

# Integrating sensing and communication in NR

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# Motivation on Integrated sensing and communication (ISAC)

## □ Motivation:

ISAC provides one set of devices with the new type of service combining of communication and sensing on the basis of 5G network. ISAC is designed to utilize NR bands (FR2, FR1) to provide consumers with new type of sensing capability, e.g. objective detection, tracking and monitoring. ISAC can provide new service at a low cost of supporting the integrating of the sensing function for commercial deployed gNB in 5G network.

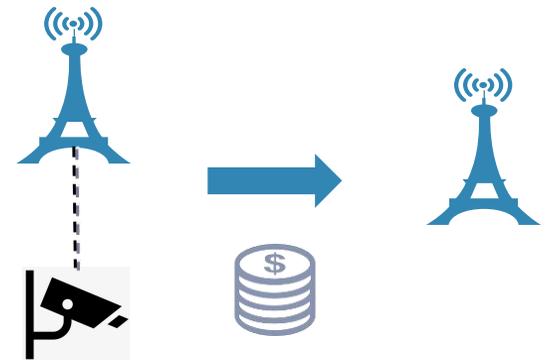
## Technical advantage for 5G network to support ISAC



**High quality sensing and communication services**



**Better coverage for 5G to provide good sensing quality**

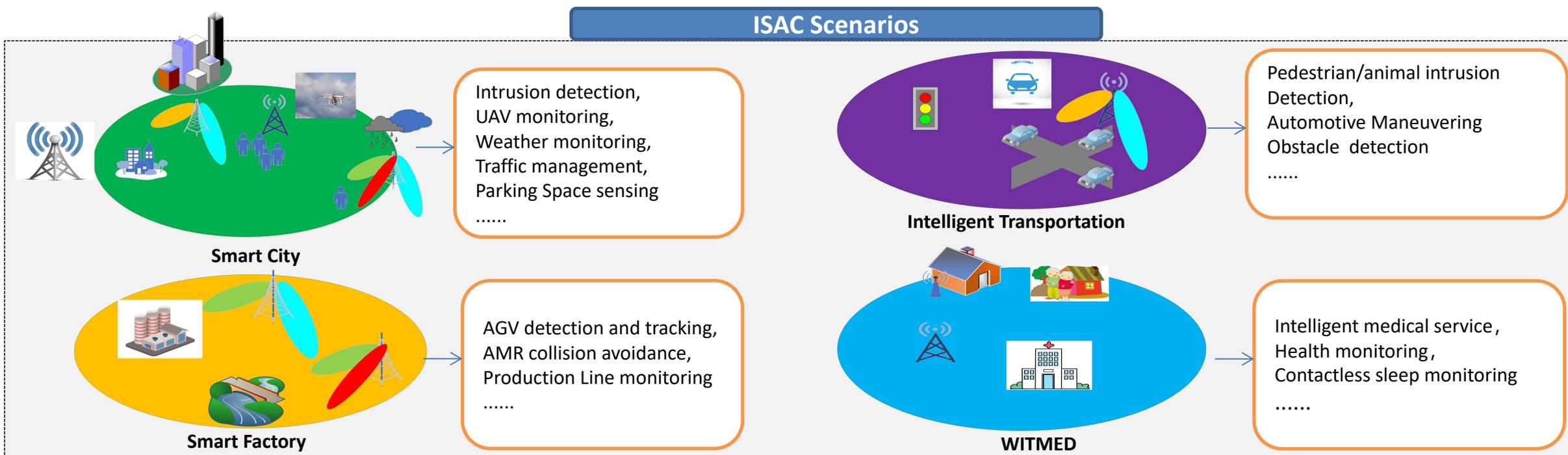


**Lower cost for networking and data transfer using one device**

# Scenarios of Integrated sensing and communication (ISAC)

## □ Scenarios

➤ R19 focus on the following scenarios: smart city, intelligent transportation, WITMED, smart factory.



# Sensing mode of ISAC for Rel-19

## Overall architecture of different sensing modes:

- gNB sensing mode: gNB mono-static sensing, gNB bi-static sensing, UE to gNB bi-static sensing;
- UE sensing mode: gNB to UE bi-static sensing, UE bi-static sensing, UE mono-static sensing.

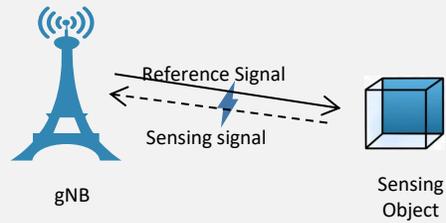


Fig 1: gNB mono-static sensing

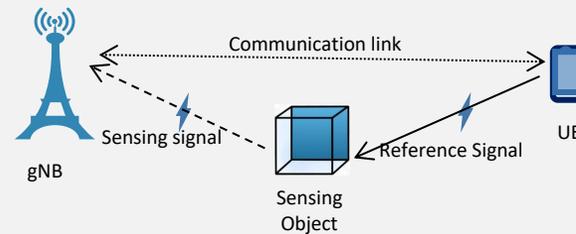


Fig 3: UE to gNB bi-static sensing

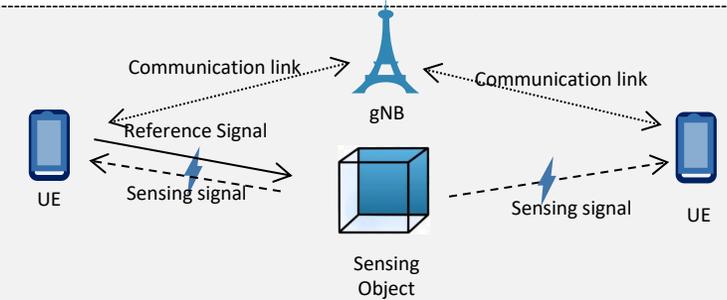


Fig 5: UE bi-static sensing

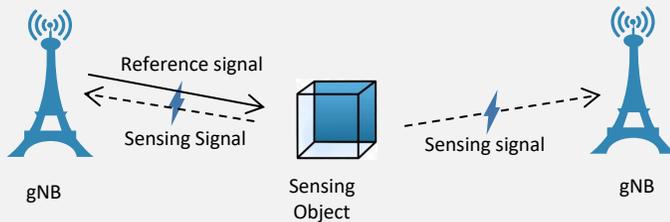


Fig 2: gNB bi-static sensing

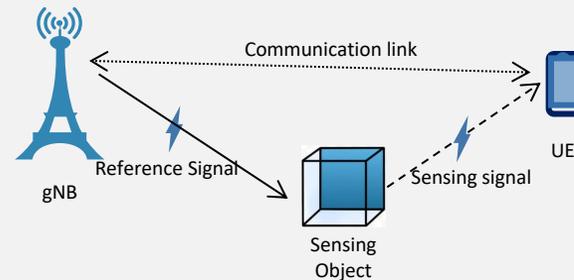


Fig 4: gNB to UE bi-static sensing

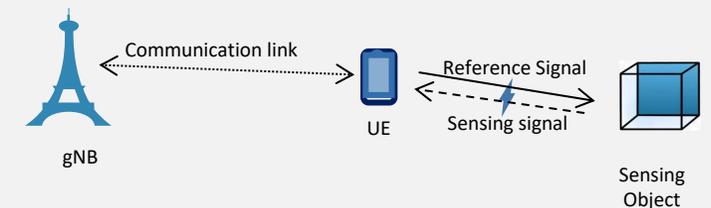


Fig 6: UE mono-static sensing

# Integrated sensing and communication (ISAC)

## □ Common parts of positioning and ISAC:

- The NE in the core network can be reused;
- Part of the reference signal can be reused, e.g. PRS, SRS, etc;

## □ Differences between positioning and ISAC:

- Two solutions apply for different scenarios.
- Positioning is designed to monitor the UE registered in the network, while ISAC can sense the registered UE and objects in the service area;
- The QoS requirements are different: the accuracy is important for positioning, while there are a list of requirements for ISAC, such as accuracy, resolution, refreshing rate, missing detection rate, false alarm rate, etc.

# Integrated sensing and communication (ISAC)

## □ Initial considerations on the work plan of ISAC in RAN Rel-19

- 3GPP is target to design and support for the preliminary service of ISAC in Rel-19, otherwise, there are no competitive 5G new service for industry customs.
- One or separate Rel-19 SI+WI for ISAC :
  - RAN1 SI for channel modeling, evaluation and PHY layer design.
  - RAN3/2 SI+WI for ISAC related architecture and functionality.

# Integrated sensing and communication (ISAC)

## □ Objective One (SI in RAN1):

- Identify the target use cases and the corresponding KPIs for each use cases.
- Study on ISAC channel models (based on TR 38.901).
  - Study sensing signal and related channel modeling for gNB mono-static/ bi-static sensing, UE to/from gNB bi-static sensing;
- Performance evaluation of the identified KPIs for the target use cases in Rel-19.

Note: restrict the performance evaluation for typical use cases and the KPIs, e.g. accuracy, range, velocity and angle, if needed.
- Study the physical layer related design and specification impacts for ISAC.
  - Take the legacy reference signals (e.g. CSI-RS, SRS, PRS) as the baseline, evaluate the performance;
  - Study the necessary enhancement on RS, measurement quantities, to fulfill the performance requirements if needed( 2nd priority, or pending to Rel-20).
- Study the interference mitigation between sensing signals and between sensing signal and communication signal.
- Study synchronization between the transmitter and the receiver for bi-static sensing, multi-TRP, etc.

## □ Objective Two (SI first and a following up WI in RAN3/RAN2):

- Study and specify the ISAC potential architecture and functionality.
  - Study and specify the ISAC sensing architectures, e.g. gNB sensing (no UE involvement), gNB and UE coordinated sensing;
  - Study and specify to support sensing functionality, e.g. sensing resource configuration, sensing information report, etc;
  - Study and specify sensing service continuity when sensing object moving in/out the coverage of multiple gNBs.

Thanks