3GPP TSG RAN Meeting #75
Dubrovnik, Croatia, 6 – 9 March 2017

RP-170423

Motivation for SI: Study on NR Positioning Technologies

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

Overview of 3GPP TR 22.862

Higher Accuracy Positioning – Requirements

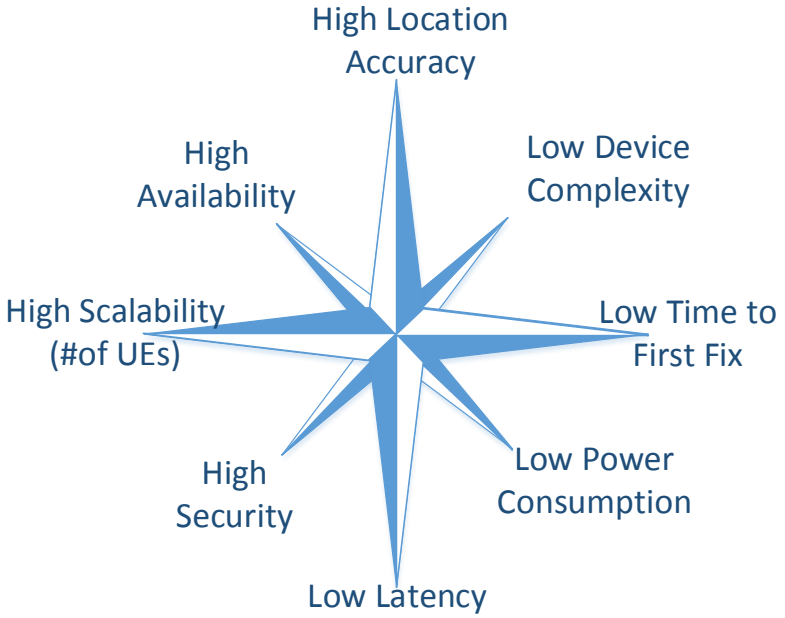
Higher Accuracy Positioning [22.862]

- 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 [22.261]

- 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 Independent Technologies

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

3GPP RAT Dependent Technologies

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

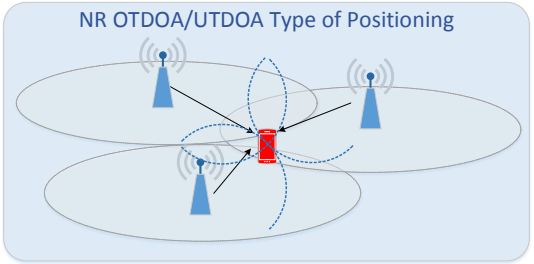
Hybrid solutions

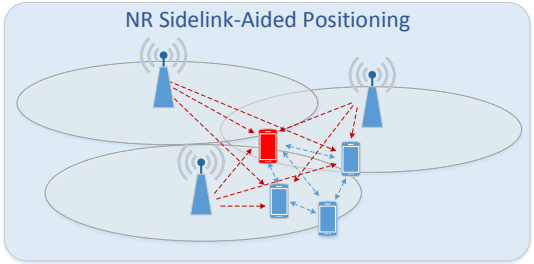
- Combination of NR with other positioning technologies (e.g. GNSS, etc.)

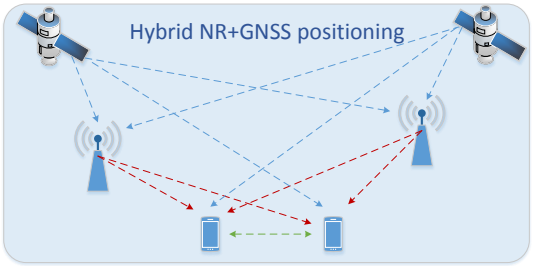
NR Based Radio-Positioning

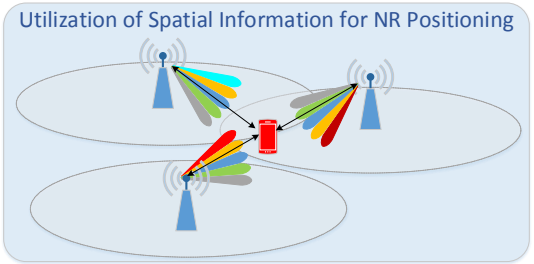
NR study on positioning should analyze different approaches to user positioning

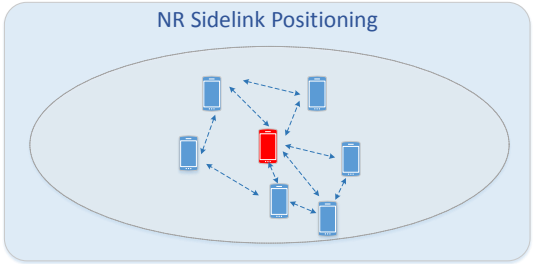
- NR positioning performance can benefit from wide signal bandwidth, massive MIMO, sidelink processing and intelligent combining with other geo-location solutions/systems

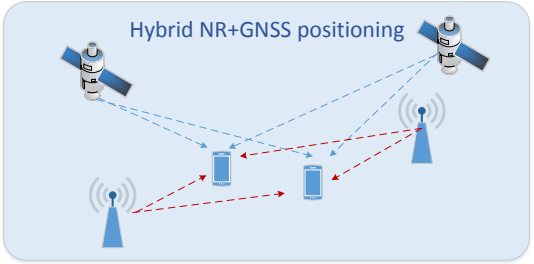








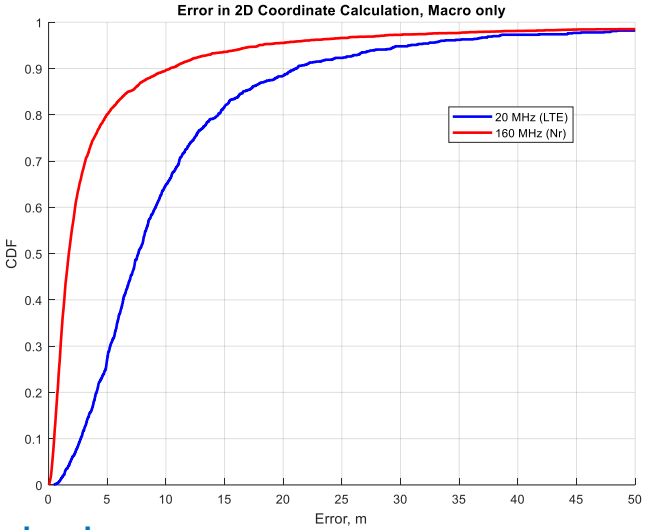




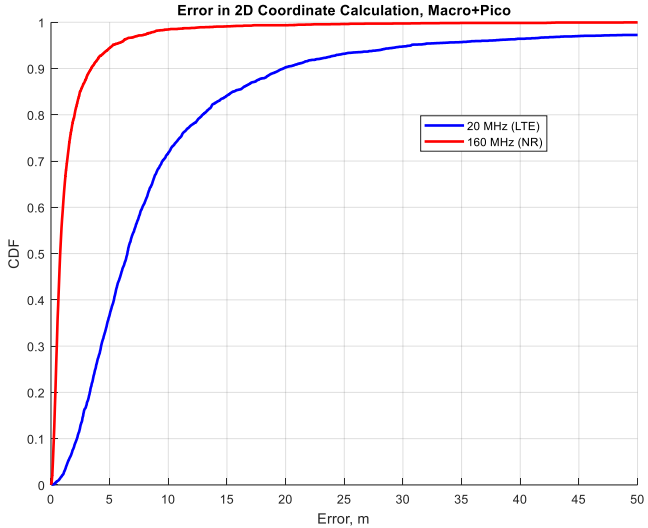
Initial System Level Evaluation Results

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

RAT dependent positioning

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

Hybrid positioning

- Study benefits of hybrid RAT dependent & RAT independent solutions (e.g. OTDOA and GNSS, etc.)

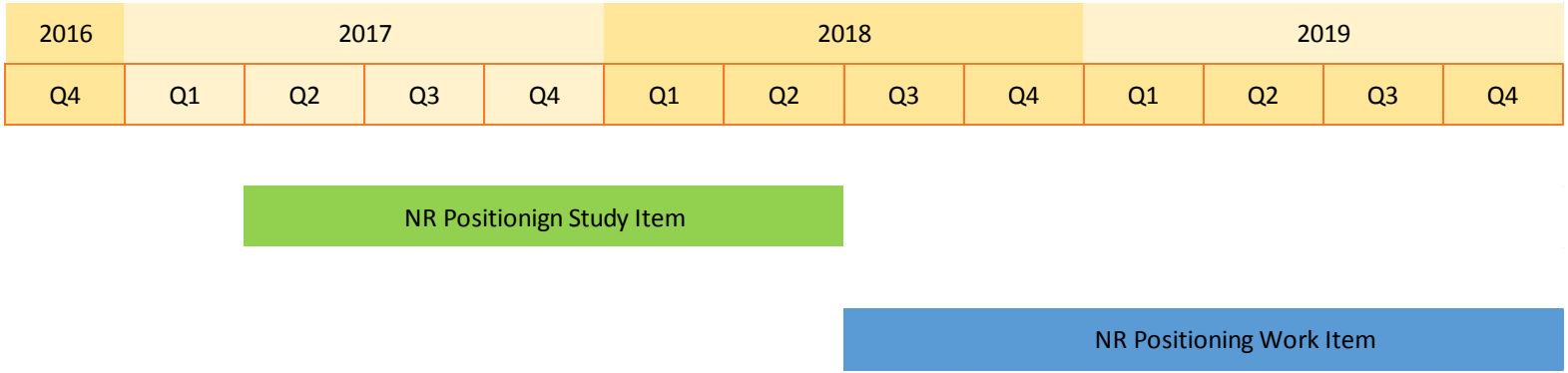
NR positioning protocols, architecture, signalling

NR Positioning

Timeline

Initiate study on NR positioning technologies in R15

Start normative work on NR positioning technologies in R16



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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