

The vivo logo is positioned in the top left corner of the slide. The background of the entire slide is a vibrant, abstract image of a flower, possibly a sunflower, with its petals and center rendered in various shades of blue and cyan, creating a dynamic, textured effect.

vivo

3GPP TSG RAN Rel-19 workshop

RWS-230056

Taipei, June 15 - 16, 2023

Agenda Item: 5

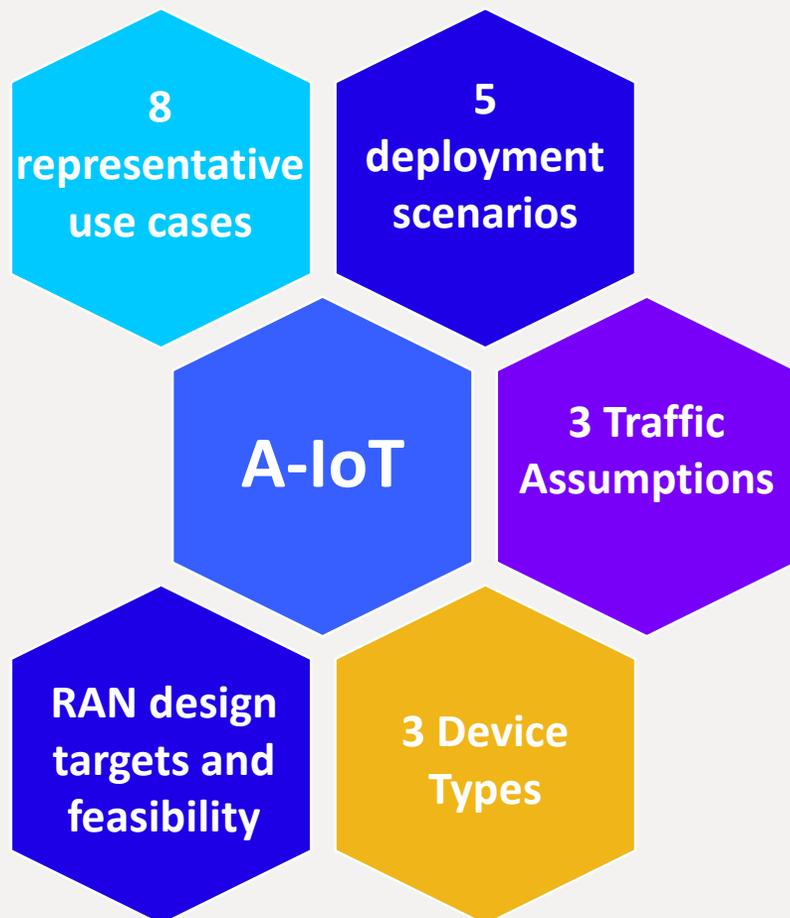
Source: vivo

Title: Views on Ambient IoT in Rel-19

Document for: Discussion

RAN SI outcome (1)

Background



8 representative use cases:

- (Indoor/outdoor) X (Inventory/sensor/positioning/command)

5 deployment scenarios and their characteristics

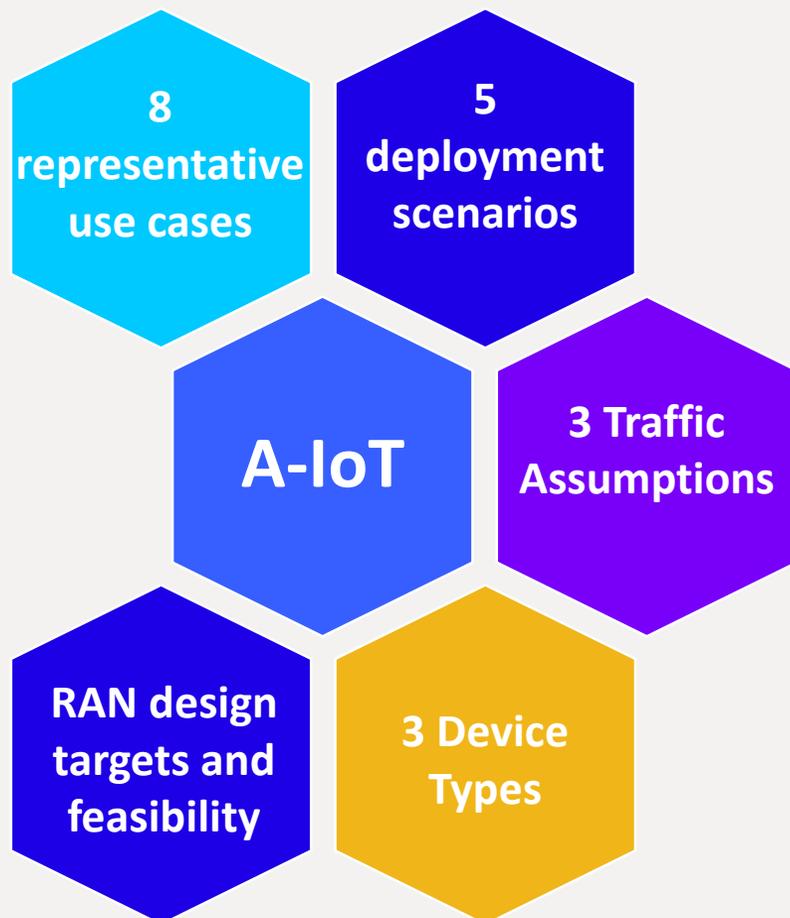
- ① Device indoor, Base station indoor;
- ② Device indoor, Base station outdoor;
- ③ Device indoor, UE as reader;
- ④ Device outdoor, Base station outdoor;
- ⑤ Device outdoor, UE as reader

3 Traffic Assumptions

- Device Terminated
- Device Originated (DO):
 - Device Originated Autonomous (DO-DOA)
 - Device Terminated Tigger (DO-DTT)

RAN SI outcome (2)

Background



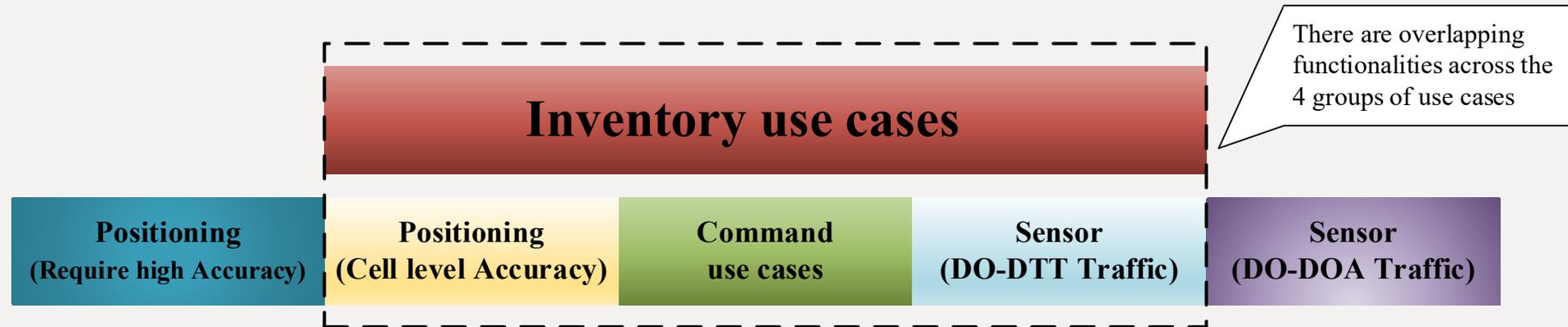
3 Device Types			
	Definition	Power	Complexity
Device A	Backscatter No energy storage	$\leq [1 \mu\text{W}]$ or $[10 \mu\text{W}]$	Comparable to UHF RFID EPC C1G2
Device B	Backscatter [w/ Amplify] Energy storage	Between device A and device C	Between device A and device C
Device C	Active Transmission Energy storage	Up to 1~10 mW	Orders of magnitude lower than NB-IoT

RAN design targets and feasibility

- Power consumption; Complexity; Coverage; Positioning accuracy; Data rate; Latency; Connection density etc.

- Required functionalities: To be concluded in RAN#100

Ambient IoT use cases

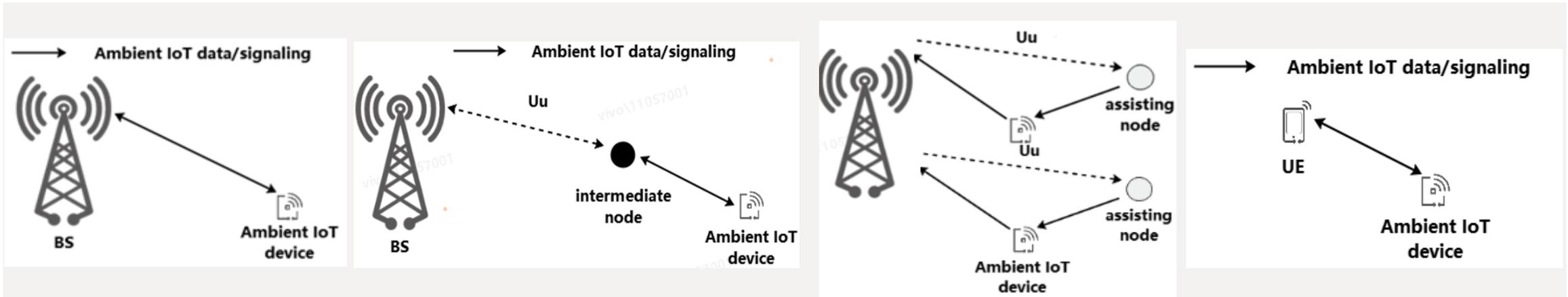


Observation: There are overlapping functionalities among A-IoT use cases

- Functionality for Sensor with DO-DTT traffic can be covered by that for inventory use cases, which also support data collection.
- Functionality for Sensor with DO-DOA traffic should be separately designed, similar to SDT/configured grant procedure in NR.
- For Positioning use case which only requires cell level positioning (appearance in coverage), can be covered by inventory use cases.
- For Positioning use case with high accuracy requirements, additional design in physical layer/higher layer is needed.
- Command use cases can be covered by inventory use cases, since it is generally required.

Proposal: *Prioritize inventory and sensor use cases in Rel-19 SI.*

Connection topologies



- Full duplex BS required for BS<->Device A/B
- Higher requirements on BS/A-IoT Rx sensitivity
- Lower latency
- Full duplex BS required for BS<->Device A/B
- Coverage Extension
- Suitable for to Customer, to Personal use cases if UE is intermediate node
- Full duplex BS NOT required even for Device A/B
- Coverage Extension
- Higher latency
- Applicable only for Device A/B
- Full duplex BS required for UE<->Device A/B
- Low coverage requirements
- Suitable for to Customer, to Personal use cases.

Proposal: Further study on the four connection topologies in Rel-19 SI,

- Prioritize connection topology (1), (2) and (4) in the study
- Unified L1 signal/channel design for gNB and UE reader cases is important to reduce implementation complexity of AIoT device
- Impacts to reader (BS or UE) Hardware shall be considered

Key RAN Design Targets

- **Coverage/Data rate**
 - WG level evaluation on coverage is needed
 - Identify candidate waveform design for communication with A-IoT devices
 - Coverage is evaluated for all 4 connection topologies and 3 device types
- **Power consumption/Device complexity**
 - Further study the device Tx/Rx architecture and characteristics for each device type.
- **Positioning accuracy**
 - Identify Positioning methods suitable for Ambient IoT
 - WG level evaluation on positioning accuracy is needed based on identified positioning methods.

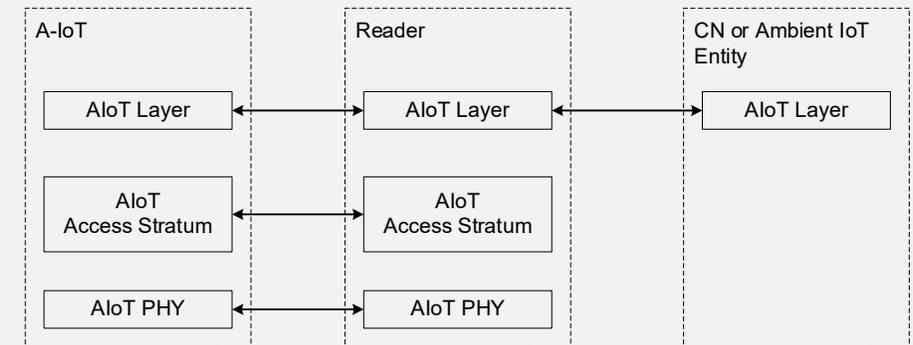
Proposal: WG level evaluation on how to reach RAN design targets is needed in Rel-19 SI, including

- Candidate signal channel design options
- Signaling and procedures

Higher Layer impacts

Considerations for high layer design:

- Protocol stack architecture design for low power consumption, low complexity and low cost.
- Access Stratum for Ambient IoT control plane and user data transmission.
- AIoT Layer for NAS or A-IoT Service.
- Cases with and without CN connection are considered



- Study high layer signaling procedure for the communication between A-IoT and Reader:
 - Different topology options
 - Different Ambient IoT device types and traffic types.
 - Efficient communication mechanism, e.g. minimize the interactions with the ambient IoT device.
 - Handling of device unavailability issue, intermittent operation due to energy harvesting

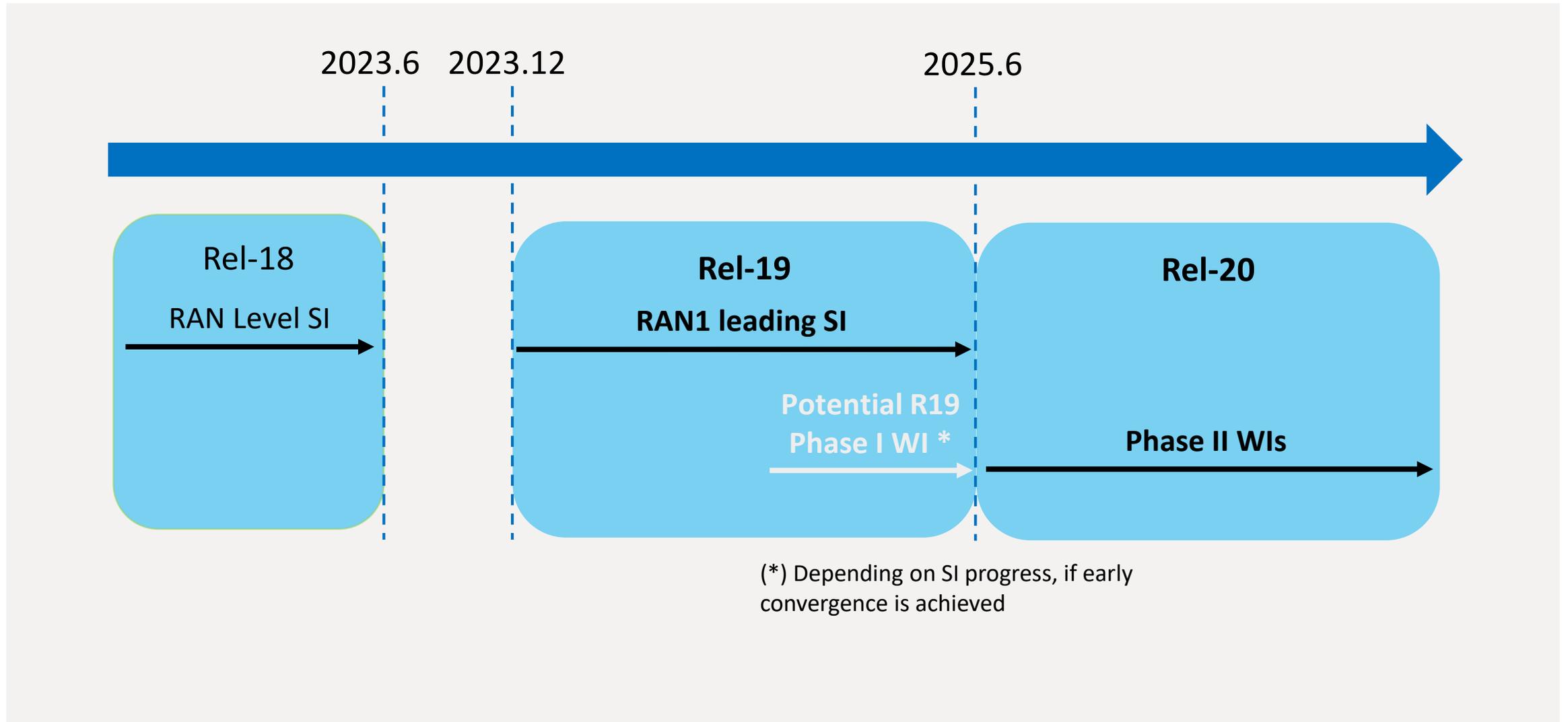
Proposal: High layer study on simplified protocol stack and procedures is needed in Rel-19 SI.

Rel-19 SI scope

Objectives

- Prioritize inventory and sensor use cases
- Consider all three device types
- Deployment scenarios
 - Prioritize TDD/FDD in licensed spectrum
 - Prioritize connection topologies 1,2,4
 - Co-existence with existing system and UE
 - TBD: deployment in-band, out-band or in guard band with existing technologies
- WG level study of achieving RAN design KPIs, e.g., Power consumption, coverage, and etc.
 - Develop evaluation methodologies for the representative use cases and KPIs
 - Identify candidate physical signal/channel design options, physical layer procedures.
- Study High layer designs for different connection topologies, different use cases, different device types
 - Protocol stack architecture design for low power consumption, low complexity and low cost
 - High layer signaling procedure for the ambient IoT communication.

Potential Work item for Ambient IoT



THANK YOU.

谢谢。