

# InterDigital's view on Rel-19

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# Outline

- R19 Considerations
- Possible Inputs and topics from Interdigital
- List of 10 topics proposed for prioritization.
- One slide summarizing each topic

# Rel-19 SA Considerations

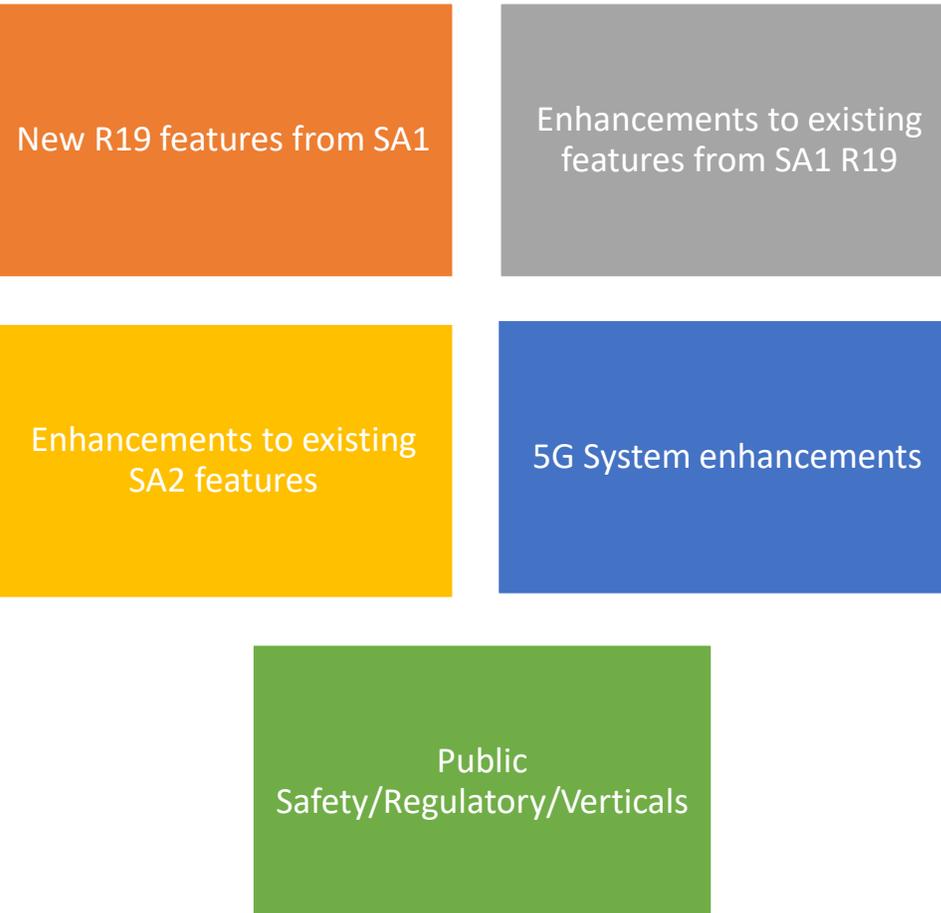
## Strike the right between depth and breadth of topics

- Maximum number of the whole R19 SA2 SIDs for SA2 - possibly 10 to 12 SIDs
- The study work of the R19 SA2 SIDs approved in the first work package on SA#101 can start from September
  - Some of items required larger TU budgets should ideally be part of the first package approved at SA#101
- There should be a common understanding that approved first package items will not be deprioritized in Dec SA#102
- Our recommendation is that companies submit most of the R19 proposals as early as possible, i.e. to SA2#158(Aug) meeting (for approval)

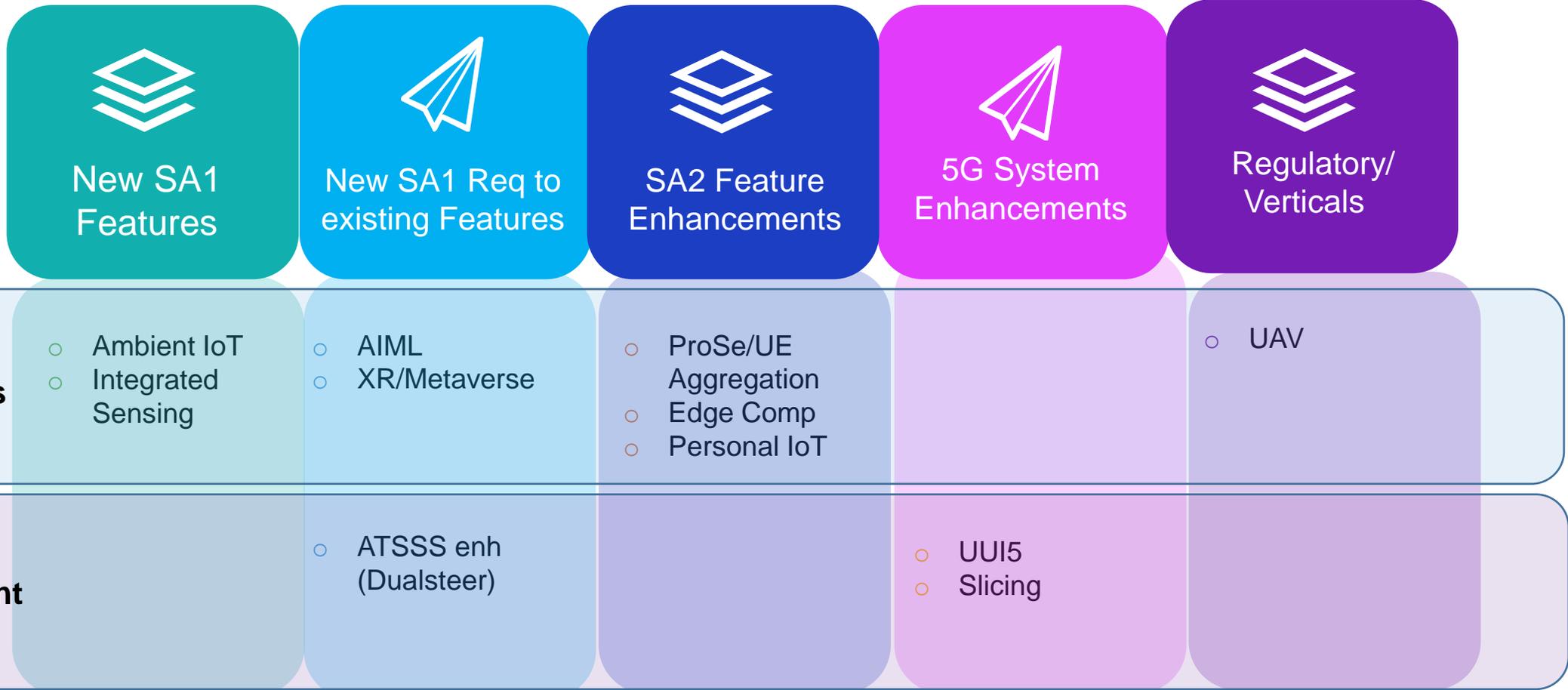
## System Enhancements vs New 5G technologies

- Further enhancements and improvements of 5GS to increase system performance, coverage, security, and user experience
  - System enhancements addressing existing features and new 5G system features
- Support of new and advanced technologies/services such as artificial intelligence, ambient IoT devices, Sensing and Immersive experience

# Inputs for Rel-19 Topics



# Possible Rel-19 Topics



# Overall View on Rel-19 Content (1/2)

S.NO.	Title	Brief Description and Key Objectives	Related Stage-1 Study/Work Item	Lead Stage-2 WG	RAN dependencies	Other WG dependencies
1.	<b>XRM/Metaverse</b> (See slide 9)	Application Layer Enablers for the Metaverse. Support for flow synchronization, protocols other than RTP, encrypted data, high mobility, communication between devices and non-3GPP access.	Yes, TR 22.856	SA2, SA6	Yes, Major	SA3, SA4, SA5
2.	<b>AI/ML</b> (See slide 10)	AIML model transfer over Uu, UE-to-UE, UE to Network/UE to UE Relay. Security considerations when supporting AIML model transfer over D2D communications.	Yes, TR 22.876	SA2	Yes	SA3, SA4, SA5
3.	<b>User Identities</b> (See slide 11)	Defining what information goes into an operator managed User Profile and where it is stored in the 5GC. Authenticating and Authorizing users. Enable charging based on user identity, including how to identify traffic from a user separate from traffic of other users. Taking user identity into account when delivering services and service settings.	Yes, TR 22.904	SA2	No or Minor	SA3, SA5
4.	<b>Ambient Power-Enabled</b> (See slide 12)	Architecture enhancements to support mobility management, positioning, tracking, security, network selection, and access control.	Yes, TR 22.840	SA2	Yes	SA3, SA5
5.	<b>Integrated Sensing &amp; Communications</b> (See slide 13)	Sensing architecture, including data collection and exposure.	Yes, TR 22.837	SA2	Yes	SA3, SA5



# Overall View on Rel-19 Content (1/2)

S.NO.	Title	Brief Description and Key Objectives	Related Stage-1 Study/Work Item	Lead Stage-2 WG	RAN dependencies	Other WG dependencies
6.	<b>Dual Steer</b> (See slide 14)	PLMN selection procedure for the secondary access leg Mechanisms to support Multi-Connectivity steering where 3GPP access legs can be different accesses, different access types, and different connectivity types.	Yes, TR 22.841	SA2	No or Minor	SA3, SA5
7.	<b>UAV</b> (See slide 15)	Improved reliability by associating with multiple PLMN. Tracking of non-networked UAVs (UAVs without network subscription) Optimal and reliable flight path planning based on the network analytics	Yes, TR 22.843	SA2	No or Minor	SA6, SA3, SA5
8.	<b>Edge Computing</b> (See slide 16)	Support for collaborative use cases, including ACR support for groups. Edge application enablers for SA1 studied verticals. Exposure of Edge Services to non-3GPP devices. UE Accessing Edge Services when non-integrated Wi-Fi becomes available.	N/A	SA6	No or Minor	SA2, SA3, SA5
9.	<b>Proximity Services</b> (See slide 17)	Support of Multi-hop for UE-to-UE Relay and UE-to-Network Relay. Discovery, association and group mobility of UEs to forming Aggregations	Yes, TR 22.866	SA2	Yes	SA3, SA5
10.	<b>Personal IoT Networks</b> (See slide 18)	Support for identifying PIN elements. Authenticating and Authorizing a PINE's access to a PIN. 5G RF acting as a PEGC/PEMC.	Yes, TR 22.859	SA2	No or Minor	SA3, SA5

The items listed in this table are in no specific priority order

# Summary

- Release 18 XR and AIML topics require further enhancements
- One or two new features should be part of the R19 SA package e.g., Ambient IoT and Integrated Sensing
- Overall R19 package should consist of a balanced combination of smaller and larger SIDs/WIDs – total maximum 10 to 12
  - Detailed technical discussion and agreement on the scope of the SIDs/WIDs should take place in the respective SA WGs.

# XRM / Metaverse

## Justification

- R18 provides support for baseline XR use cases such as cloud gaming, VR, smartphone-based AR
- R19 and beyond to consider advanced and demanding XR use cases which are more AR-centric, outdoor and mobile
  - Example: Localized Mobile Metaverse Service, virtual alter egos, spatial mapping and localization services
- Advanced XR use cases and requirements are characterized by:
  - *Multi-modality*
  - *New traffic patterns and stringent target QoS*

## Proposed R19 Scope

- Metaverse and XRM Service Enablers (SA6, SA2)
- Synchronization of Flows (SA2)
- Support for protocols other than RTP, e.g. HTTP3/QUIC (SA4/SA2)
- The PDU Set feature with Encrypted Data (SA2/SA3/SA4)
- Fault Tolerance for high reliability (e.g. Critical Health Care) (SA2)
- Service/experience continuity in high mobility scenarios (SA2)
- Support of non-3GPP access and ATSSS (SA2)
- Communication between devices (e.g. via N6 with no AS) (SA2)

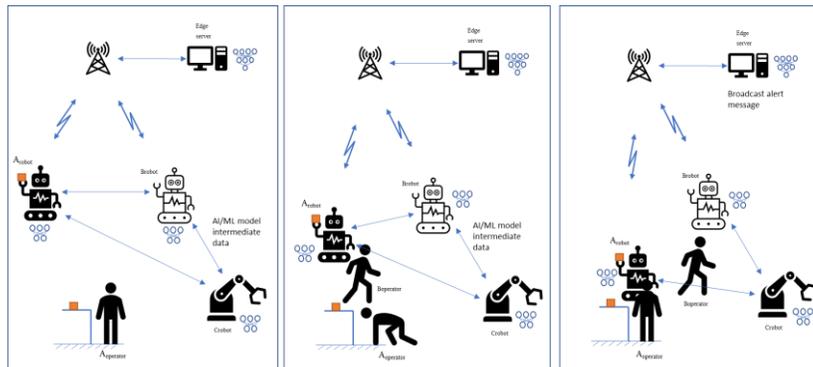
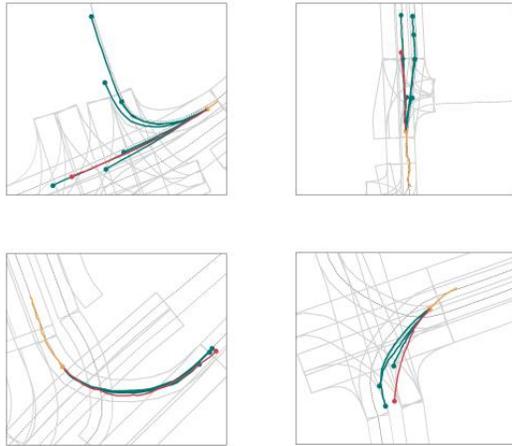


**Localized Mobile Metaverse Services offering relevant information**



**Virtual humans in metaverse**

# AIML System



## Justification

- R18 addressed model transfer on 5GS networks for efficient transport of AIML traffic, including model distribution and federated learning, albeit limiting scope to single slice and device-to-NW communications
- R19 to consider model transfer over, direct and indirect communications, e.g., D2D and AIML model transfer on 5G hotspots
  - Example: QoS prediction along predetermined route, Distributed Learning using device offloading of intermediate data
- Some Use Cases benefiting from these capabilities:
  - *Intelligent Driving Services based on Trajectory Prediction*
  - *Local AIML model split on Factory Robots*

## Proposed R19 Scope

- AIML model transfer over Uu, UE-to-UE, UE to Network/UE to UE Relay
- AIML model transfer with Predicted QoS along predefined AoI
- Network Exposure to UE
- AIML model transfer supported by more than one S-NSSAI
- AI for Media (SA4)
- Architectural aspect of Security considerations when supporting AIML model transfer over D2D communications

# User Identities

## Justification

- A user can be person, device, or an application.
- 5G System Requirements were established in Rel-16 for identifying users (TS 22.101, section 26a and TS 22.115, section 5.2.17)
- As of Rel-18, the UE has only one identifier that is capable of being authenticated (i.e., the SUPI - subscription identifier).
- By adding support for identifying users, *network settings can be adapted and services can be offered to users according to the needs of the user.*
- By acting as an identity provider, the operator can take additional information from the network into account to provide *a higher level of security for the authentication of a user.*
- **Charging** can be based on the person, application, or non-3GPP device that is using network services.
- Use cases include PIN Deployments (identifying devices), smart phones (identifying the human user and adjusting network settings), and Edge Computing (identifying Edge Applications).

## Proposed R19 Scope

- Defining what information goes into an **operator managed User Profile** and where it is stored in the 5GC (SA2)
- Authenticating and Authorizing users (SA2/SA3)
- Linking and unlinking User Identities with Subscriptions (SA2)
- Enable **charging based on user identity**, including how to identify traffic from a user separate from traffic of other users (SA2)
- Taking user identity into account when delivering services and service settings (e.g., policies) (SA3)

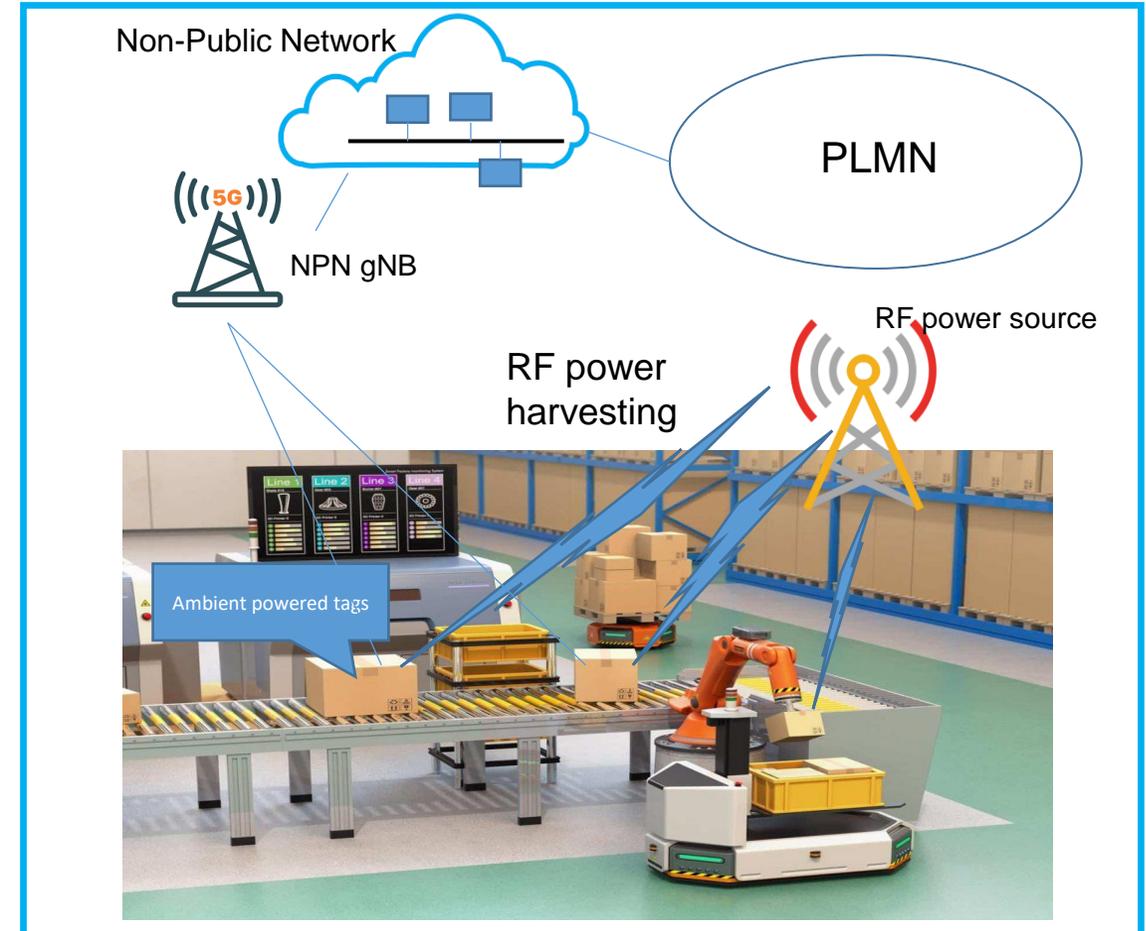
# Ambient IoT

## Justification

- Ambient IoT devices find its use in many diverse use cases such as smart warehouse, smart home, industrial wireless sensor network, etc. The addressable market is estimated to be over 10 trillion devices.
- Ambient IoT is also a promising technology to address some environmental concerns.
- The use cases and characteristics of Ambient IoT require 5GS to support ultra-low complexity devices, minimum active-time communication and light-weight security mechanisms which the existing system doesn't support.
- Other standards bodies are also actively investigating the technology.

## Proposed R19 Scope

- Evolved system architecture, procedures and security mechanisms that require less transactions between the devices and the network
- Mobility and reachability management for Ambient IoT devices
- Positioning and tracking for Ambient IoT devices
- Network selection and access control
- Enhancement of existing features (e.g. NPN) to support Ambient IoT devices



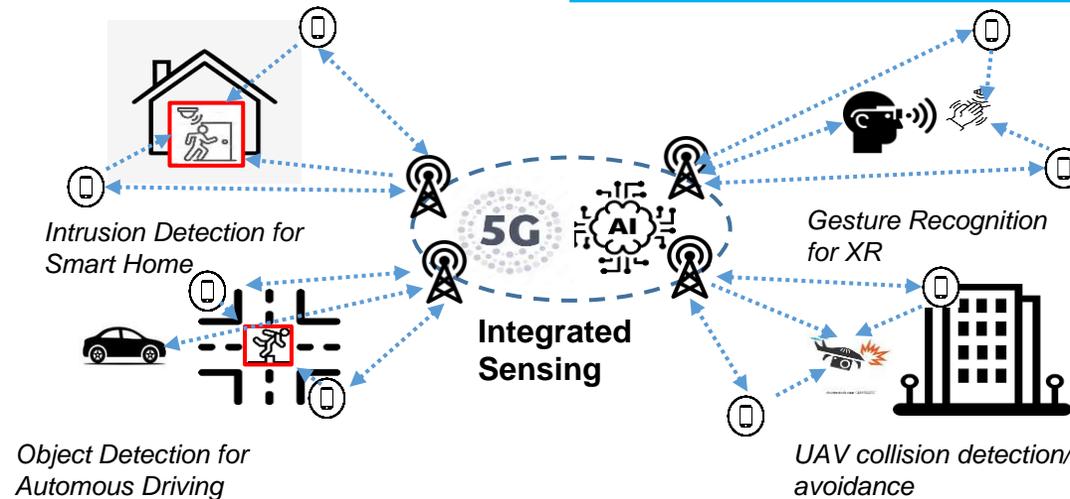
# Integrated Sensing

## Justification

- Many use cases rely on sensing technology (e.g., positioning, environment recognition, HMI) for UAV, Autonomous driving, Public Safety, and XR services
- New business opportunity with 3GPP based sensing services without new infrastructure dedicated for sensing.
- SA1 developed use cases and system requirements at FS\_Sensing.
  - *Intruder detection for Smart Home*
  - *Sensing Assisted Automotive Maneuvering and Navigation*
  - *UAV trajectory tracing*
  - *Gesture Recognition for Immersive Interaction*

## Proposed R19 Scope

- Framework for sensing data collection.
  - Functional split between RAN and Core Network.
  - System Architecture and E2E signaling for Sensing Operation
  - Sensing Data Collection and Management Framework
  - Policy and QoS support for 3GPP based sensing services
- Support of non-3GPP sensing data for integrated sensing.
- Service exposure of sensing internally and externally
- Security, Privacy and charging aspects



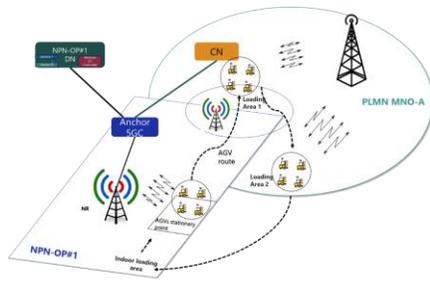
# Dual Steer

## Justification

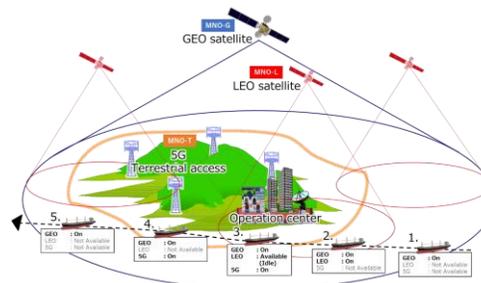
- Most UEs already support Multi-Connectivity over two 3GPP access legs – this is handled **at lower layers** (e.g. Carrier Aggregation, Dual Connectivity)
  - However, this lower-layer Multi-Connectivity is **not meant to steer, split, and switch traffic of a single service data flow across both access legs**
- ATSSS does support these features– but for ATSSS case, one leg is 3GPP and the other is non-3GPP
- Multi-Connectivity over two 3GPP access legs allows use cases where one leg is over satellite, leveraging the work from R17/R18, which focused on defining operation over satellite based 3GPP access
- There are many use cases, where there are advantages to support these features where both access legs are 3GPP
- Benefits: Improve access and network resources utilization, capacity, coverage, reliability and QoE

## Proposed R19 Scope

- New PLMN selection procedure for secondary access leg
- Mechanisms to support Multi-Connectivity steering where 3GPP access legs can be: different accesses (NR, LTE), different PLMNs, different mobile network types (HPLMN, VPLMN, NPN), different access types (terrestrial vs satellite) + they may potentially consider different bands (licensed and unlicensed), different connectivity (direct path and indirect path)
- Steering modes for multi-connectivity over 3GPP
- Support of seamless mobility as one access leg changes (including case that the access leg changes from 3GPP to non-3GPP)
- Mechanisms to allow simultaneous steering of user data for a group of UEs



Simultaneous steering for group of UEs



Seamless Mobility with Multi-Connectivity



3GPP Accesses: satellite, NPN

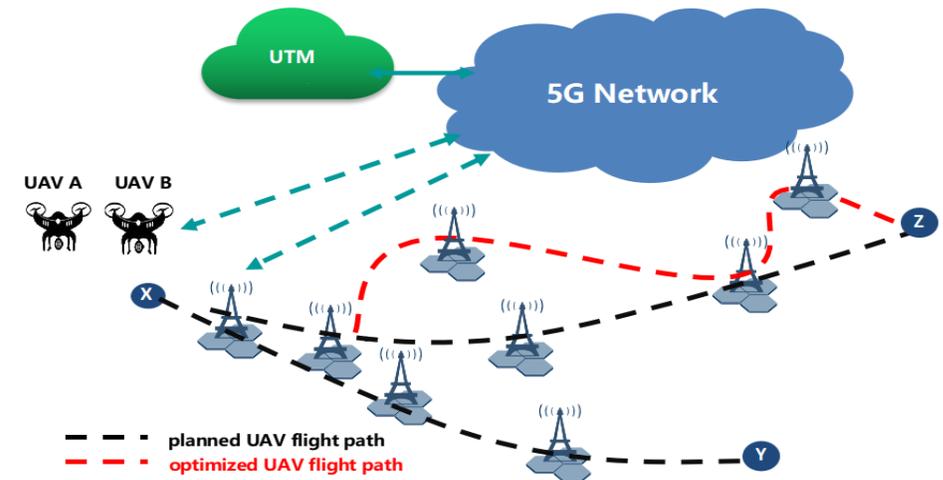
# UAV

## Justification

- R18 provides multi-USS support, the detect-and-avoid (DAA) support and direct command-and-control (C2) via PC5
- R19 and beyond to consider enhancements for UAV path scheduling and optimization based on UAV tracking and 5GS network analytics
  - Example: Tracking via ground stations, considering the QoS along the proposed flight path based on network analytics
- R19 and beyond also considers to enhance DAA, e.g., sensing can be additional 5G system capability for UTM for situational awareness
- Future regulatory requirements for BVLOS (e.g., see FAA's UAS BVLOS ARC) are expected to cover communications and safety aspects for scalable flight path planning, high level of reliability and improved resilience during flight operations.

## Proposed R19 Scope

- Reliability associated to multiple PLMN
  - E.g. for commercial services redundancy and reliability are key
- Tracking of non-networked UAVs (UAVs without network subscription)
  - E.g. Using non-3GPP direct communication
- Optimal and reliable flight path planning based on the network analytics



UAV pre-flight path optimization

# Edge Computing

## Justification

R18 addressed support for roaming UEs and provided additional edge connectivity and application framework improvements.

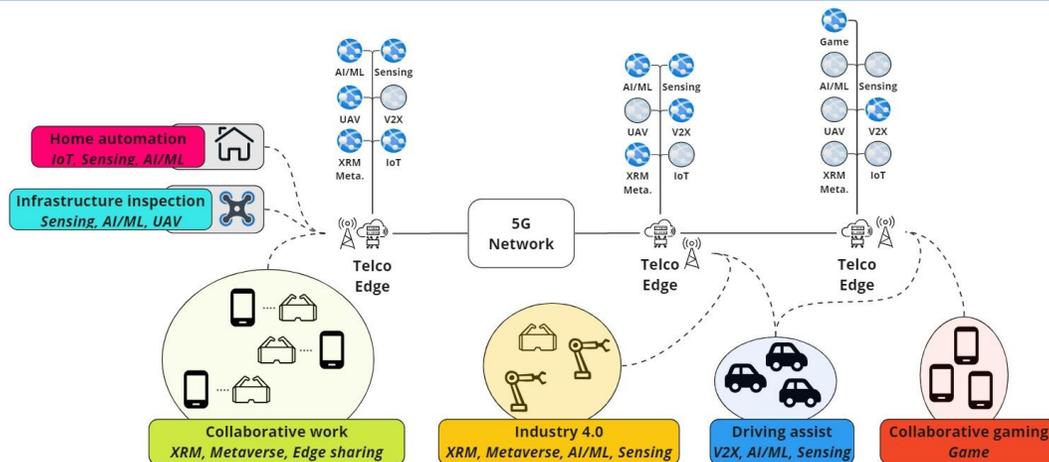
R18 addressed use cases that involve groups of UEs and groups of EASs **collaborating** only in a limited way.

The **collaboration capabilities that have been introduced in Rel-18 are limited**. For example, service continuity for groups of UEs and EAS bundling for groups of UEs is not supported. Thus far, there has been **little exploration of how Edge features can be utilized by other verticals** such as metaverse, AI/ML, IoT, V2X, and UAV deployments.

## Proposed R19 Scope

- Full support for **collaborative** use cases, including ACR support for groups [SA6]
- Edge application enablers for SA1 studied verticals [SA6,SA2?]
- Performance monitoring & reliability of edge enablement layer [SA6]
- Exposure of Edge Services to non-3GPP devices [SA6]
- Consecutive traffic steering in different N6 LAN [SA2]
- UE Accessing Edge Services when non-integrated Wi-Fi becomes available [SA2]

*NOTE: Most require SA3 involvement*



Edge Computing

Rel17	- SA2/SA6 Edge framework - Service provisioning - Services discovery - Service continuity
Rel18	- Roaming - Collaborative use cases - Connectivity enhancements - Framework enhancements
Rel19	- Vertical enablement - Collaborative use case enhancements - Reliability / Performance monitoring

# Proximity Services Enhancements

## Justification

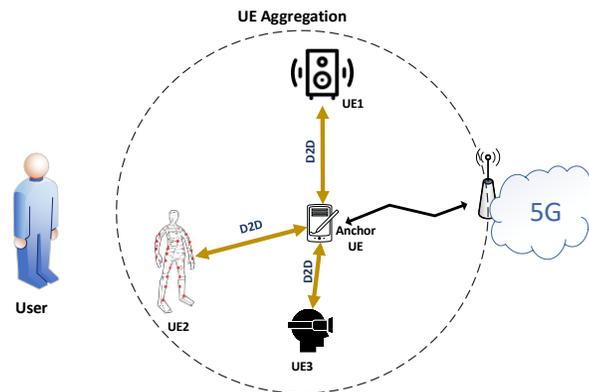
- R17 provides support for network access via proximity communication to a UE-to-Network Relay
- R18 provides UE-to-UE proximity communication via a UE-to-UE Relay
- R19 and beyond to consider low latency, high reliability, limitation of UE power capacity and poor network coverage use cases. Examples are:
  - Mining robots, Offshore drilling, Tunnels, UE power saving using PC5 instead of far away gNB
- Use cases requirements are characterized by:
  - *Enhanced coverage, Enhanced throughput, Enhanced reliability*

## Proposed R19 Scope

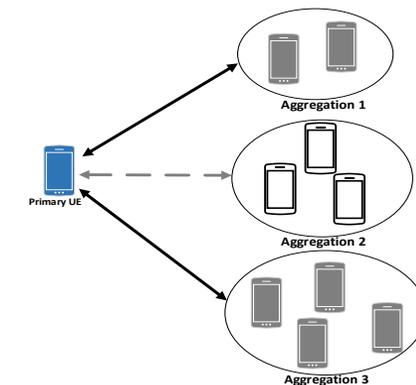
- ProSe Enhancements
  - Layer-2 UE-to-UE Relay completion (RAN dependencies)
  - Support of Multi-hops for UE-to-UE Relay and UE-to-Network Relay
  - 5MBS traffic over UE-to-Network Relay and UE-to-UE Relay
  - Multi-path transmission using any combination of direct/indirect paths (U2U/U2N Relays, direct PC5, direct Uu)
- Support of UE Aggregation
  - Discovery and association of UEs to form Aggregations
  - Discovery and joining existing Aggregations
  - Aggregation of UEs belonging to the same or different users
  - Fast path switching (mobility, congestion)



Mining robots

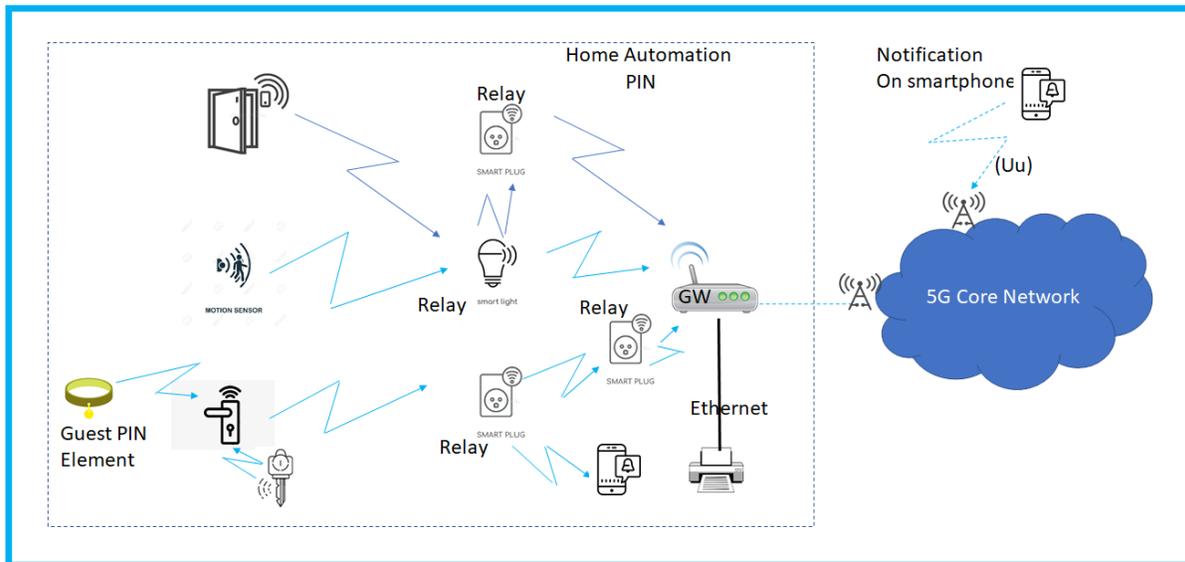


UE Aggregation for a single user/application



Discovering UE Aggregations

# Personal IoT Networks



## Justification

- R18 provides basic functionality for Personal IoT Networks, where in PIN elements can communicate directly or via PIN Elements with Gateway Capability (PEGC), communicate with 5G network via PEGC, and managed by PIN Element with Management Capability (PEMC).
- Some of the requirements from SA1 remain unsatisfied.
- PEGC functionality in a 5G-RG is not supported in Rel-18.

## Proposed R19 Scope

- Identifying PIN elements (PINEs)
  - Use of identities to provide customizable services, charging framework for PINEs, update URSP and Session Management framework.
- Support for PIN Collaboration
  - Authorization/deauthorization of specific PIN elements from a PIN to communicate/access services from different PIN/ PINE.
  - Authorization/deauthorization of specific non-3GPP devices of a PIN to access PEGC from different PIN to get access to external applications/services.
- 5G RG acting a PEGC/PEMC controlling PINE devices