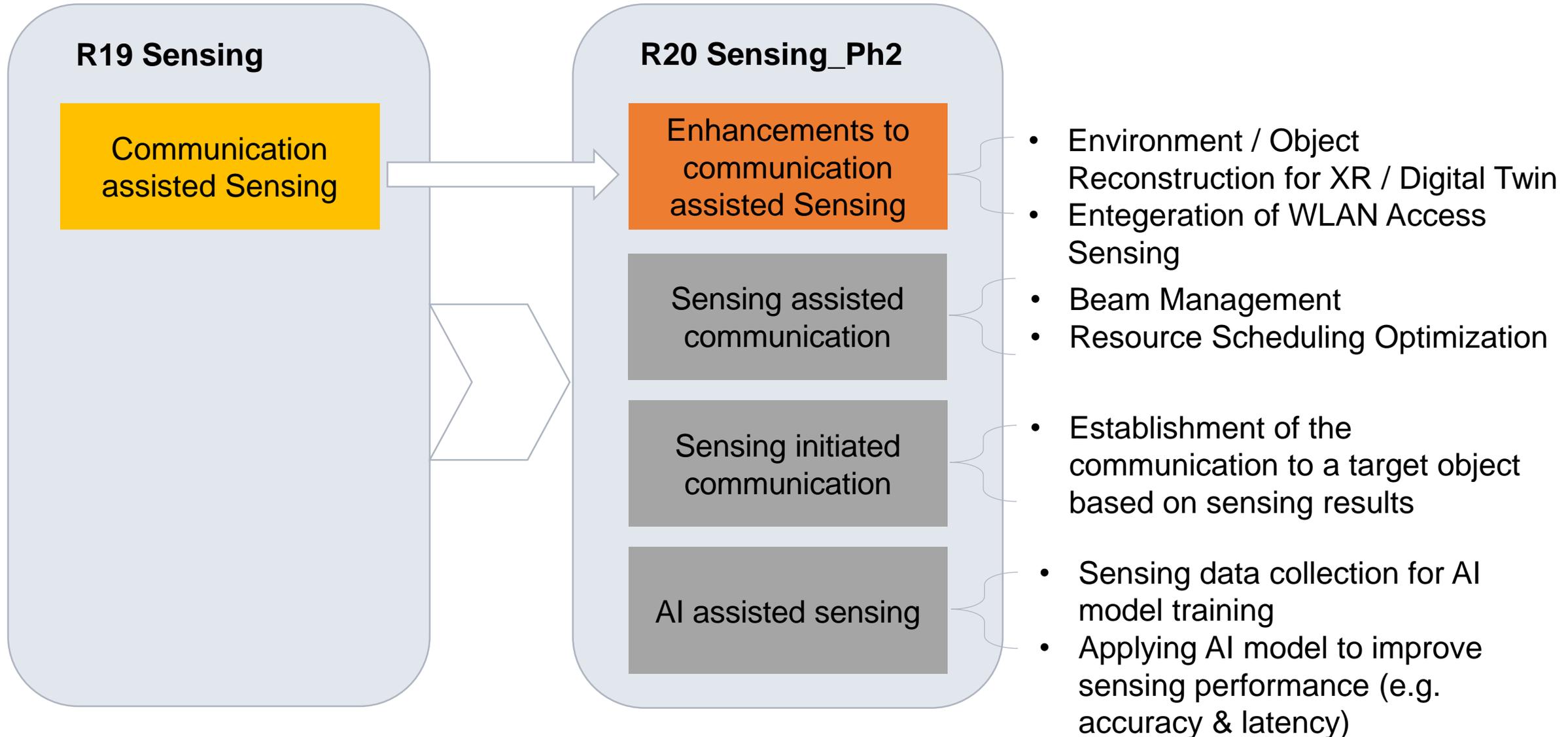


Integrated Sensing and Communication Phase 2

Xiaomi

Motivations, Use cases and Proposed Objectives

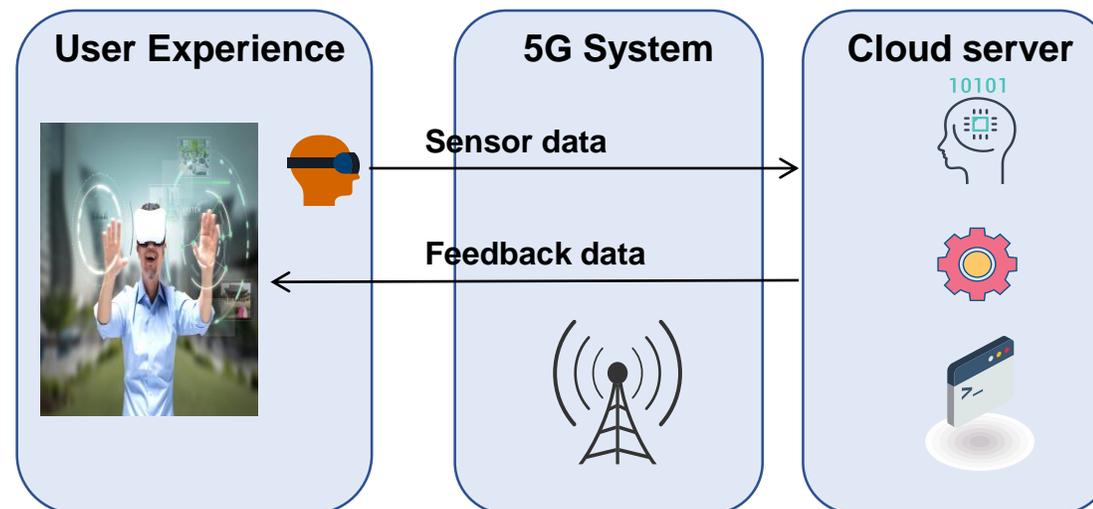
Motivations



Environment / Object Reconstruction for XR / Digital Twin

□ Use Case: Immersive experience

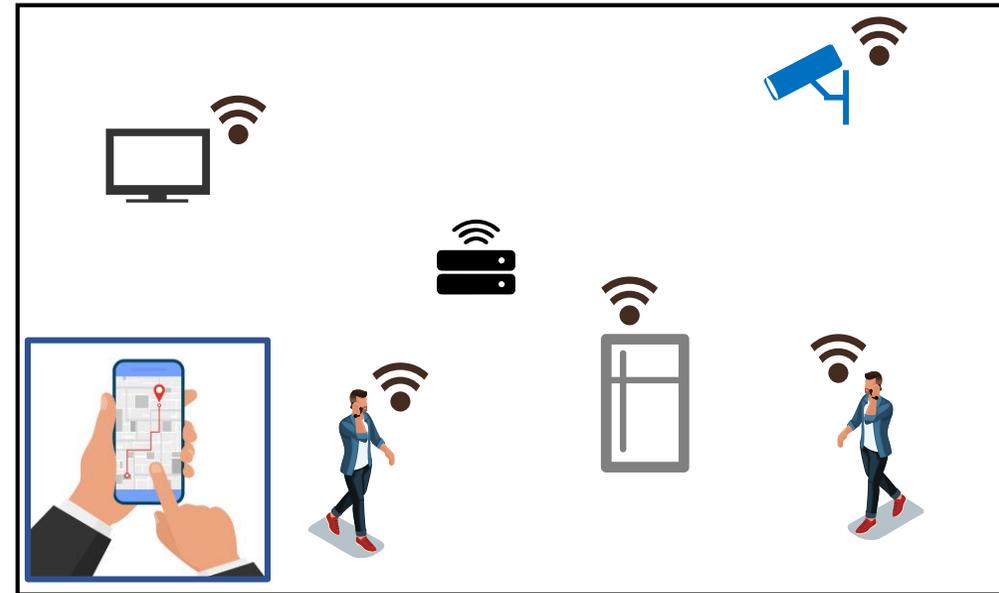
- With the broad usage of user immersive services, the requirements for improving user experience are increasing. Immersive services require higher sensing accuracy and lower latency due to the demand of interaction.
- Applying sensing technology in the immersive services can help capturing human body movements and other sensing information more accurately. The user interacts with application servers in real time to generate immersive content with extremely low latency to further improve user experience.



Integration of WLAN access sensing

□ Use Case: Indoor navigation

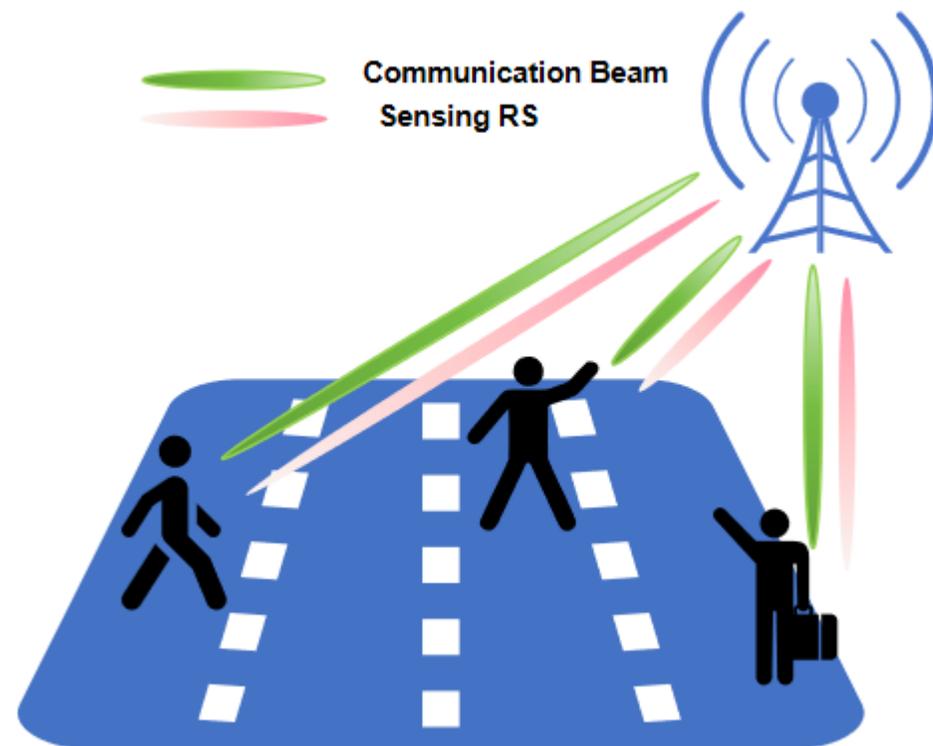
- WLAN devices are popularly deployed in public sites, especially the indoor environments where the cellular coverage is poor.
- In large buildings, airports, shopping malls and other public sites, by using WLAN access sensing, users can receive real-time 3D map, which can help navigating more easily and accurately.



Sensing assisted communication

Use Case: gNB and UE beam management

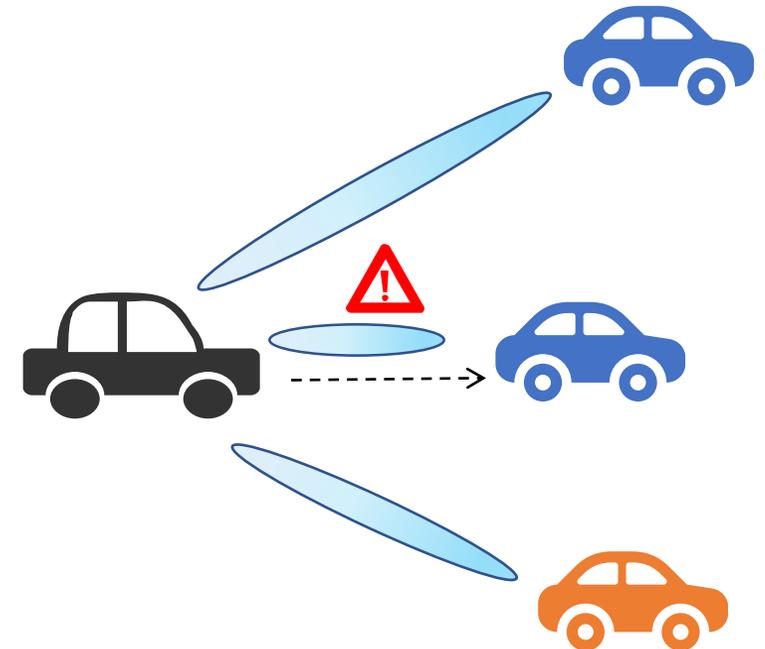
- Currently, broadcast channels, reference signals, etc. are transmitted and received using beamforming methods. The base station and UE need to measure beams of each other to ensure the beam transmission accuracy.
- Obtaining UE location information based on sensing can narrow the beam scanning range and shorten the beam training time.



Sensing initiated communication

□ Use Case: Call to cars based on sensing in V2X

- In some cases, an object with specific characteristics (e.g. location, distance/direction, color, shape...) may be a communication target. The characteristics can be sensed and then used to determine the communication target.
- A target object is communicated over Uu or PC5 when it matches with the sensed characteristics.
- For example, when Sam is driving on the road, the onboard system can detect the distance/direction of other vehicles by sensing. When the system discovers that certain vehicles are too close, it initiates communication with these vehicles to warn or prevent the potential collisions.



Proposed Objectives

- Study new use cases for:
 - Enhancements to Communication-Assisted Sensing, including
 - New use case categories requiring higher or different performance requirements, e.g. Environment / Object Reconstruction for XR / Digital Twin
 - Integration of WLAN access sensing
 - Sensing-Assisted Communication
 - Sensing-Initiated Communication
 - AI-Assisted sensing
- Identify potential service requirements, KPIs and performance requirements.
- Aspects related to security, privacy, regulatory requirements and charging.
- Gap analysis between the identified potential requirements and existing 5GS requirements or functionalities.

Annex

Use Case: Environment reconstruction

- Environmental reconstruction requires high sensing accuracy and resolution. Integrated sensing and communication technology can achieve accurate sensing of the physical world environment, including surrounding objects, animals, people, etc., and build a real virtual world based on the sensing data.
- As various behaviors occur in the physical world, the physical world environment is changing in real time, and the virtual world should also change accordingly. Integrated sensing and communication technology can timely and accurately capture environmental changes, as well as the changes to the multiple objects, and can reflect the changes to the virtual environment in real time.



Use cases: Smart Home

- WLAN not only provides connections to the network as a radio access technology, but also enables security and home care services at home using sensing technology.
- WLAN has the ability to sense the external environment and the objects, and is the key to successfully realize interactions of "things-things" and "human-things" in smart home.
- WLAN devices (e.g. UE or WLAN AP) detect sensing data using wifi sensing, collect the sensing data, and send the collected data to the network for further processing. The sensing data collected over wifi sensing can be combined with the 3GPP sensing data to generate the sensing result.
- WLAN access sensing can support the detection of multiple sensing characteristics, such as motion detection, human activity detection and recognition, and vital sign detection. It makes home life more intelligent and efficient.



Use cases: BS resource scheduling optimization

- The network can sense and predict the number of services and QoS requirements of users in the network based on service characteristics, user preferences, etc., and choose the optimal base station resource scheduling strategy.
- The base station can sense network status, UE status, and environmental status, etc. Optimize resource scheduling strategies based on sensing information, improve network service quality, and improve resource utilization.
- For example, by sensing the distribution of UEs within the cell, it can identify user density and mobility, and then determine the allocation and management of wireless spectrum, network resources, slicing, etc., enabling wireless resources to be scheduled to areas with higher demand and improving user QoS.



Use cases: Smart City Governance

- In the process of building a virtual world of a city, the data of the physical world environment is detected using 5G NR sensing, WLAN access sensing and/or non-3GPP sensing.
- A sensing AI model can be applied to improve performance of sensing, e.g. accuracy and latency.
- The sensing AI model may be trained using some specific sensing data; in that sense, the sensing data will be collected for the AI model training

