

vivo



Motivation for Rel-19 study on architecture enhancement for sensing

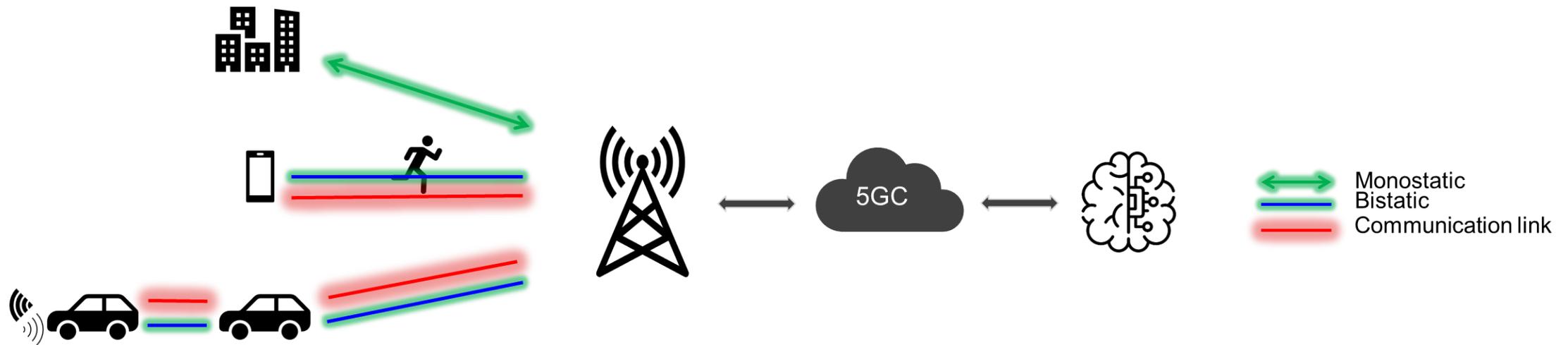
3GPP SA2#157

Berlin, Germany, 22 – 26 May, 2023

Agenda: 10.5

S2-2306458

- Wireless sensing technologies aim at acquiring information about a remote object and its characteristics without physically contacting it. The perception data of the object and its surrounding can be utilized for analysis, so that meaningful information about the object and its characteristics can be obtained.
- Integrated Sensing and Communication refers to the technologies that combine sensing and communication systems to utilize wireless resources more efficiently. ISAC provided by 3GPP 5G system means the sensing capabilities are provided by the same 5G NR wireless communication system and infrastructure as used for communication, and the sensing information could be derived from RF-based and/or non-RF based sensors.



- Intruder detection is a typical use cases that was proposed by several companies with different scenarios. This use case can be achieved via different sensing modes: BS monostatic, BS and UE bistatic, UE monostatic.
- Similar use cases are parking lot detection, UAV collision avoidance, AGV collision avoidance.

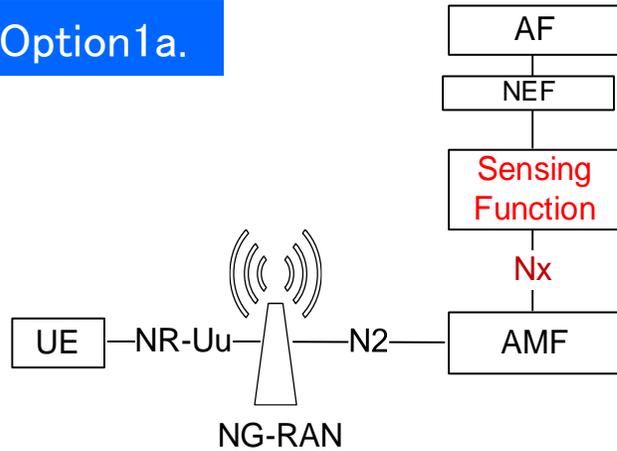
	Base station monostatic	BS and UE bistatic	UE Monostatic
Intruder detection	<p>Use case 5.2, higyway human/animal detection</p>	<p>Use case 5.7, railway human/animal detection</p>	<p>Use case 5.1, home intrusion detection</p>
Parking lot detection	<p>Use case 5.20</p>	<p>Use case 5.20</p>	<p>Use case 5.20</p>
Collision avoidance	<p>Use case 5.12, avoid UAV (UE, or not) collision to building/tree</p>	<p>Use case 5.13, avoid human (holding UE) collision to AGV</p>	

- SA1's ongoing FS_Sensing will start the consolidation work since SA1#102 in May 2023.
- There are 6 sensing modes: (were discussed in SA1 once, but more appropriate to be discussed in SA2)

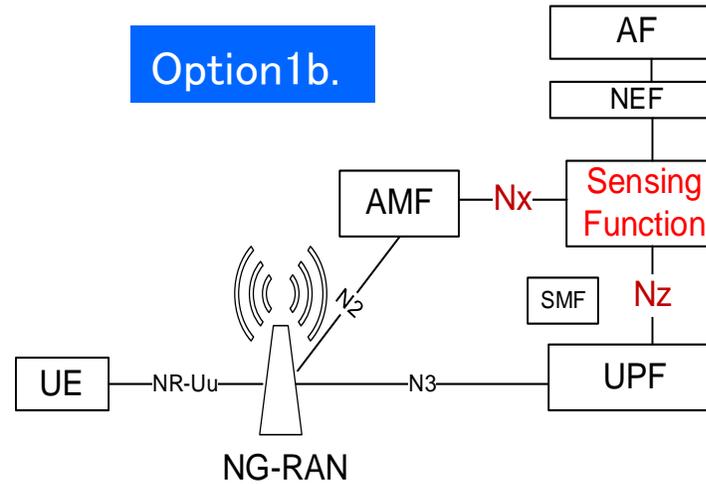
Base station oriented	Base station and UE	UE oriented
<p>1) gNB-to-gNB, monostatic</p>	<p>3) gNB-to-UE, Bistatic</p>	<p>5) UE-to-UE, Monostatic</p>
<p>2) gNB1-to-gNB2, bistatic</p>	<p>4) UE-to-gNB, Bistatic</p>	<p>6) UE1-to-UE2, Bistatic</p>

- SA1 has common consensus that sensing mode (monostatic/bistatic) will not be specified/mentioned in the requirements. Solution-oriented description will restrict downstream workgroups, i.e., SA2 will decide the architecture for sensing.
- **vivo's preference:** Architecture should flexibly support the different sensing modes i.e. BS monostatic, BS and UE bistatic, UE monostatic and at least support sensing mode 1), 3), 4) in R19 if time is limited

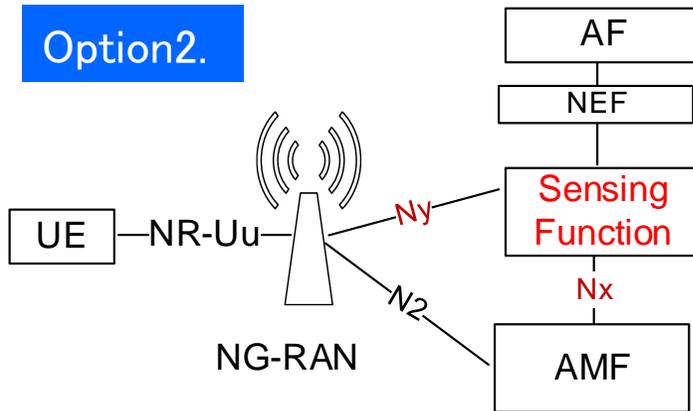
Option1a.



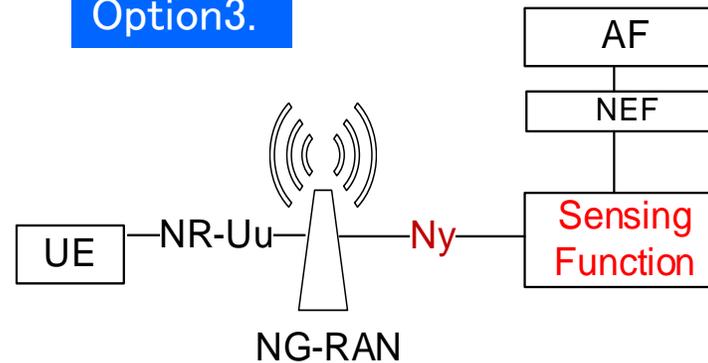
Option1b.



Option2.

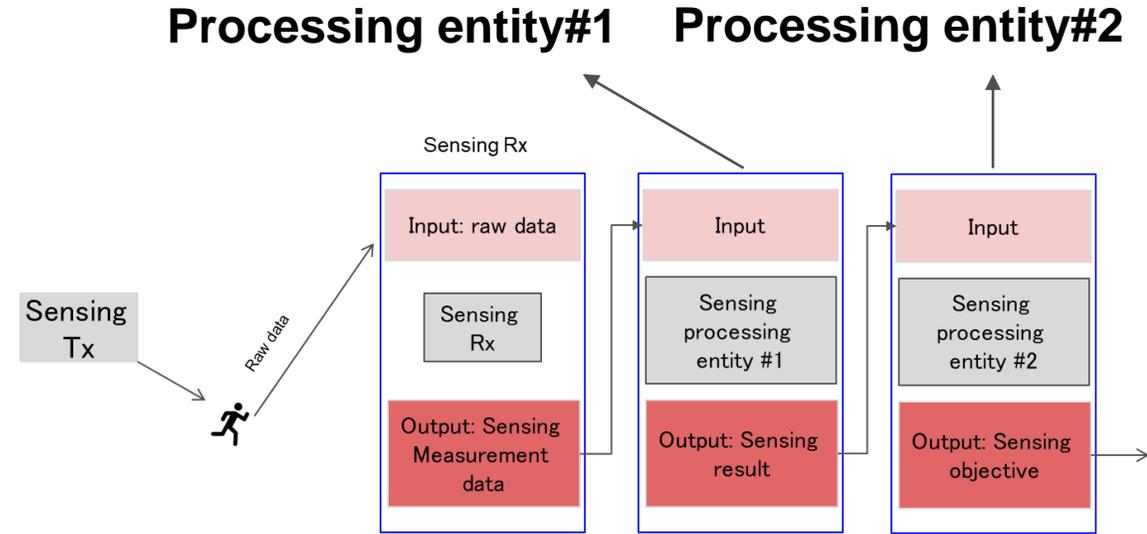
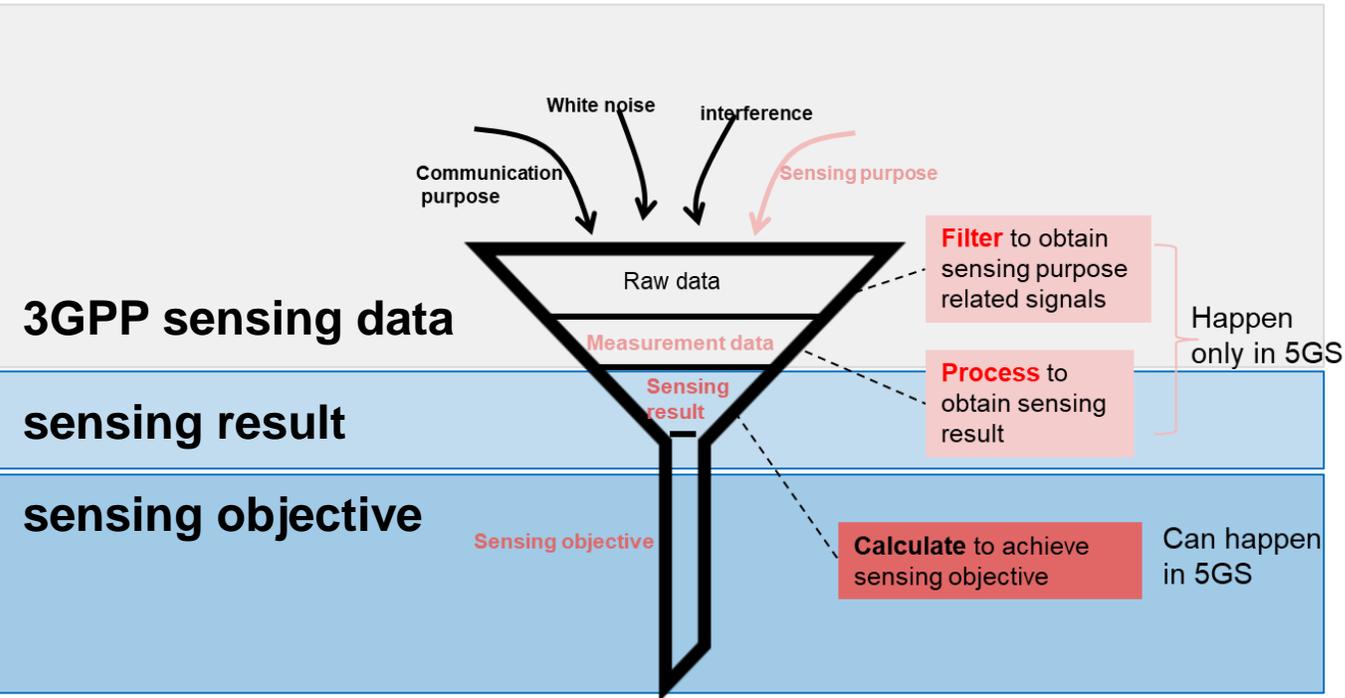


Option3.



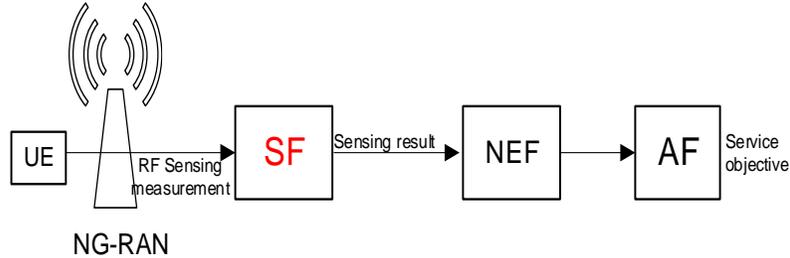
Nx → interface between AMF and SF
 Ny → interface between RAN and SF
 Nz → interface between UPF and SF

- **vivo's preference:** prefer Option 1 as it can flexibly support the different sensing modes i.e. BS monostatic, BS and UE bistatic, UE monostatic.



- SA1 has defined
 - **3GPP sensing data:** Data derived from 3GPP radio signals impacted (e.g. reflected, refracted, diffracted) by an object or environment of interest for sensing purposes, and optionally processed within the 5G system
 - **Sensing result:** processed 3GPP sensing data requested by a service consumer
- **Sensing objective** is a kind of sensing result that can be directly consumed by an application, i.e. by utilizing sensing data and sensing assistance information exposed by a trusted 3rd party to derive, e.g. is there any intruder or not,
- Sensing processing functionalities describe the capability that an entity in 5G system can process the sensing data to obtain sensing result and/or achieve sensing objective (S1-230297, S1-230286).

Option 1



SF exposes **sensing result** to a 3rd party

SF performs functionalities of Processing entity #1 as shown in page#6

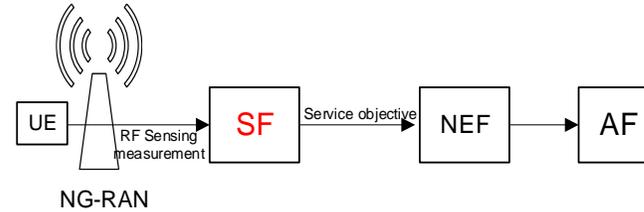
Advantages:

- Only expose the sensing result to avoid or alleviate data privacy

Disadvantages:

- Not clear how to define “intermediate” sensing result in 3GPP

Option 2



SF exposes **sensing objective** to a 3rd party.

SF preforms functionalities of Processing entity #1 and Processing entity #2 as shown in page#6

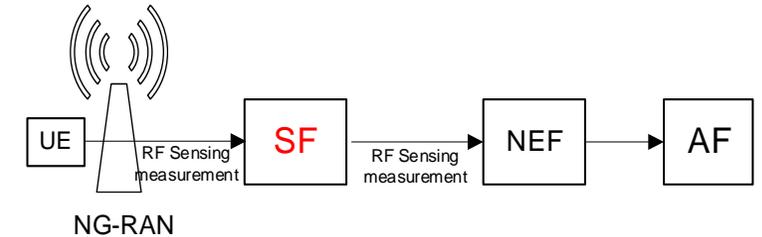
Advantages:

- No data privacy issue
- 5GS is self contained and can cater to different sensing services.

Disadvantages:

- Complexify SF functionalities, which is service-oriented.

Option 3



SF exposes **sensing data** to a 3rd party.

SF mainly performs the functionality of exposure

Advantages:

- Simplified SF functionalities in 5GS, as well as leaves flexibilities to 3rd party to enrich sensing services.

Disadvantages:

- Huge amount of data exposure
- Requirement of protecting data privacy

■ **vivo's initial preference:** Option 1 simplifies core network SF functionalities and secure the information to be exposed to a 3rd party.

Coordination between RAN and SA

- Compared to positioning service, sensing service involves diversified sensing targets (human, car, rainfall, etc.) and offers richer service types (intruder detection, health monitoring, autonomous driving etc.) than positioning service.
- Different service requires different sensing measurement, which is foreseen to produce a larger volume and more private data.
- Investigation on standardized sensing measurement parameters (L1/L2) is necessary.

Option#1: Standardized service-oriented sensing measurement transfer	Option#2: Non-standardized sensing measurement	Option #3: Standardized + Non-standardized
<p>RAN1 standardizes service-oriented sensing measurement parameters to transfer SA2 standardizes corresponding sensing result for exposure</p> <p>Advantage:</p> <ul style="list-style-type: none"> - Standardized interface between RAN and SF, high interoperability among different manufacturers - Service-oriented authentication and authorization <p>Disadvantage:</p> <ul style="list-style-type: none"> - Lower compatibility to new sensing services - Much standardize work for each sensing service 	<p>Using a container for sensing data transfer from RAN to SF SA2 standardizes service-oriented sensing result for exposure</p> <p>Advantage:</p> <ul style="list-style-type: none"> - Less dependency on RAN 1 work <p>Disadvantage:</p> <ul style="list-style-type: none"> - Lower interoperability regarding different RAN and core network manufactures <p>NOTE: Concept of container has been widely utilized in RAN regarding positioning measurement data transmission, e.g. PrivateIE-Container as defined in TS38.455</p>	<p>RAN1 standardizes some service-oriented (e.g. 5GS provided sensing service) sensing measurement parameters to transfer, meanwhile, uses container for some private or new sensing services SA2 standardizes service-oriented sensing result for exposure</p> <p>Advantage:</p> <ul style="list-style-type: none"> - Safeguarding 5G sensing services - More flexible to new services <p>Disadvantage:</p> <ul style="list-style-type: none"> - Lower interoperability among different manufacturers regarding new services

- **vivo's view:** Option#3 offers better balance between standardization work and market. Opt.2 and 3 could be studied in SA2 study, which is in parallel with RAN study.

■ **WT1: Architecture enhancement**

- To study potential architecture enhancements for supporting sensing services, e.g. whether new Network Functionality is needed
- To study whether and how to split the sensing functionalities into control plane function for the control of sensing service, and user plane function for the sensing measurement data/result transmission.
- To conduct investigation on whether and how enhancements are provided to interfaces (e.g. new interface, N1, N2, N3) used to transmit sensing related information.
- To study potential architecture enhancements for sensing data/result exposure

■ **WT2: Procedures to support sensing service management**

- To study end to end procedures on how to support different entity (i.e. UE-initiated, AF-initiated and network-initiated) triggered sensing service including the sensing control and sensing data report among UE, RAN, CN and AF
- To study authorization and exposure procedures of sensing service value-added sensing services

■ **WT3: QoS model and policy enhancements to support diverse sensing services**

■ **WT4: Non-3GPP sensing data usage**

NOTE 1: Security part is foreseen to be studied in SA3, and charging part is foreseen to be studied in SA5.

NOTE 2: Interaction with RAN working groups is needed on any RAN impact

THANK YOU.

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