



Xiaomi's View on Release 19

Sherry Shen

Xiaomi

Outline

- Principles of proposing and selecting topics for the R19 package
- Overall view on Rel-19 Content
- Introduction of the Rel-19 SIDs
 - Integrated Sensing and Communication
 - AI enabled 5G System
 - Integration of satellite components in the 5G architecture Phase III
 - DualSteer/Dual NR Access Registration/ATSSS Ph4
 - Ambient IoT
 - XRM phase II
- Summary

Principles of proposing and selecting topics for the R19 package



- 🌿 **Market relevance:** address a significant market need or opportunity, and have a clear business case.
- 🌿 **Clear benefits:** improving network performance, enhancing user experience, enabling new services and applications, etc.
- 🌿 **Broad support:** network operators, verticals, equipment manufacturers (network, chipset, UE)
- 🌿 **Timeliness:** timely, addressing emerging market needs and technology trends



Overall View on Rel-19 Content

S.NO.	Title	Brief Description and Key Objectives	Related Stage-1 Study/Work Item	Lead Stage-2 WG	RAN dependencies	Other WG dependencies
1	Integrated Sensing and Communication (see slide 9-17 for more details)	<p>5G system enabler to acquire information about characteristics of the environment and/or objects within the environment, that uses radio waves to determine the distance (range), angle, or instantaneous linear velocity of objects, etc. The 5G wireless sensing service relies on analyzing the transmissions, reflections, and scattering of wireless sensing signals.</p> <p>Key Work Tasks includes defining -</p> <ol style="list-style-type: none"> 1. Service authorization and policy/parameter provisioning for a UE or a gNB 2. Sensing service operation, including <ul style="list-style-type: none"> - Sensing Transmitter/Sensing Receiver discovery and selection - Coordination between Sensing transmitter(s) and Sensing receiver(s) - Data (3GPP sensing data and/or non-3GPP sensing data) collection and transmission by the gNB or the UE or both - Data (3GPP sensing data and/or non-3GPP sensing data) processing 3. Sensing service invocation and exposure to the 3rd party application and to the UE 4. QoS mechanism and QoS handling 5. Sensing service continuity 6. Power saving 	Yes, TS 22.873	SA2	Yes, Major for 5G-NR sensing	SA3 for security, SA5 for charging, SA6 for API

S.NO. indicates order of priority (1: Highest, 10: Lowest)



Overall View on Rel-19 Content

S.NO.	Title	Brief Description and Key Objectives	Related Stage-1 Study/Work Item	Lead Stage-2 WG	RAN dependencies	Other WG dependencies
2	AI enabled 5G System (see slide 18-27 for more details)	<p>5G system supports the AI framework defined by RAN (e.g., LCM for AI model , AI model transfer/AI model training, AI model inference, performance monitoring, Data Collection, etc.), and support the use cases/requirements specified in SA1 Rel-19 FS_AIML_MT_Ph2.</p> <p>Key Work Tasks includes defining -</p> <ol style="list-style-type: none"> Overall architecture and function enhancement to support AI framework defined by RAN. Management of AI models by NG-RAN, 5GC NF or UE, including: <ul style="list-style-type: none"> AI models registration/deregistration, AI models creation/updates/removal, AI storage/AI models training/inference, AI models distribution to the required NG-RAN, 5GC NF or UE, e.g. over user plane or control plane Data collection distributed AI training and AI inference Support the requirements defined in SA1 Rel-19 FS_AIML_MT_ph2 (e.g., supporting AI/ML operations (e.g., distributed AI training and AI inference, etc.) by using direct device connection) 	Yes, TS 22.876	SA2	Yes, Major	SA3 for security, SA5 for charging

S.NO. indicates order of priority (1: Highest, 10: Lowest)



Overall View on Rel-19 Content

S.NO.	Title	Brief Description and Key Objectives	Related Stage-1 Study/Work Item	Lead Stage-2 WG	RAN dependencies	Other WG dependencies
3.	<p>Integration of satellite components in the 5G architecture Phase III</p> <p>(See slide 28-32 for more details)</p>	<p>5GC supports satellite access with regenerative mode (Store & forward, local switch, MEC with UPF on-board, RAN node mobility)</p> <p>Key Work Tasks includes defining</p> <p>1. Feeder link discontinuous connection</p> <ul style="list-style-type: none"> - Store and forward operation for delay-tolerant service when feeder link is unavailable - Support of time sensitive communication between UEs using the same satellite access in case of feeder link discontinuous connection <p>2. RAN node mobility for Regenerative mode</p> <ul style="list-style-type: none"> - Functionality(RAN/5GC) and Interface (X2/N2) enhancement to support frequent RAN node mobility - Overload control for RAN node mobility 	<p>Yes</p> <p>TR22.865 for first bullet</p>	SA2	Yes	SA3 for security, SA5 for charging

S.NO. indicates order of priority (1: Highest, 10: Lowest)



Overall View on Rel-19 Content

S.NO.	Title	Brief Description and Key Objectives	Related Stage-1 Study/Work Item	Lead Stage-2 WG	RAN dependencies	Other WG dependencies
4.	<p>Dualsteer/Dual NR Access registration/ATSSS-Ph4</p> <p>(See slide 33-36 for more details)</p>	<p>5G system support for simultaneous registration via Multiple NR accesses for a UE with single subscription, and further support for steering, splitting and switching of user data, pertaining to a UE data session, across two 3GPP accesses with a) single PLMN, b) two PLMNs, c) PLMN+SNPN</p> <p>Key Work Tasks includes defining -</p> <ol style="list-style-type: none"> Support simultaneous registration to 5GC via Multiple NR accesses for a UE with single subscription <ul style="list-style-type: none"> UE can be registered to a single PLMN, to a single SNPN, to two different PLMNs or SNPNS, or to one PLMN and one SNPN Support MO/MT services when the UE is registered to the 5GC simultaneously via multiple NR accesses and potentially one non-3GPP access Overall architecture and function enhancement to support dual 3GPP access with one single PLMN, two different PLMNs or PLMN+NPN <ul style="list-style-type: none"> PLMN selection Registration to one PLMN via different 3GPP access or registers to two PLMNs using the same credential (i.e. assuming one single PLMN subscription) MA PDU session establishment using two 3GPP access Traffic routing policy Charging 	Yes, TR 22.841 (only for the second bullet)	SA2	Yes	SA3 for security, SA5 for charging and OAM

S.NO. indicates order of priority (1: Highest, 10: Lowest)



Overall View on Rel-19 Content

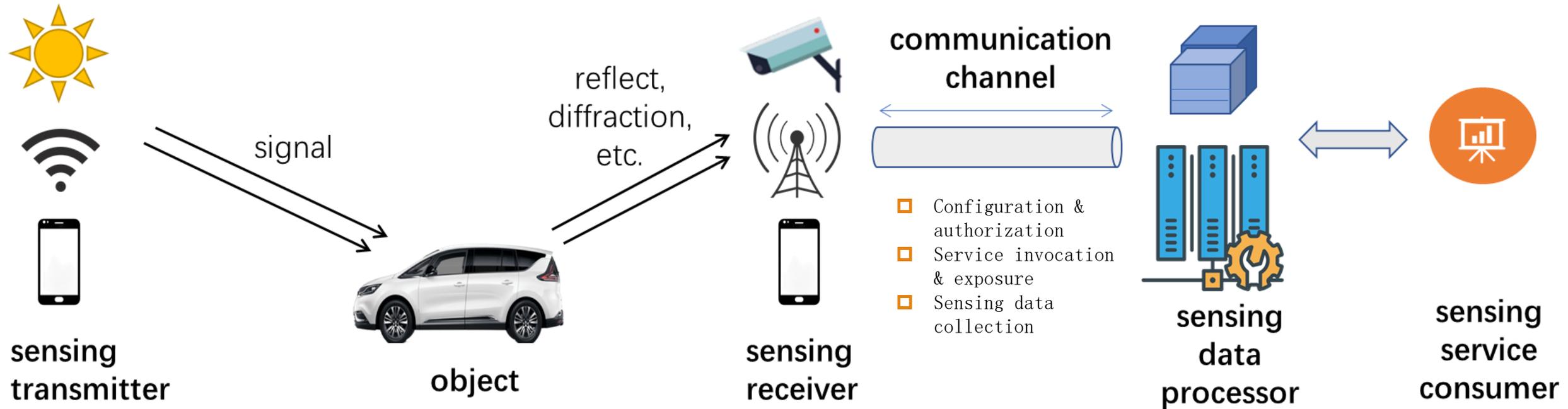
S.NO.	Title	Brief Description and Key Objectives	Related Stage-1 Study/Work Item	Lead Stage-2 WG	RAN dependencies	Other WG dependencies
5.	Ambient IoT (See slide 37-41 for more details)	5G system Support the energy efficient communication with different type Ambient IoT device to fulfill the service requirements for one or a group of Ambient-IoT device(s) Key Work Tasks includes defining - 1. Identify the architecture impacts based on the use cases provided by SA1 and RAN to support the energy efficient communication; 2. the access control and mobility management for the Ambient IoT supporting; 3. the QoS mechanism for the Ambient IoT device(s) supporting; 4. the information collection and exposure to the AF (identified by SA1 an RAN); 5. the life cycle management of the Ambient IoT device(s);	Yes, TS 22.840	SA2	Yes, Major	SA3 for security, SA5 for charging
6.	XRM phase II (See slide 42-46 for more details)	continue the study XRM service supporting considering the requirements identified from SA1, RAN, SA4 and the SA2 Phase I. Key Work Tasks includes defining - 1. the PDU Sets based handling optimization; 2. the mobility enhancement; e.g. service continuity for XR services and the connectivity for XR services under high UE mobility; 3. power management, tradeoff of the power consumption and QoE; 4. the synchronization/coordination of multi-SDFs of the same Multi-modality service; 5. QoS enhancement for the UE to UE interaction;	Yes, TS 22.856	SA2	Yes, Major	SA3 for security, SA5 for charging, SA6 for application,

S.NO. indicates order of priority (1: Highest, 10: Lowest)

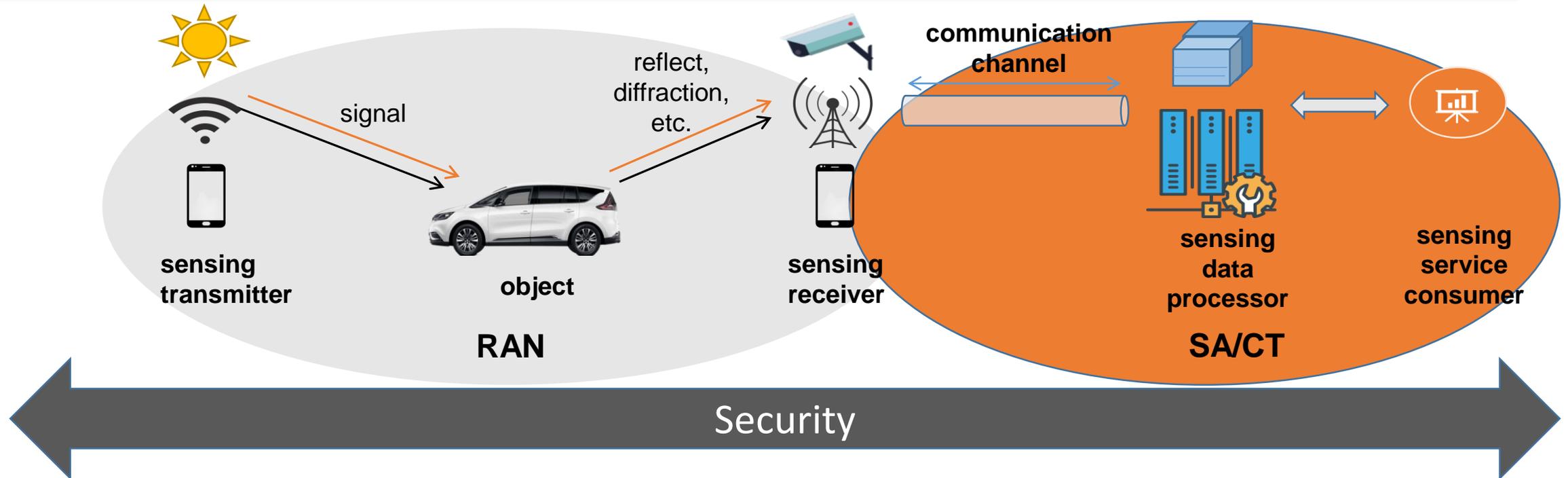


Integrated Sensing and Communication

Key components of sensing system



Work split between RAN WGs and SA/CT WGs



- ❑ Measurement: signaling procedure for controlling the measurement, signal transmission/receiving
- ❑ Performance evaluation (5G-NR)

- ❑ Configuration & authorization
- ❑ Service invocation & exposure
- ❑ Sensing data (3GPP/non-3GPP) collection
- ❑ Sensing data (3GPP/non-3GPP) processing
- ❑ Charging

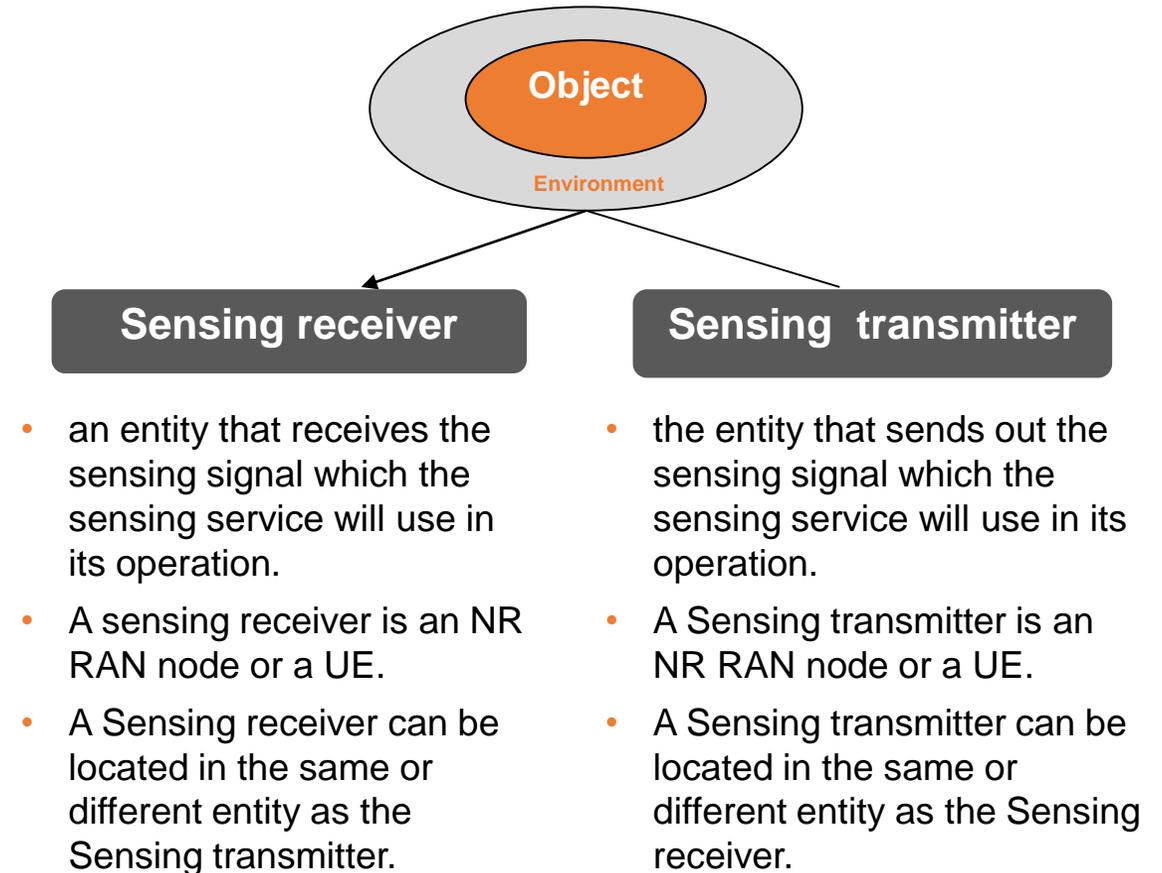
Overview (TR 22.873)

Concept

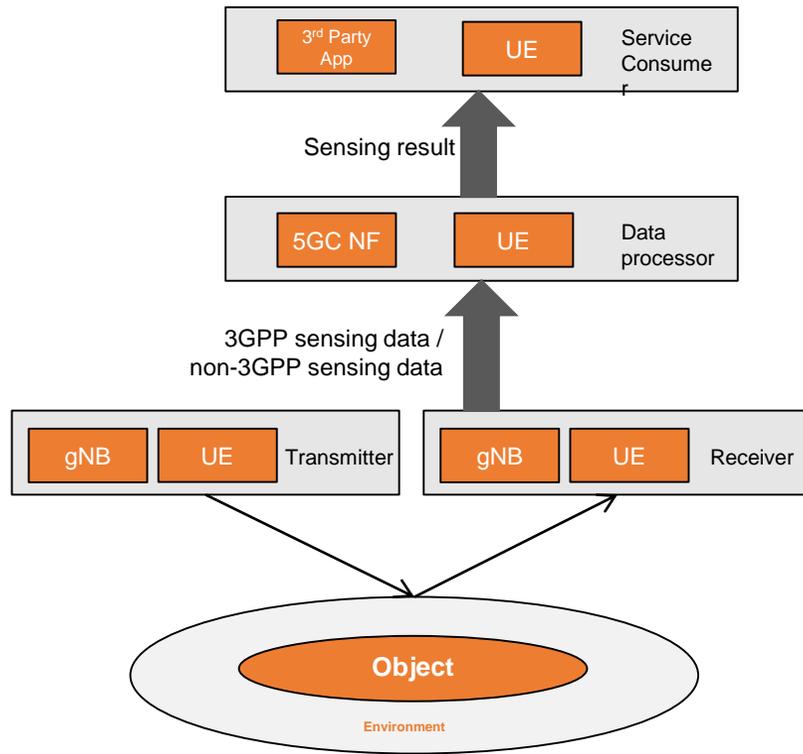
5G Wireless sensing: 5GS feature providing capabilities to get information about characteristics of the environment and/or objects within the environment (e.g. shape, size, orientation, speed, location, distances or relative motion between objects, etc) using NR RF signals and, in some cases, previously defined information available in EPC and/or E-UTRA.

Scope & Scenarios

- Served or not served by NG-RAN
- Licensed or unlicensed spectrum
- 5G NR RF, non-RF, and previously defined information available in EPC and/or E-UTRA (no impact to EPC/E-UTRA is assumed)
- UE on board target object or non-UE on board target object
- Commercial, V2X, public safety and emergency services



Potential Architecture Impacts



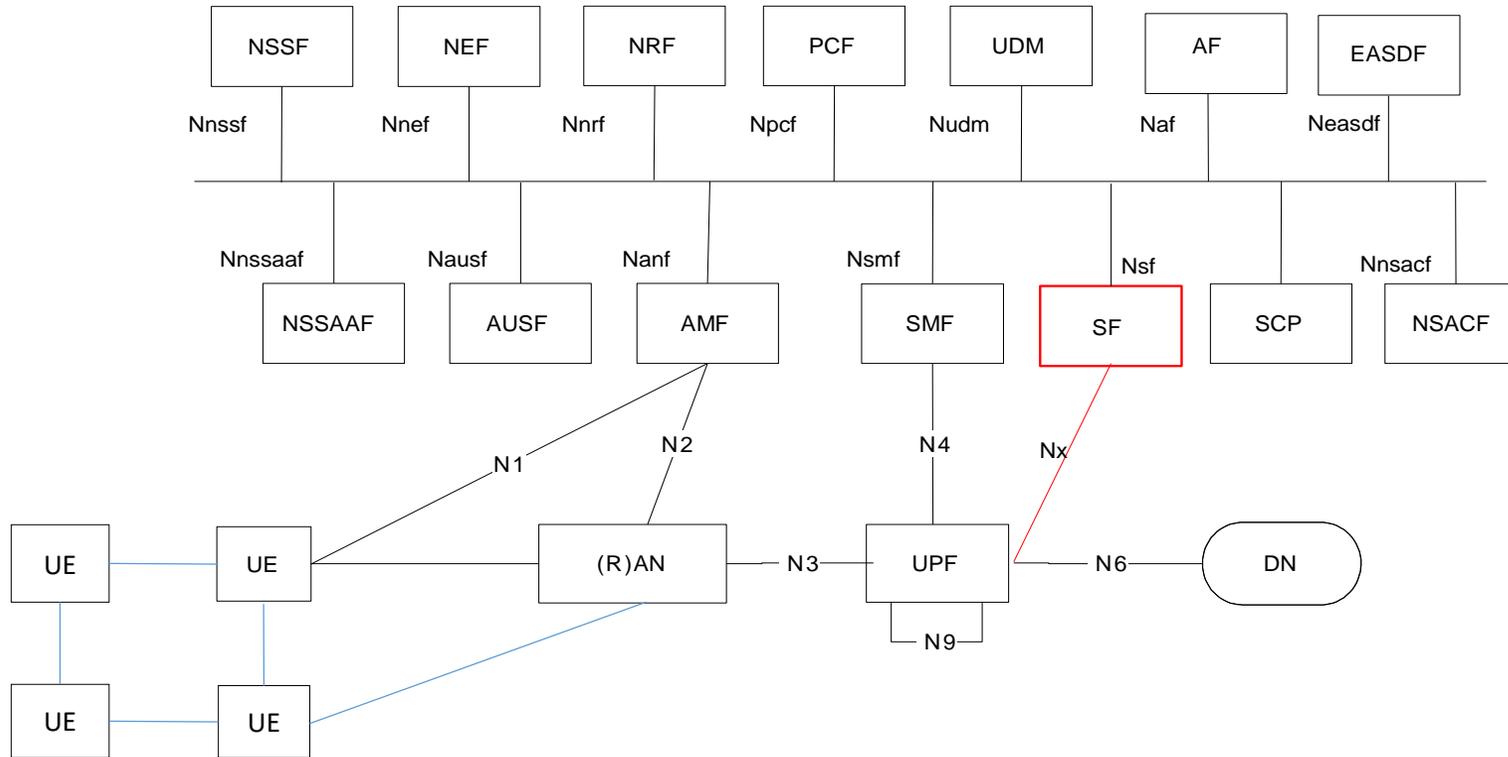
- ❑ **Sensing result:** processed 3GPP sensing data requested by a service consumer.
 - ❑ **3GPP sensing data:** Data derived from 3GPP radio signals impacted (e.g. reflected, refracted, diffracted) by an object or environment of interest for sensing purposes, and optionally processed within the 5G system.
 - ❑ **non-3GPP sensing data:** Data provided by non-3GPP sensors (e.g. video, LiDAR, sonar) about an object or environment of interest for sensing purposes.
- Source: TR 22.837

- Sensing result can be requested and exposed to 3rd party App or UE
 - ❑ Sensing result may include the final result or the processed sensing data per request of service consumer
- Sensing data can be processed at the 5GC NF or at UE
 - ❑ 5GC NF in the figure performs sensing measurement data processing, which can be a new NF or an existing NF
- Based on sensing option(s) adopted, transmitter/receiver may be gNB or UE
- Based on sensing option(s) adopted, a communication channel (over CP or UP) may be established between gNB and the data processor or between UE and the data processor
- UE(s) shown in the figure does not have to be served by NG-RAN





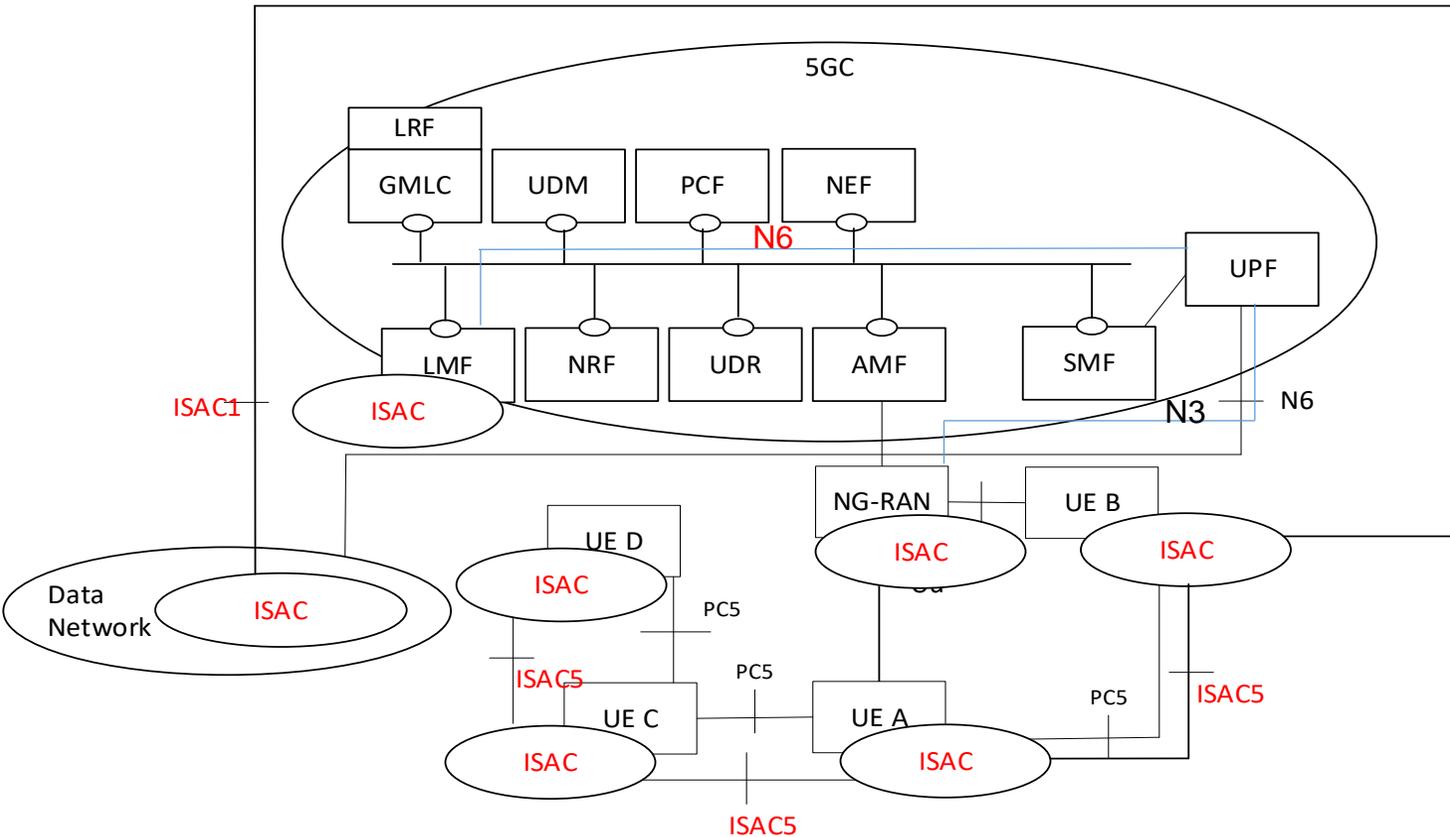
5GC Architecture Option 1: new NF and new reference point



- Sensing Function (SF)
 - transmitter/receiver selection
 - transmitter/receiver coordination
 - data processing
 - result exposure
- Nx reference point
 - Interface between UPF and SF
 - If sensing data is collected over UP, a PDU session may be established between UE and SF (Uu+N3+Nx) or between gNB and SF (N3+Nx) based on the adopted sensing option



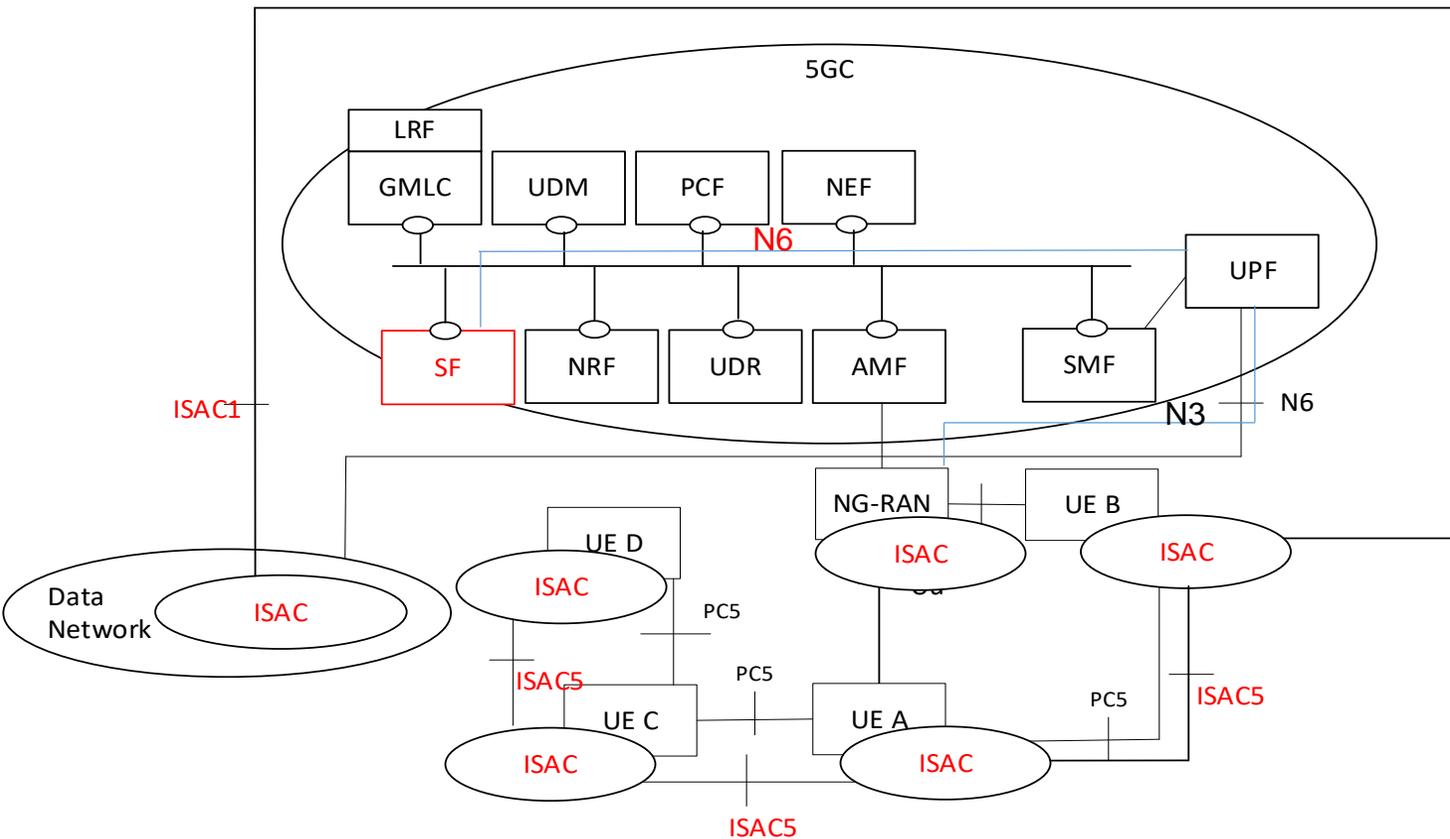
5GC Architecture Option 2: reusing eLCS/Ranging_SL architecture



- LMF is enhanced to support ISAC:
 - ▣ transmitter/receiver selection
 - ▣ transmitter/receiver coordination
 - ▣ data processing
 - ▣ result exposure
- N6 is reused for sensing data collection over UP
 - ▣ a PDU session established between UE and LMF (Uu+N3+N6) (existing solution)
 - ▣ a PDU session established between gNB and LMF (N3+N6) (new enhancements)
- LMF-UE interaction: enhance LPP or define similar protocol to support ISAC (to be developed by RAN WGs)
- LMF-gNB interaction: enhance NRPPa or define similar protocol to support ISAC (to be developed by RAN WGs)
- ISAC5 is used for communication between UE when acting as sensing transmitter/sensing receiver and data collection when sensing data is processed at UE



5GC Architecture Option 3: new NF & reusing eLCS existing mechanisms



- Sensing Function (SF):
 - ▣ transmitter/receiver selection
 - ▣ transmitter/receiver coordination
 - ▣ data processing
 - ▣ result exposure
- N6 is reused for sensing data collection over UP
 - ▣ a PDU session established between UE and SF (Uu+N3+N6) (existing eLCS UP solution)
 - ▣ a PDU session established between gNB and SF (N3+N6) (new solution)
- SF-UE interaction: define LPP similar protocol to support ISAC (to be developed by RAN WGs)
- SF-gNB interaction: define NRPPa similar protocol to support ISAC (to be developed by RAN WGs)
- ISAC5 is used for communication between UE when acting as sensing transmitter/sensing receiver and data collection when sensing data is processed at UE



Potential SA2 objectives for the R19 study

Architecture enhancement to support Integrated Sensing and Communication for an target object (and its environment) with or without UE on board over licensed or unlicensed spectrum for commercial, V2X, public safety and emergency services use cases:

- 🌿 Service authorization and policy/parameter provisioning for a UE or a gNB
- 🌿 Sensing service operation
 - Sensing Transmitter/Sensing Receiver discovery and selection
 - Coordination between Sensing transmitter(s) and Sensing receiver(s)
 - Data (3GPP sensing data and/or non-3GPP sensing data) collection and transmission by the gNB or the UE or both
 - Data (3GPP sensing data and/or non-3GPP sensing data) processing
- 🌿 Sensing service invocation and exposure to the 3rd party application and to the UE
- 🌿 QoS mechanism and QoS handling
- 🌿 Sensing service continuity
- 🌿 Power saving
- 🌿 Charging
- 🌿 Security



AI enabled 5G System



Background

- Rel-18 Artificial Intelligence (AI)/Machine Learning (ML) related topics are been started in RAN WGs:
 - ❑ RAN1 has started to study the AI framework to enable performance improvement by using AI models in UE/NG-RAN to support the scenarios, e.g., AI based CSI, AI based beam management, AI based positioning.
 - ❑ For AI Model distribution, RAN2 has worked on the CP/UP solutions. And also worked on the general AI/ML framework, which was concluded to consist of, (i) Data Collection, (ii) Model Training, (iii) Model Management, (iv) Model Inference, and (v) Model Storage.
 - ❑ RAN3 has started to specify data collection enhancements and signaling support within existing NG-RAN interfaces and architecture. And concluded AI/ML Model Training can be located in OAM or gNB, and AI/ML Model Inference is in gNB.
- SA2 has also worked on the AI/ML related topics,
 - ❑ Enablers for Network Automation for 5G (FS_eNA_Ph2/3), which provides/consumes the AI models within NWDAF, and sharing the AI models between NWDAF(s).
 - ❑ FS_AIMLsys has started to specify the 5GC enhancement (e.g., monitoring of NW resources, enhancement for QoS/Policy, and exposure enhancement, etc.) to support for AI/ML traffic transport and Federated Learning Operation.
- SA1 has a Rel-19 study on Artificial Intelligence (AI)/Machine Learning (ML) phase 2 to support the AI/ML operations (e.g., distributed AI training/inference, etc.) using direct device connection.
- **Observation:** SA2 has worked on AI/ML topics, but currently the 5GC cannot support the scenarios/requirements defined by RAN WGs. And also the requirements defined in SA1 Rel-19 needs to be supported.



Motivations (RAN1)

- Study on Artificial Intelligence (AI)/Machine Learning (ML) for NR air interface (RP-221348) has started to study the AI framework to enable performance improvement by using AI models in UE/NG-RAN in order to support following scenarios, e.g.

- AI based CSI
- AI based beam management
- AI based positioning

- RAN1 has identified 6 cases in the table,

- Model distribution
 - Out of 3GPP network
 - 3GPP network (e.g., NWDAF, OAM, etc.)
- Model storage location
- Training location
 - UE side/Neutral side/ NW-side (e.g., NWDAF, OAM, etc.)

Case	Model distribution (delivery/transfer)	Model storage location	Training location
y	model delivery (if needed) over-the-top	Outside 3gpp Network	UE-side / NW-side / neutral site
z1	model transfer in proprietary format	3GPP Network	UE-side / neutral site
z2	model transfer in proprietary format	3GPP Network	NW-side
z3	model transfer in open format	3GPP Network	UE-side / neutral site
z4	model transfer in open format of a known model structure at UE	3GPP Network	NW-side
z5	model transfer in open format of an unknown model structure at UE	3GPP Network	NW-side

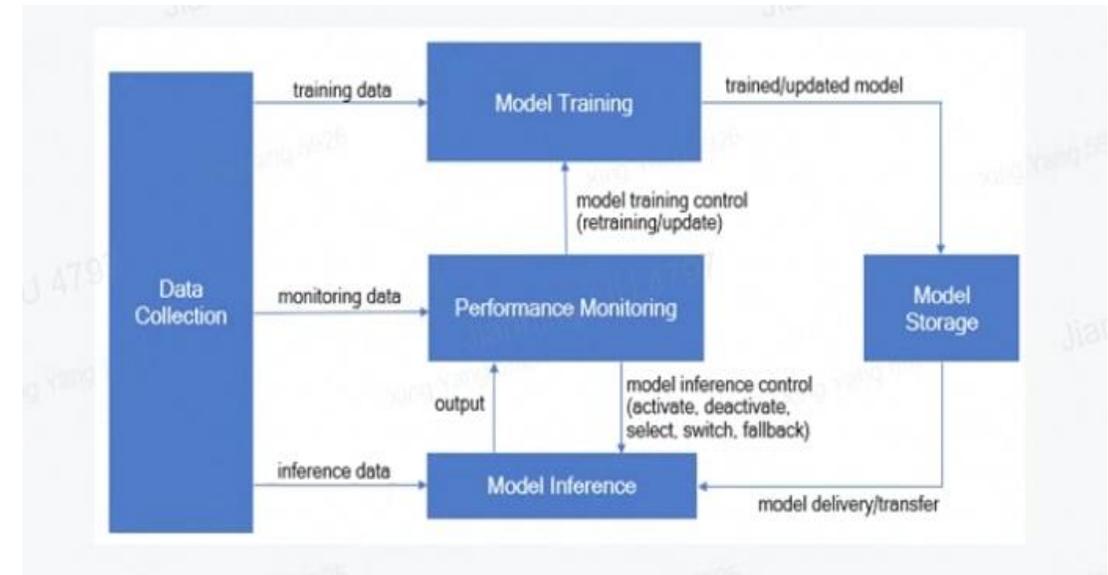
- **Gaps:** currently SA2 doesn't support the RAN use cases above, 5GS architecture needs to be enhanced to support:

- Lifecycle management (LCM) for AI models
- AI model storage, AI model training, AI model distribution (e.g., to UE/NG-RAN/5GC NF(s))
- Performance monitoring, Data collection

Motivations (RAN2)

- For the AI Model distribution, RAN2 has studied different solutions in the table, from gNB to UE, CN/LMF to UE, Server (e.g., OAM, OTT) to UE, including Control Plane and User Plane solutions.
- RAN2 has concluded that the general AI/ML framework consist of, (i) Data Collection, (ii) Model Training, (iii) Model Management, (iv) Model Inference, and (v) Model Storage.

Solution 1a: gNB can transfer/deliver AI/ML model(s) to UE via RRC signalling.
Solution 2a: CN (except LMF) can transfer/deliver AI/ML model(s) to UE via NAS signalling.
Solution 3a: LMF can transfer/deliver AI/ML model(s) to UE via LPP signalling.
Solution 1b: gNB can transfer/deliver AI/ML model(s) to UE via UP data.
Solution 2b: CN (except LMF) can transfer/deliver AI/ML model(s) to UE via UP data.
Solution 3b: LMF can transfer/deliver AI/ML model(s) to UE via UP data.
Solution 4: Server (e.g. OAM, OTT) can transfer/delivery AI/ML model(s) to UE (e.g. transparent to 3GPP).



- **Gaps:**
 - ❑ Based on the general AI/ML framework, current 5GS architecture cannot support the AI/ML framework. SA2 needs to study how to distribute these entities (i.e. Data Collection, Model Training, Model management, Model Inference and Model storage) to 5GS architecture.

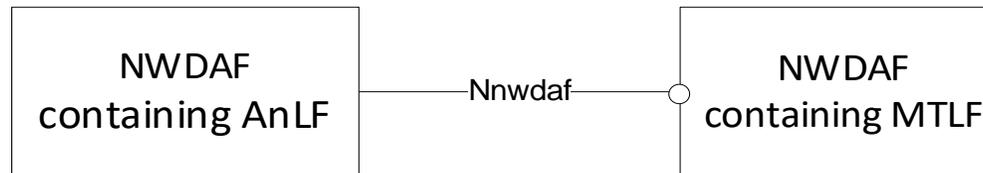


Motivations (RAN3)

- Artificial Intelligence (AI)/Machine Learning (ML) for NG-RAN (RP-220635) has started to specify data collection enhancements and signaling support within existing NG-RAN interfaces and architecture for the following scenarios, e.g.
 - ❑ AI/ML-based Network Energy Saving
 - ❑ AI/ML-based Load Balancing
 - ❑ AI/ML-based Mobility Optimization
- For the deployments of RAN intelligence, following scenarios may be supported in R18:
 - ❑ AI/ML Model Training is located in the OAM and AI/ML Model Inference is located in the gNB.
 - ❑ AI/ML Model Training and AI/ML Model Inference are both located in the gNB.
- **Gaps:**
 - ❑ Existing RAN3 mechanism doesn't support multi-vendor interoperability and collaboration with 5GC AI/ML enabled functions, which limits the scenarios and performance of AI/ML for NG-RAN.
 - ❑ New uses cases such as AI/ML based QoE optimization, AI/ML based network slicing management may need collaboration with 5GC in data collection, model training and model transfer and management.

Motivations (SA2)

- Enablers for Network Automation for 5G (**FS_eNA_Ph2/3**), which provides/consumes the AI models within NWDAF, and sharing the AI models between NWDAF(s).
 - ❑ Analytics logical function (AnLF): performs inference, derives analytics information and exposes analytics.
 - ❑ Model Training logical function (MTLF): trains Machine Learning (ML) models and exposes new training services.



- **Observation:** currently the AI models is not supported to be shared by other 5GC NFs. It is benefit for NWDAF to share the AI models with other NFs, e.g., NG-RAN, 5GC NF(s) or UE.



Motivations (SA2)

- Rel-18 Study on 5G System Support for AI/ML-based Services (**FS_AIMLsys**) has started to specify the 5GC enhancement (e.g., monitoring of NW resources, enhancement for QoS/Policy, and exposure enhancement, etc.) to support for AI/ML traffic transport and Federated Learning Operation.
- SA1 has performed a Rel-19 study, FS_AIML_MT_Ph2, investigating new use cases and requirements related to support efficient AI/ML operations (e.g., distributed AI training/inference, etc.) using direct device connection for various applications e.g. auto-driving, robot remote control, video recognition, etc. with requirements:
 - ❑ Supporting AI/ML mode/data distribution among a group of UEs using direct connection
 - ❑ Authorization for a group of UEs to exchanging data with each other via direct connection
 - ❑ QoS enhancement for a group of UEs served by a Relay UE, e.g., QoS control, Aggregated QoS, etc.
 - ❑ Supporting FL between UEs using direct connection, including member selection, etc.
- **Observation:** currently AI/ML models transport is over the top via application layer, and further enhancement is needed to support SA1 Rel-19 FS_AIML_MT_Ph2 requirements.

Potential architecture enhancement

- Enablers Option1 (case Z1-Z5)

- AI model storage location: Network

e.g., NWDAF/LMF or new NF

- AI model training location: UE, and (R)AN

- AI model inference: UE, RAN

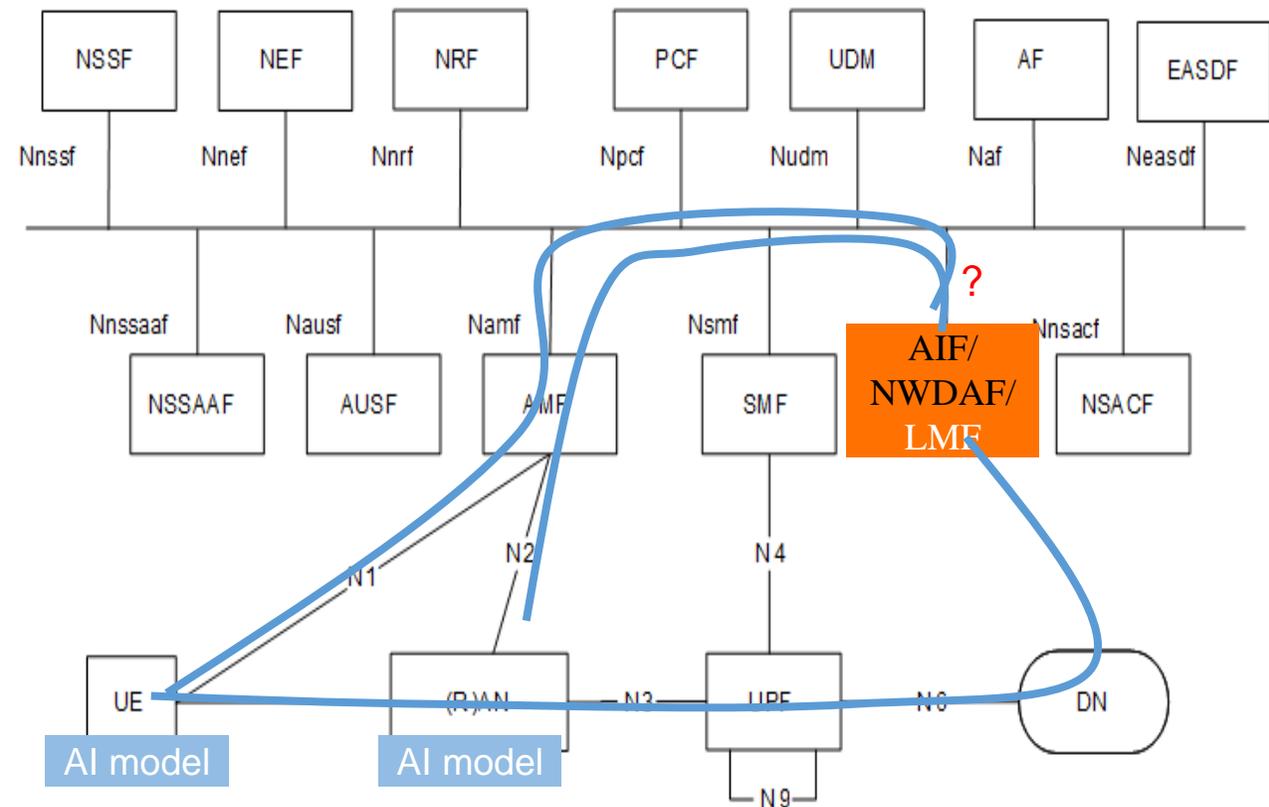
- AI model distribution:

- From NWDAF/new NF/LMF to (R)AN

- From NWDAF/new NF/LMF to UE

- Control plane

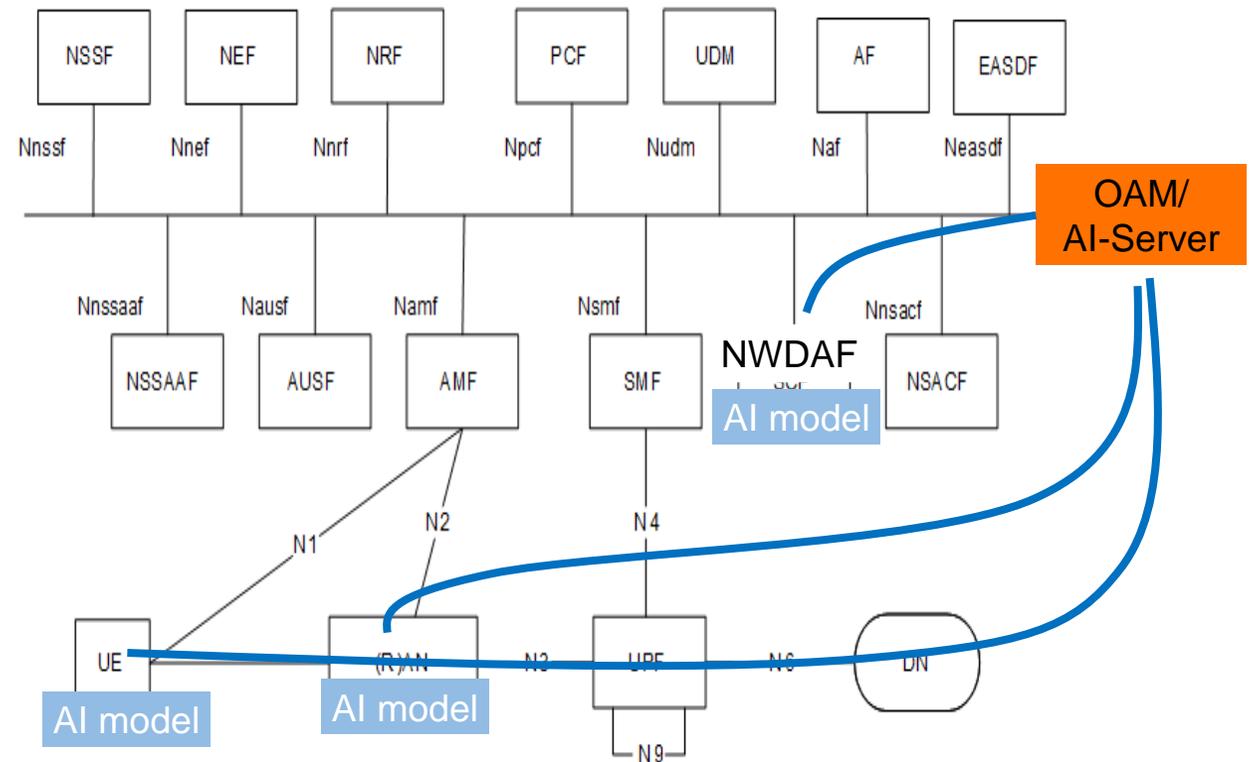
- User plane



Potential architecture enhancement

- Option2 (case Y)

- AI model storage location: outside 3GPP
e.g., OAM, or AI-Server
- AI model training location: UE, NWDAF, OAM
- AI model inference: UE, RAN
- AI model distribution:
 - From OAM to (R)AN
 - From OAM to NWDAF
 - From AI-Server to UE via user plane





Potential SA2 Objectives

This SID is aiming to introduce AI technologies to 5G System for the enhancement of radio resources management, positioning/location, etc. The potential Objective includes:

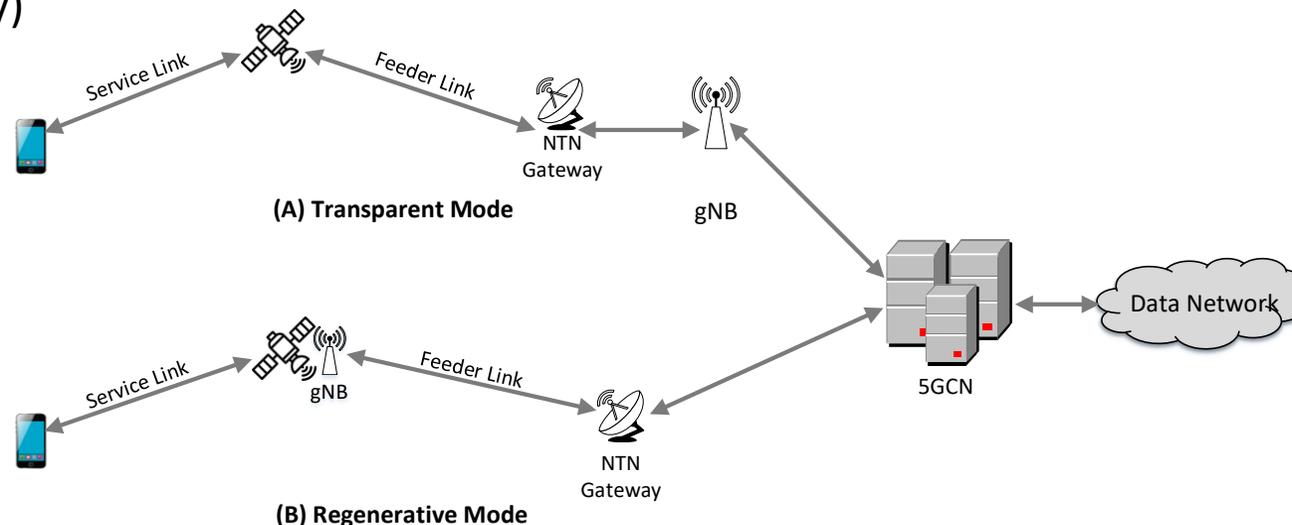
- Identify the architecture impacts based on the use cases provided from RAN (i.e. Y, Z1-Z5)
- Study on how to distribute the entities of AI framework in RAN into 5G architecture, including Data Collection, Model training, performance monitoring, Model interference, Model storage, etc. How to apply the AI enabled 5G architecture to support the scenarios identified by RAN [e.g., AI based CSI/beam management/position]
- The management of AI models by the NG-RAN, 5GC NF or UE, including,
 - ❑ AI models registrations/deregistration
 - ❑ AI models creation/updates/removal
 - ❑ AI storage/AI models training/inference
 - ❑ AI models distribution to the required NG-RAN, 5GC NF or UE, e.g. over user plane or control plane
 - ❑ Data collection from UE/NG-RAN/5GC NF(s)/application server for AI models training.
- Supporting the requirements defined in SA1 Rel-19 FS_AIML_MT_Ph2 to support for AI/ML operations using direct device connection
- QoS mechanism enhancement to support, e.g., the delivery of AI models.
- Security



Satellite Access Phase III

Motivations

- Satellite access has gained more and more consensus which is playing a key part in extending cellular 5G networks to air, sea and other remote areas not covered by terrestrial cell networks
- Transparent mode (full transparent to NR protocols) and Regenerative mode (On-board part or full NG-RAN functionality)



- ❑ Such two modes mentioned in TR 23.737(SA2 R-17 5GSAT_ARCH), but only transparent mode is targeted until R-18
- ❑ Most use cases and requirements described in TR22.865 (SA1 R-19 FS_5GSAT_Ph3) are based on Regenerative mode
- ❑ Supporting regenerative mode can further enrich satellite access deployment. In some cases, it can reduce latency and improve service experience, compared with transparent mode (e.g. on-board NR+UPF)

Potential issue & Identified Gaps (1)

🌿 Feeder link discontinuous connection

📄 Descriptions

- UE network connection may interrupt due to satellite coverage without active feeder link connection to the ground station (e.g. UE locates in . deep-sea maritime areas with few ground station)
- Enable RAN on-board with:
 - Store and forward operation is proposed to support delay-tolerant/non-real-time services during discontinuous feeder link
 - Authentication and authorization to a UE using S&F
 - How and where to enable S&F operation to UL/DL data.
 - How to avoid overload due to large number of UE using S&F
 - Support real time communication between UEs using the same satellite access without going through the terrestrial network
 - How to enable service continuity in the case of serving satellite is changing
 - QoS, routing policy, charging...

📄 Gaps

- Support of store and forward operation for delay-tolerant service when feeder link is unavailable
- Support of time sensitive communication between UEs using the same satellite access in case of feeder link discontinuous connection

Potential issue & Identified Gaps (2)

📶 RAN node mobility for Regenerative mode

📄 Descriptions

- Embarking RAN on-board NGSO satellites implies frequent handovers of RAN nodes for any given 5GC.
- A large number of UE under the same coverage will be simultaneously handed over from one RAN node to another one, which may cause overload in RAN and CN

📄 Gaps

- Interface (X2/N2) and Functionality(RAN/5GC) enhancements to support frequent RAN node mobility
- Overload control due to the RAN node mobility

Potential SA2 Objectives

📶 Feeder link discontinuous connection

- ❑ Store and forward operation is proposed to support delay-tolerant/non-real-time services during discontinuous feeder link
- ❑ Support real time communication between UEs using the same satellite access without going through the terrestrial network

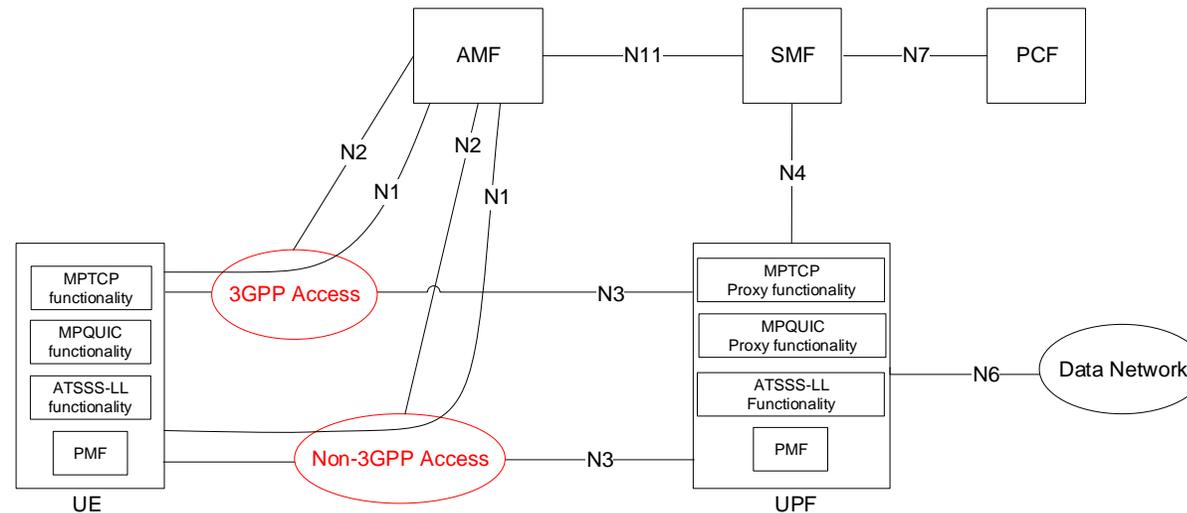
📶 RAN node mobility for Regenerative mode

- ❑ Interface (X2/N2) and Functionality(RAN/5GC) enhancements to support frequent RAN node mobility
- ❑ Overload control due to the RAN node mobility

DualSteer/Dual NR Access registration/ATSSS-Ph4

Motivations

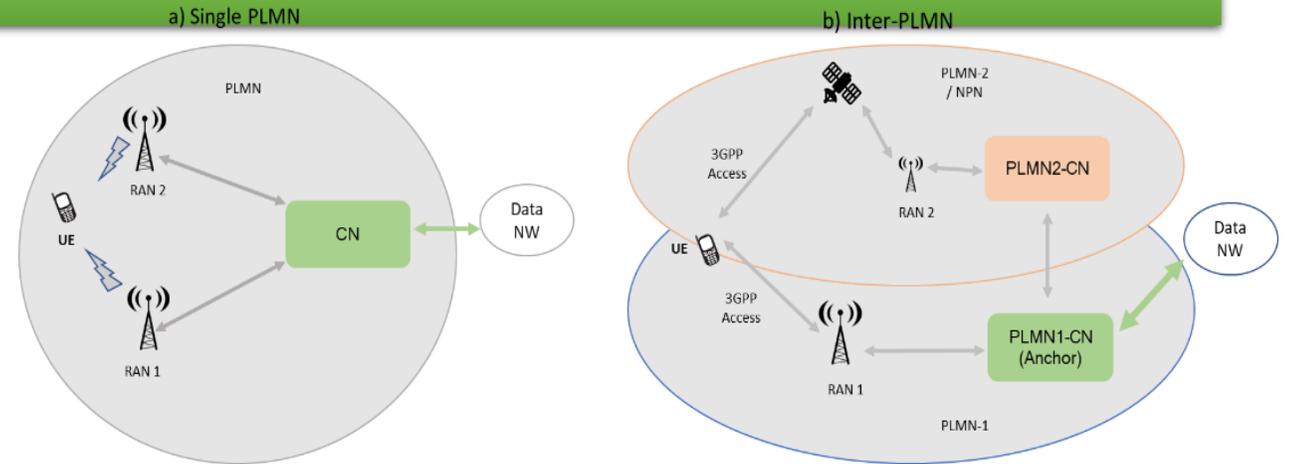
- ATSSS enables data traffic between UE and UPF simultaneously over one 3GPP access path and over another non-3GPP access path
- By leveraging the data traffic over multiple paths, the 5G system can provide services with higher data rate, better service continuity which can improve user experience
- In some circumstance, there is a lack of non-3GPP access or insufficient network coverage. Instead, more than one 3GPP access is deployed which can provide double coverage in such areas



Potential issue & Identified Gaps (1)

Concept & Scenarios

- **DualSteer:** is to study further enhance of ATSSS feature which enables data traffic across two 3GPP access networks, where only one single subscription is assumed.
- **Typical scenarios:** two 3GPP access belongs to a) one single PLMN, b) two PLMNs, c) PLMN+NPN
- Data traffic is anchored in the HPLMN (in case of different PLMNs).
- Data routing across two 3GPP accesses can be based on:
 - connectivity conditions on both access networks
 - service preference
 - other conditions or restrictions, e.g. location, time



Intra-PLMN and Inter-PLMN scenarios

SA1 Status

- SID: SP-220445 TR latest version: 22.841 v1.0.0
- Percentage completion: 70% (SA1#101)
- Target completion date: SA#100 (06/2023)
- Potential requirements derived from use cases do not foresee RAN impacts and assume UE support of proper capabilities (e.g., dual radio)



Potential SA2 Objectives

- Enhancement of steering, splitting, switching of user data across two 3GPP networks
 - Support of dual 3GPP access with one single PLMN, two different PLMNs or PLMN+NPN
 - Support of dual 3GPP access with same or different RATs
 - Potential enhancements on:
 - PLMN selection
 - Registration to one PLMN via different 3GPP access or registers to two PLMNs using the same credential (i.e. assuming one single PLMN subscription)
 - MA PDU session establishment using two 3GPP access
 - Traffic routing policy
 - Charging



Ambient IoT

Overview (TR 22.840)

Definition

An ambient power-enabled Internet of Things device is an IoT device powered by energy harvesting, being either battery-less or with limited energy storage capability (e.g., using a capacitor).

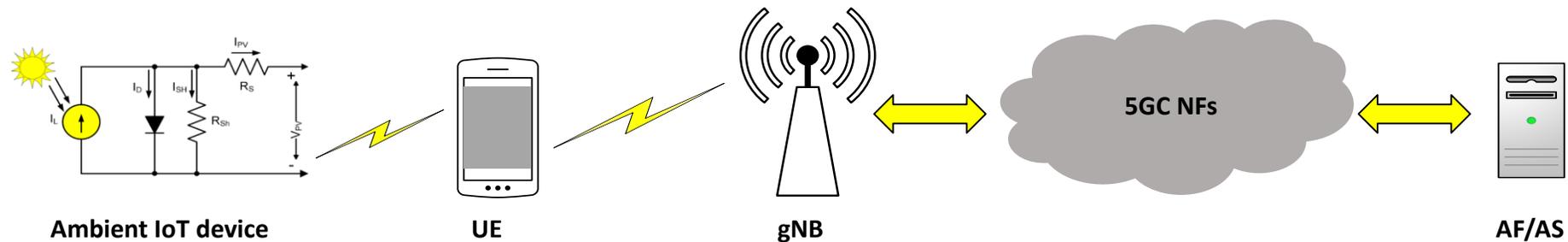
GAP with 5G LPWA

- extreme environmental conditions e.g., high pressure, extremely high/low temperature, humid environment;
- where a device driven by a conventional battery is not applicable;
- ultra-low complexity, very small device size, longer life cycle;

Characteristics

Ambient IoT:

- Low complexity
- small size
- lower capabilities
- lower power consumption
- long lifecycle (>10 years)
- maintenance free



* Xiaomi interested: UE be Ambient Reader

Motivations (SA1)

SA1 Ambient power-enabled Internet of Things (SP-220085) studies the Ambient IoT in SA1 with the objectives include:

- ❑ Study use cases of Ambient IoT and identify potential service requirements
- ❑ Study traffic scenarios, device constraints (e.g., power consumption) and identify potential performance requirements and KPIs
- ❑ Gap analysis between the identified requirements for ambient power-enabled Internet of Things and what is already defined by existing 3GPP requirements.

The potential service requirements:

- Security aspects, e.g., authentication and authorization.
- Network selection, access control, connection, mobility and identification management
- Charging (e.g., per data volume, per message)
- Aspects related to stakeholder models (e.g., involving interactions in PLMNs, NPNs or other parties)
- Positioning
- Aspects on device life cycle management related to 3GPP system.

30 use cases and 3 traffic scenarios is identified in the TR 22.840 of SA1.

Note 1: Specifics of how the device performs energy harvesting are not in the scope of the study.

Motivations (RAN)

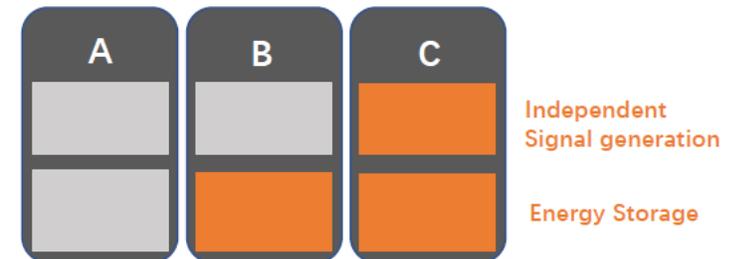
Study on Ambient IoT in RAN (TR 38.848) has stated to study the Ambient IoT with progress include:

- use cases grouping based on deployment environment or functionality/application;
- 5 deployment scenarios and 4 topologies for connectivity topologies is identified;



- Device categorization based on the storage capacity:

- Device A:** No energy storage, no independent signal generation/amplification, i.e. backscattering transmission.
- Device B:** Has energy storage, no independent signal generation, i.e. backscattering transmission. Use of stored energy can include amplification for reflected signals.
- Device C:** Has energy storage, has independent signal generation, i.e., active RF components for transmission.





Potential SA2 Objectives

Support the energy efficient communication with different type Ambient IoT device to fulfill the service requirements for an or group Ambient-IoT device(s)

- Potential objectives including:
 - Identify the architecture impacts based on the use cases provided by SA1 and RAN to support the energy efficient communication;
 - the access control and mobility management for the Ambient IoT supporting;
 - the QoS mechanism for the Ambient IoT device(s) supporting;
 - the information collection and exposure to the AF (identified by SA1 an RAN);
 - the life cycle management of the Ambient IoT device(s);
 - the security and privacy with light-weight;
 - Charging. e.g. collection of charging information based on charging policies for Ambient-IoT device;



XRM phase II



Motivations (SA1)

SA1 Metaverse(SP-220353, TR 22.856) is studying XR-based services(28 use cases identified) with the objectives:

- Investigate specific use cases and service requirements for 5GS support of enhanced XR-based services as well as potentially other functionality, to offer shared and interactive user experience of local content and services, accessed either by users in the proximity or remotely.
- The interactive XR media shared among multiple users in a single location.
- Identification of users and other digital representations of entities interacting within the metaverse service.
- Acquisition, use and exposure of local (physical and digital) information to enable metaverse services.
- Privacy, charging, public safety and security requirements.

SA1 XRMobility(SP-230233) is studying XR-based services with the objectives:

- the 5G system shall support the service continuity for XR services and support the connectivity for XR services under high UE mobility.

Gaps:

- Not support the service continuity for XR services and the connectivity for XR services under high UE mobility.
- Not support the synchronize multiple SDFs from multiple UEs associated with one user, and different users at different locations.
- Not support the QoS enhancement/coordination for the UE to UE interaction, e.g. latency of the UE to UE;
- Not support the spatial anchors interaction, e.g. establish an association between a physical location and service information, exposure of spatial anchors to authorized third parties, and of service information associated with spatial anchors.

Motivations (RAN)

📶 RAN XR (eXtended Reality) enhancements for NR(TR 38.835) studied the enhancement for the XR services. Conclusions are recommended as follows,

- For XR Awareness:
 - Provisioning by CN of semi-static information per QoS flow (e.g. PDU set QoS parameters), dynamic information per PDU set (PDU Set information and Identification) and End of Data Burst indication;
 - Identifying by UE of PDU Sets, Data bursts and PSI;
 - Provisioning by UE of XR traffic assistance information e.g. periodicity, UL traffic arrival information (FFS).
- For Power Saving, DRX support of XR frame rates corresponding to non-integer periodicities.
- For Capacity Enhancements:
 - Multiple CG PUSCH transmission occasions in a period of a single CG PUSCH configuration;
 - Dynamic indication of unused CG PUSCH occasion(s) based on UCI by the UE;
 - BSR enhancements including at least new BS Table(s);
 - Delay reporting of buffered data in uplink;
 - Discard operation of PDU Sets.

📶 Gaps:

- Continue study the XR awareness for the UL, e.g. PDU set based QoS handling of the UL.
- Continue study the power saving, and trade off between the power consumption with the QoE.
- Not support the PDU set based QoS handling cross the QoS flows, e.g. discard and coordination of the PDU set cross the QoS flows.



Motivations (SA2 and SA4)

SA2 XRM (TR 23.700-60) studied the architecture aspects related to better support advanced media services, e.g., HDRLL services, AR/VR/XR services, and tactile/multi-modality communication services.

- The conclusions of all 9 KIs are recommended for normative work (TS 23.501/502/503) described in clause 5.37 of TS 23.501:
 - support QoS policy control for multi-modal traffic, see clause 5.37.2.
 - support network information exposure which can be based on ECN markings for L4S, see clause 5.37.3 or 5GS exposure API, see clause 5.37.4.
 - support PDU Set based QoS handling including PDU Set identification and marking, see clause 5.37.5.
 - ensure that the UL and DL packets together meet the requested RT delay and also update the delay for UL and DL considering QoS monitoring results, see clause 5.37.6.
 - perform per-flow PDV monitoring and policy control according to AF provided requirements, see clause 5.37.7.
 - provide traffic assistance information to the NG-RAN to enable Connected mode DRX power saving, see clause 5.37.8.

SA4 5G Real-time Media Transport Protocol Configurations (TS 26.522) focuses on RTP over UDP

- Optimizing the use of RTP for uni and bi-directional transport of real-time immersive media and associated metadata.
- On progress the RTP Header Extension for PDU Set Marking.

Gaps:

- Not support the inter PDU sets dependency, inter SDFs coordination for PDU set based QoS handling.
- Need to enhance the mobility management for XR, e.g. policy coordination for multi-UEs, NF discovery and reselection.
- Power saving, tradeoff of the power consumption and QoE, e.g. for different type device;
- The synchronization/coordination between multi-SDFs of the same Multi-modality service, e.g. multi-SDFs of multi-UEs.



Potential SA2 Objectives

- 📶 Study XRM service supporting considering the requirements identified from SA1, RAN, SA4 and the SA2 Phase I
 - Potential objectives including:
 - The PDU Sets based handling optimization, e.g. UL PDU set handling, PDU set dependency, PDU set handling cross QoS flows, encrypted SDFs supporting;
 - The mobility enhancement, e.g. service continuity and connectivity for XR services under high UE mobility;
 - Power management considering the characteristic of services or UE on the different scenarios, e.g. localization service, spatial information; tradeoff of the power consumption and QoE, e.g. for different type device;
 - The synchronization/coordination between multi-SDFs of the same Multi-modality service, e.g. multi-SDFs of multi-UEs in different location;
 - The QoS enhancement for the UE to UE interaction, e.g. latency of UE to UE.

Summary

Our interested topics (with priority order high to low)

- Integrated Sensing and Communication
- AI enabled 5G System
- Integration of satellite components in the 5G architecture Phase III
- DualSteer/Dual NR Access Registration/ATSSS Ph4
- Ambient IoT
- XRM phase II

Principles of proposing and selecting topics for the R19 package

- Market relevance
- Clear benefits
- Broad support
- Timeliness