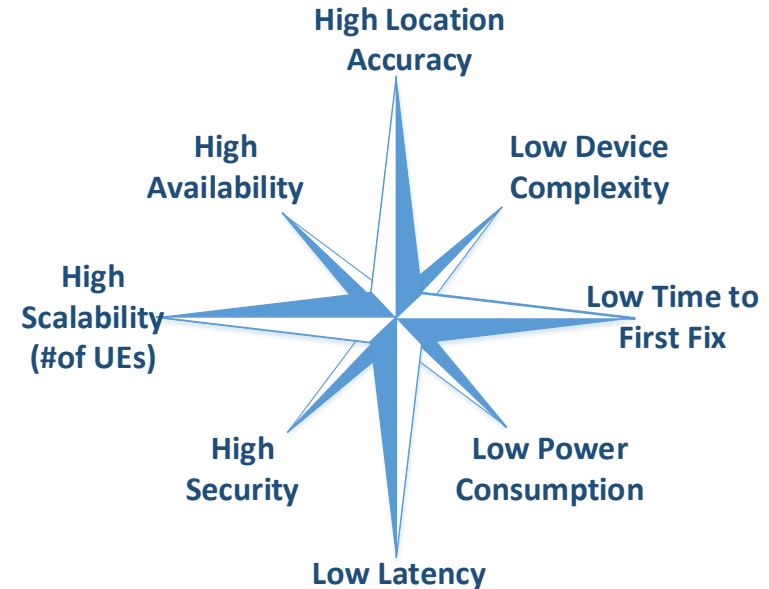
- Outdoor positioning for high speed
 - Mobility at minimum of 100 km/h
- Positioning for low speed moving
 - Indoor and outdoor environments
- Low altitude positioning (e.g. UAV)
 - Vertical and horizontal location
- Positioning for mIoT
 - High density (e.g. 1 million UEs per km²)

3GPP NR Positioning Targets TS 22.261 (7.3)

- Accuracy < 0.5m; acquisition time < 500 ms.
- Regulation requirements:

<http://www.fcc.gov/document/proposes-new-indoor-requirements-and-revisions-existing-e911-rules>

Requirements for NR positioning



Positioning Technologies

Accurate Positioning – Combination of Multiple Technologies

3GPP RAT Dependent Technologies – Main Focus of 3GPP RAN Studies

- Standalone NR based positioning (AoA, ToA, TDOA, RSRP, etc.)
- Assisted by LTE, etc.

3GPP RAT Independent Technologies

- GNSS (GPS, GLONASS, GALILEO, BEIDOU)
- Sensors (altimeters, barometers, camera, accelerometer, etc.)
- Other RATs (BT, Wi-Fi, etc.)

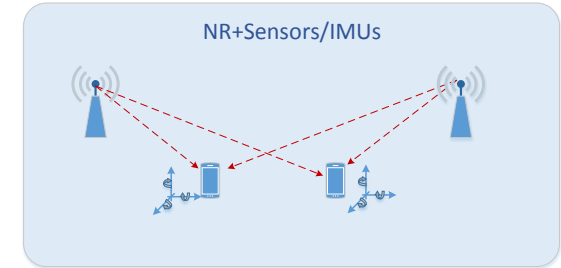
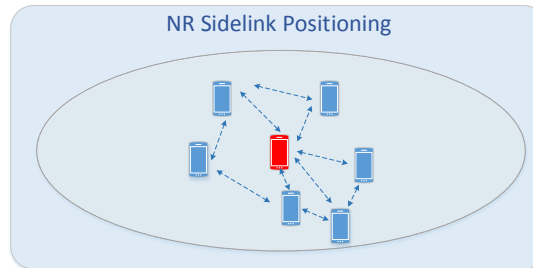
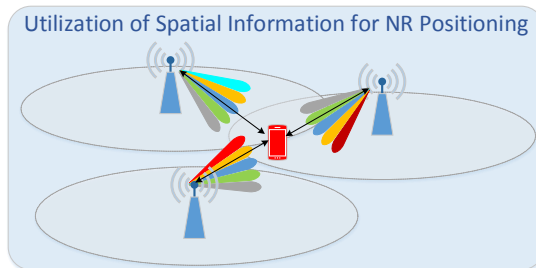
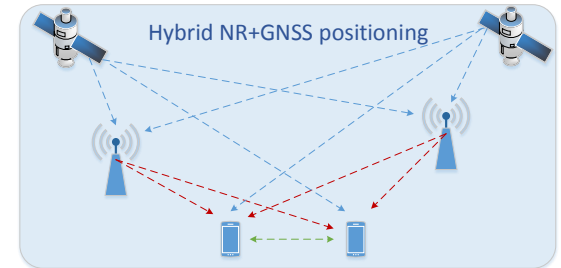
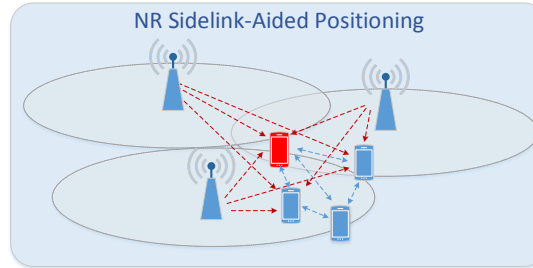
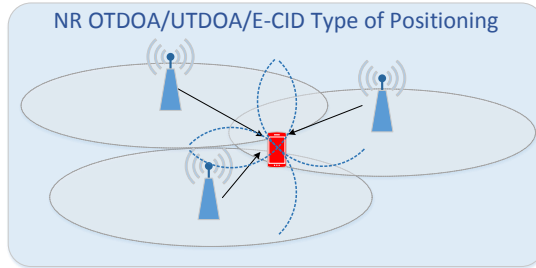
Hybrid Solutions

- Combination of NR with other positioning technologies (e.g. GNSS, etc.)

NR Based Radio-Positioning

NR study on positioning – focus on radio-layer solutions to assist user positioning

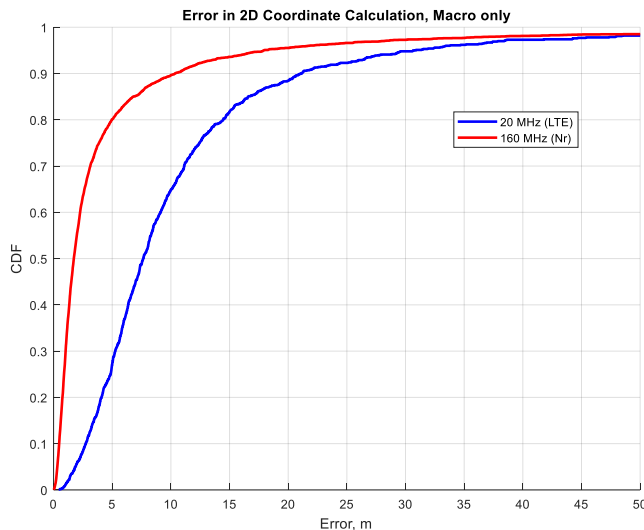
- NR positioning performance can benefit from wide signal bandwidth, massive MIMO technologies, sidelink processing and intelligent combining with other geo-location solutions/systems



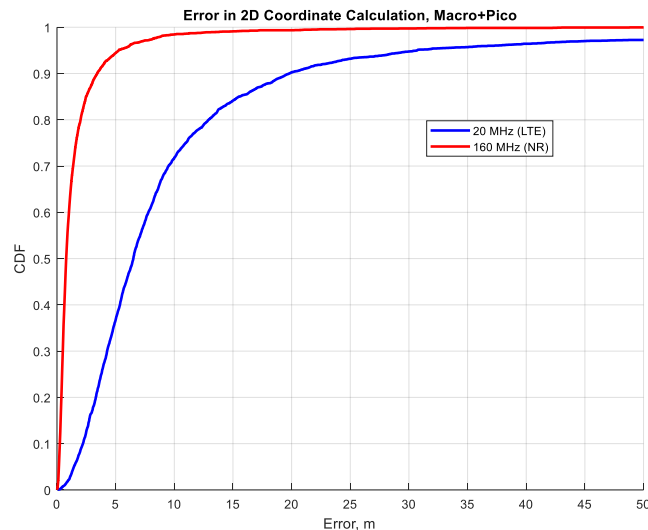
Initial System Level Evaluation Results

OTDOA Positioning

Macro only Scenario



Macro & Outdoor Pico Scenario



Conclusion

- Increased signal bandwidth can substantially improve positioning accuracy

NR Positioning

Study Item Scope

Evaluation methodology

- Indoor/outdoor scenarios, operating bands, UE dropping, performance metrics using TR37.857 as a starting point

RAT dependent positioning technologies and their combination

- Study performance and analyse design options for NR positioning (OTDOA, UTDOA, RTT, RSRP, Cell ID, etc.)

NR positioning protocols, architecture, signalling

- Study of NR positioning architecture for location services, functional interfaces, protocol and procedures for supporting RAT dependent, RAT independent, and hybrid of RAT dependent and independent positioning technologies

NR positioning support in standalone (NR only) and mixed LTE-NR deployments

NR Positioning

Timeline

Initiate study on NR positioning technologies in R15

Start normative work on NR positioning technologies in R16

2016	2017				2018				2019			
Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4

NR Positionign Study Item

NR Positioning Work Item

Backup

OTDOA Evaluation Assumptions

System Level Analysis

Parameter	Value
Deployment Scenarios	Scenario 1: Macro Only (i.e. Case 1A from TR 37.857) Scenario 2: Macro + Outdoor Pico (i.e. Case 1C from TR 37.857)
Carrier Frequency	2 GHz
Bandwidth	20 MHz, 160MHz
SCS	15 kHz
Number of gNB TX antennas	1
Number of UE RX antennas	2
Positioning Reference Signal	LTE like PRS signals, (No interference)
Timing estimation	Single shot
Channel model	Channel Model from TR 37.857 on Indoor Positioning Enhancements
First path detection	Practical timing estimation
Geo-location	OTDOA based on Taylor Series Expansion Method

