Industry view and Samsung role in LOCUS project

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Contents

Introduction

- Samsung is one of **top R&D spenders** globally and leading 5G vendor

- Samsung **has contributed to EU funded R&D** with industry partners, SMEs and universities

- Samsung R&D has **increased its presence in H2020 5G projects** since 2015

- By joining LOCUS project with European partners the company has committed to **develop 5G localisation and analytics technology** for new applications

WP2 contributions – Use cases, Requirements, Security, System Architecture

- Samsung proposed **a framework and a template for describing use cases** and their technical requirements adopted in Deliverable 2.1
  - Methodology based on the proven pre-standardization industry approach

- Samsung introduced **two new use cases** in Deliverable 2.1
  - **3D Indoor Localization for Emergency Scenarios** – to address novel localization mechanisms when legacy approaches are not suitable e.g. GNSS not supported indoors, existing communication infrastructure not available
  - **Vulnerable Road User (VRU)** - represents new 5G vertical Cooperative and Automated Mobility and defines challenging localization requirements required by road safety

- **LOCUS system architecture discussions** supported by Samsung
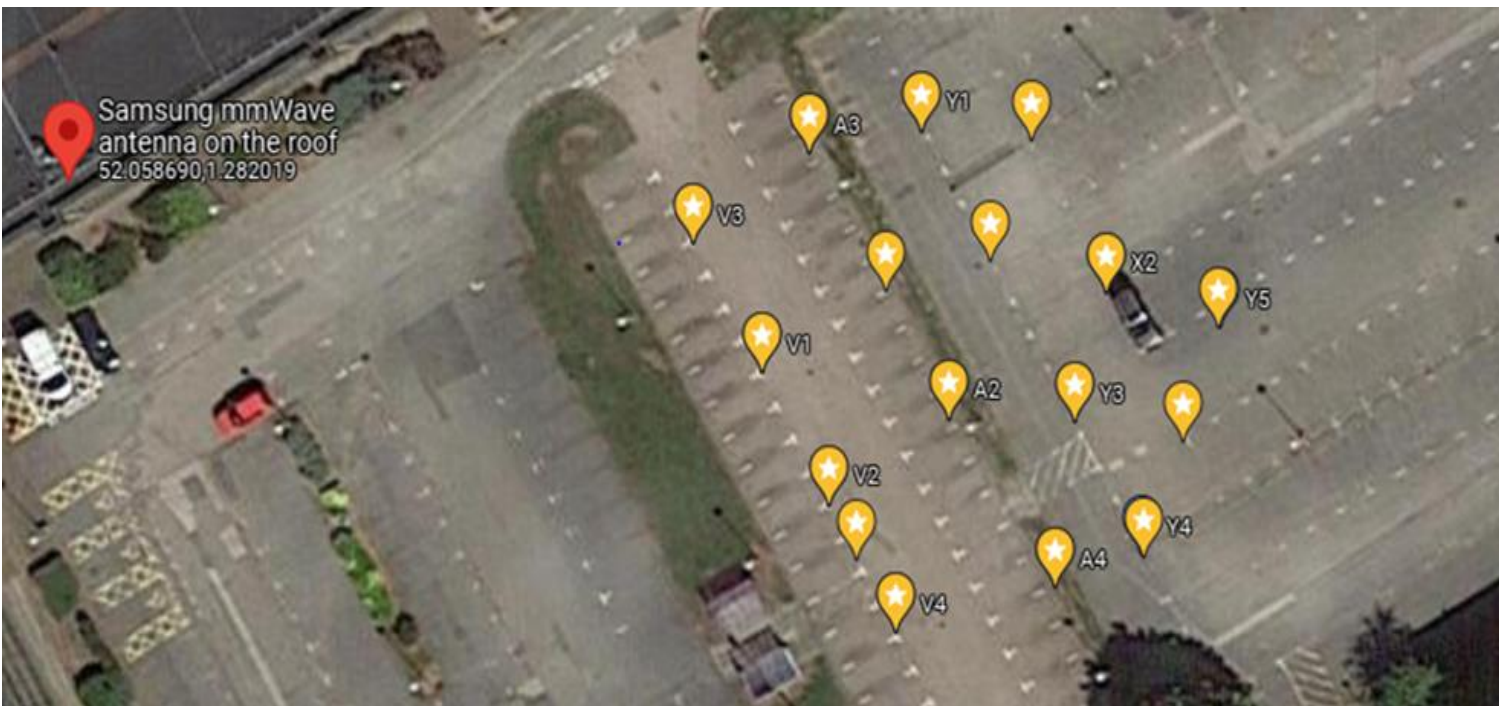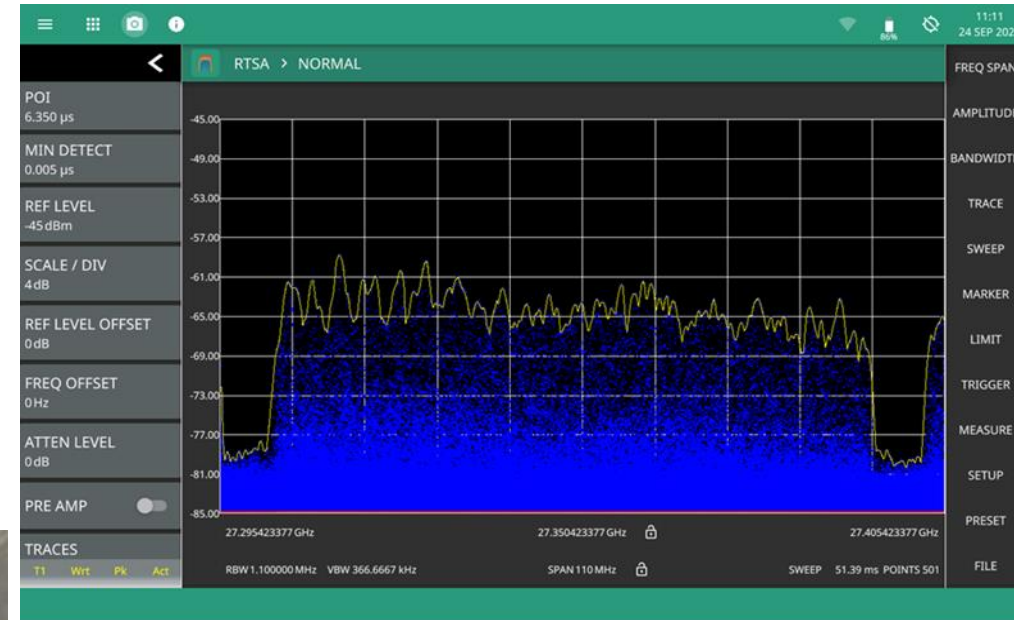
WP3 contributions – Localization Enablers

- **Accurate indoor localization** is a critical requirement for the emergency and law enforcement services
  - The concept and results being shared with the experts of UK Emergency Services Network

- 5G based localization expected to provide **3D indoor localization** information
  - KPIs target agreed after discussions with emergency services with a building fire as the target use case
  - State-of-the-art indoor localization focused on fingerprinting solutions, which are unreliable in building fires

- Novel **drone based 3D localization solution** using 5G has been developed
  - Two tier system in both frequency ranges of 5G-NR demonstrated in Deliverable 3.1 using an integration of two 3GPP localization techniques

- **Feasibility study** and simulation based performance evaluation
  - UE positioning accuracy thresholds are well below the 3GPP commercial use case requirements
  - IEEE Globecom 2020 paper published
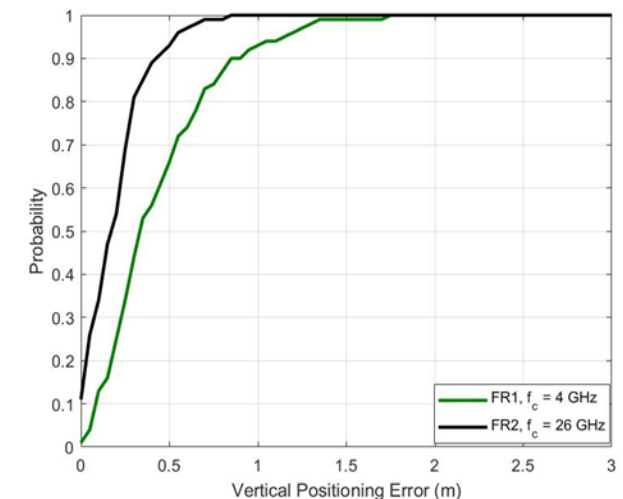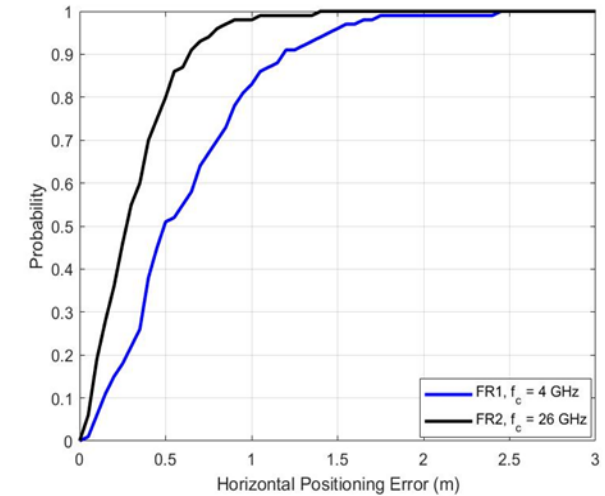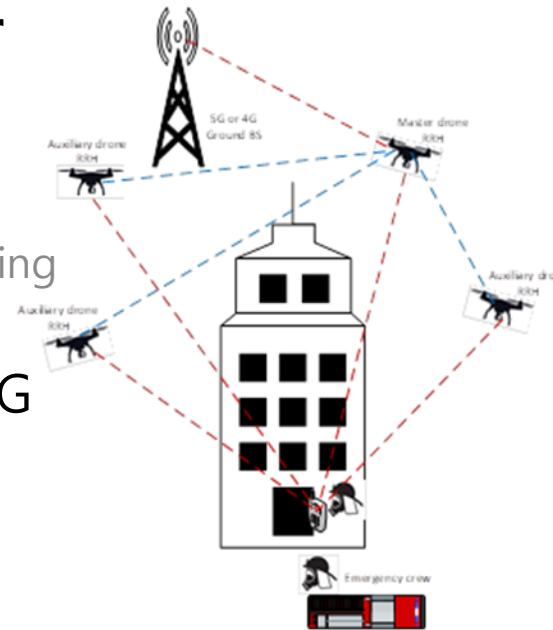
- **RAT-independent localization technologies** are expected to be integrated in the 5G standards to deliver improved performance for evolving commercial applications
  - High precision localization paramount for flow monitoring and crowd control in large venues and dense urban environments

- 3GPP/UWB solution proposed for **mass localization at high precision**
  - Stadium entry use-case developed in Deliverable 3.4
  - User clustering solution provided to reduce overhead of localizing and tracking 100s of UEs to sub-meter-level accuracies with 5G NR
  - Multiple QoS class operation provides reductions in latency at the 5G-UWB boundary region

- Proposed Multiple QoS Class operation **adopted in 3GPP 5G standards**

- **IEEE ICCE 2022 paper** accepted
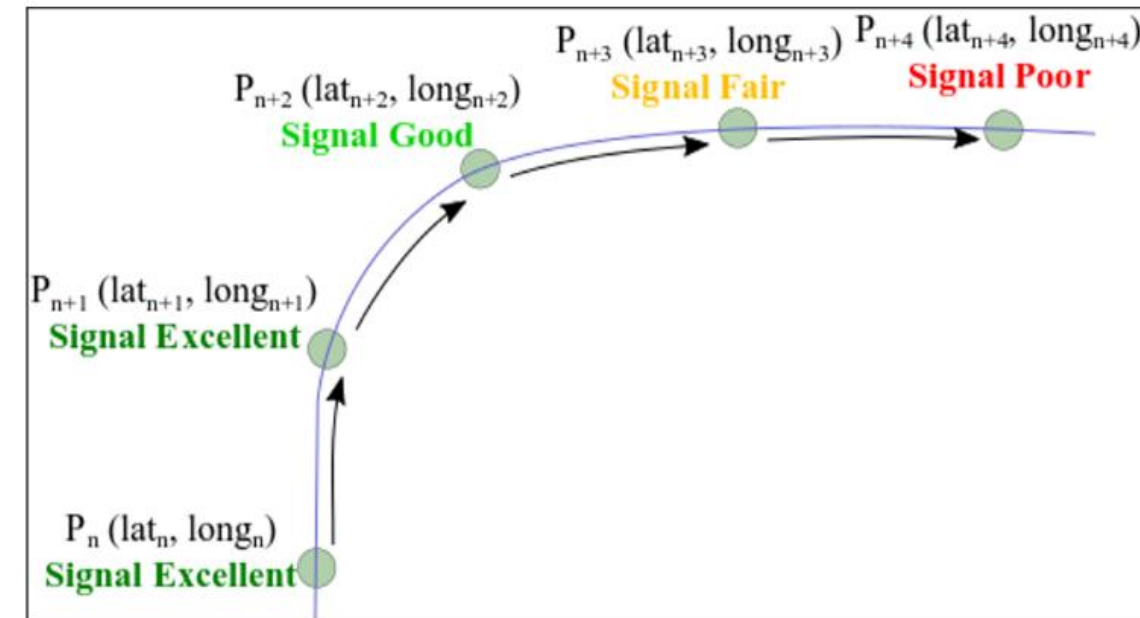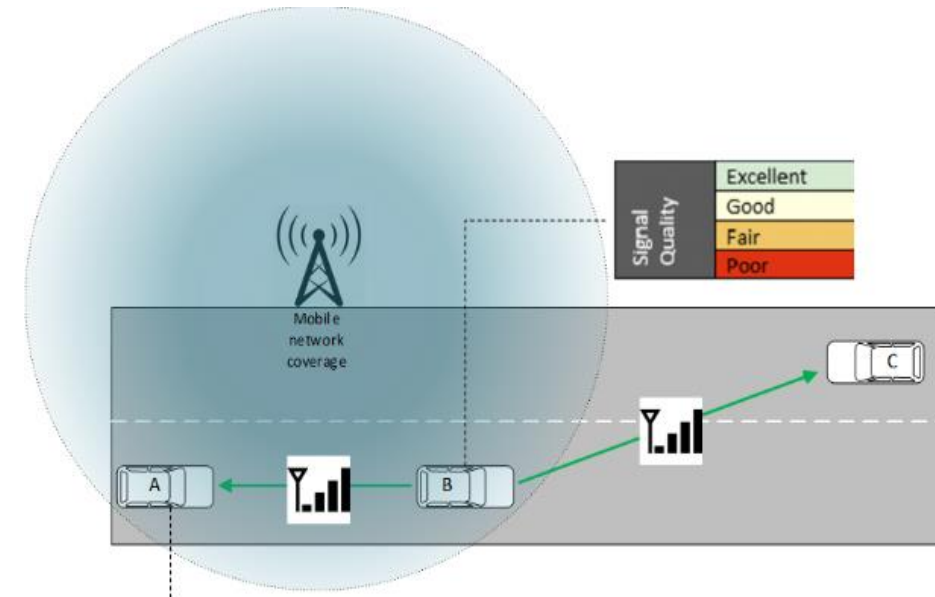
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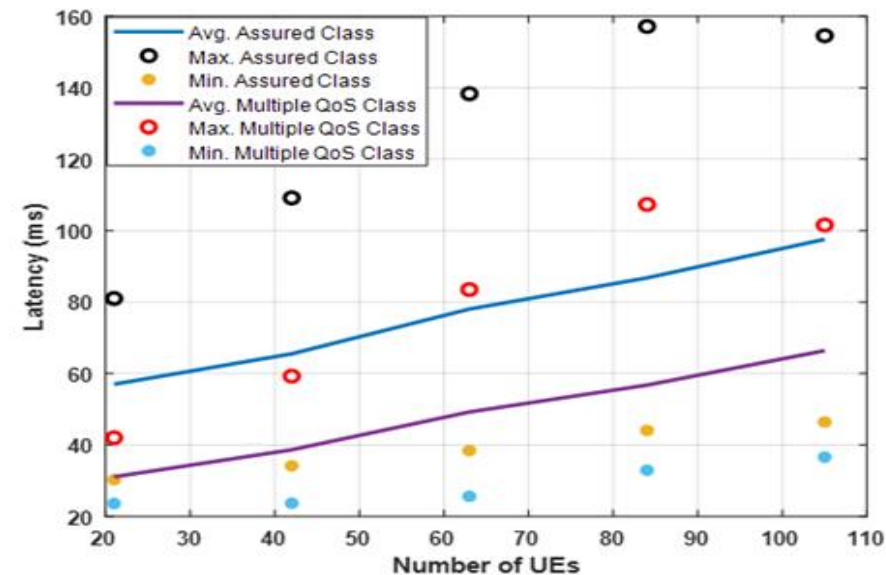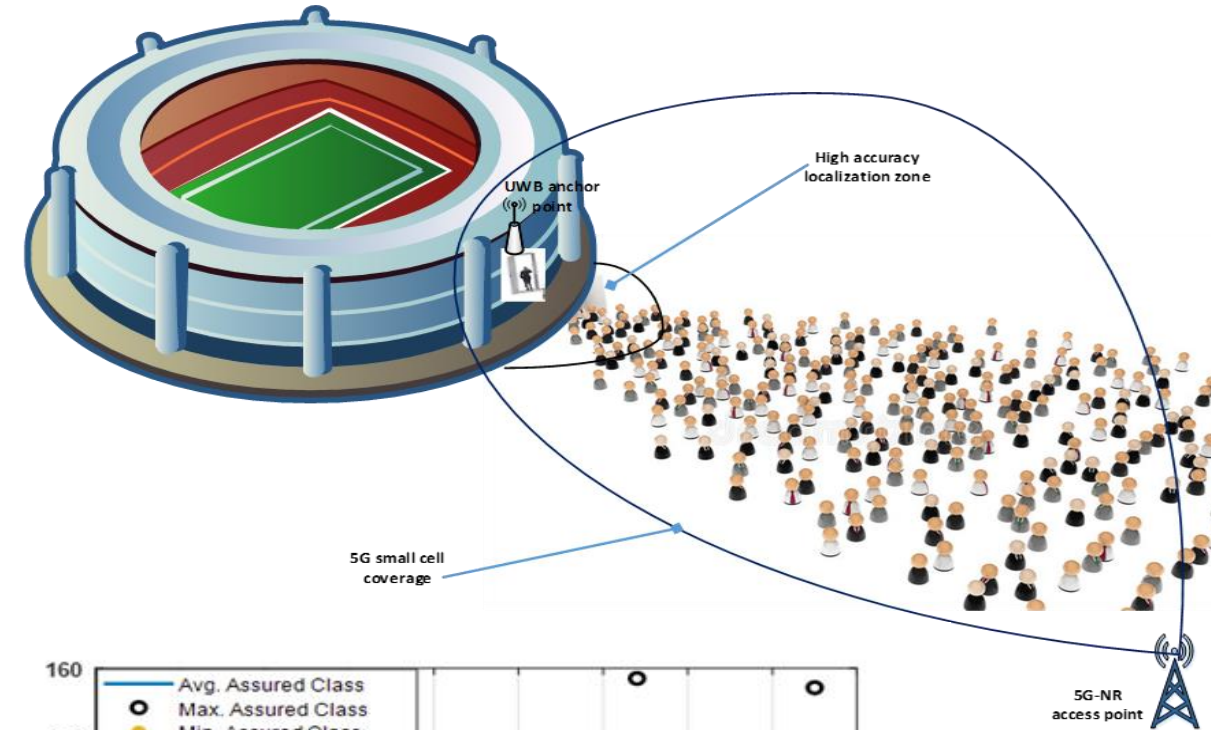
- **mmWave measurements campaign** to investigate the concept of device free localization through the backscattering from an illuminated passive object - vehicle

  - **28 GHz radio measurements** were conducted by Samsung Research UK at the 5G VINNI test network facility at BT Labs Ipswich, UK

  - These channel measurements will be used in the research activity in Task 3.3 - **Device Free Localization**

- 5G mobile networks expected to **support mission critical services** with stringent reliability, availability, latency and throughput
  - QoS variation prediction critical for new use cases e.g. V2X
  - State-of-the-art QoS prediction focused on CN solutions - NW based approach informs about likely to occur QoS changes
  - Allows UE to adapt behaviour before QoS degradation e.g. collection of critical information, application preparation
  - NW based predictions are generated based on collected connection data (KPIs) through specific algorithms

- Novel lightweight and fast **D2D based RAN coverage prediction framework** has been developed
  - UE autonomous but complementary to CN based prediction
  - Preferable when lightweight and fast prediction is required
  - Preliminary analysis and V2X application included in LOCUS Deliverable 4.1
  - Feasibility study, signalling aspects and simulation based performance evaluation described in Deliverable 4.2

- IEEE ICC 2021 conference **paper published**

Samsung Research

- Two novel **spatio-temporal functionalities developed** related to 'Vulnerable Road User' use case

  - **Vulnerable road users clustering** – two or more VRUs e.g. pedestrians moving with similar mobility pattern grouped together to reduce Vehicle-To-Pedestrian communication via cluster leader and improve road safety

  - **Time to collision as a service in V2X** - defines the time period before the physical collision of one moving object with another one with a conflicting movement trajectory. Typically used to decide the urgency of the required collision avoidance action

- Introduced in Deliverable D5.1 which also **identified proposed ML techniques** for each functionality

- Time to collision as a service in V2X could be **a location analytics-based enabler for new business applications** in connected and automated mobility such as

  - Driving risk evaluation for individual vehicle or VRU
  - Traffic management for vehicles in a specific region
  - Transport network planning for a specific road network section

- **Analytics specification** for Time to collision as a service in V2X described in Deliverable 5.3

- Vulnerable road user clustering **performance evaluation planned** in Deliverable 5.2
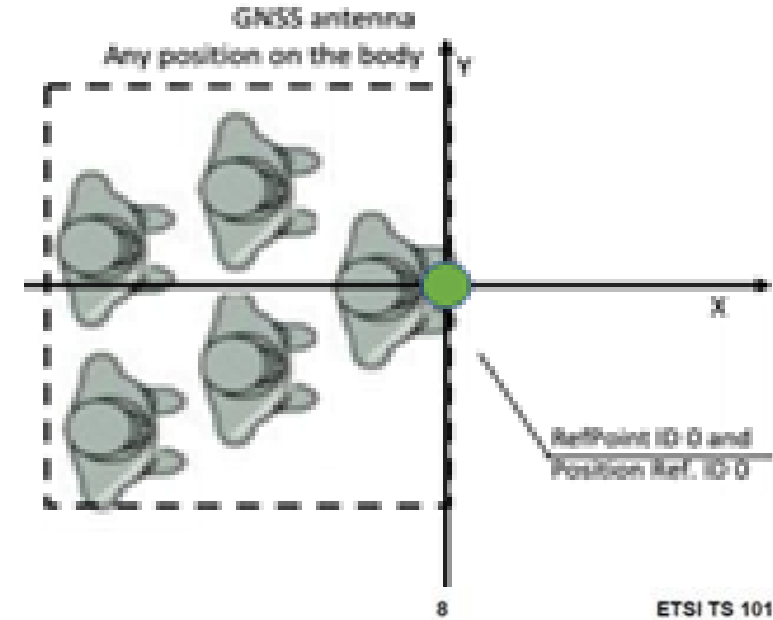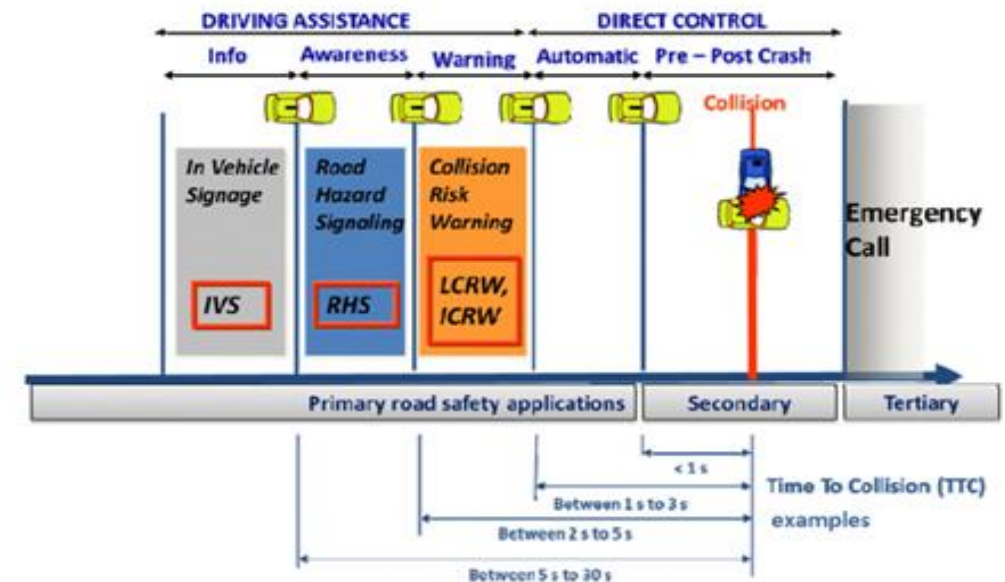
- **Localization related developments in 3GPP RAN and SA2 in Rel. 16, 17 and now 18**
  - Samsung hosts **quarterly LOCUS 3GPP focus group meetings** to discuss potential opportunities to contribute
  - Collaborated successfully with Ericsson to co-sign **contributions to 3GPP SA2 on the Multiple QoS class**, where some of the work conducted in LOCUS project was cited

- **ETSI Europe for Privacy Preserving Pandemic Protection (E4P)**
  - Samsung **acted as rapporteur for this work**, accelerated as a response to COVID-19. Informed the project regularly of the developments here, to identify synergies in a similar contact tracing use case in LOCUS

- **ETSI Intelligent Transport Systems (ITS) & 5G Automotive Association**
  - Samsung **initiated the Vulnerable Road User (VRU)** use case in LOCUS, to align with similar work in ITS
  - Ensuring V2X related research in LOCUS **aligned with standardization approach in ETSI and 5GAA**
  - Plan to take some of the **VRU work in WP5 to ITS** in the final project year

Conclusion

- **In LOCUS project Samsung have**
  - Actively **contributed to most WPs** including all core technical areas (WP3/4/5)
  - Demonstrated **technical, coordination and collaboration leadership**
  - Developed **novel technical solutions, frameworks and their evaluations** in the areas of 5G radio access enablers, analytics and new services
  - Provided **commercial and industry insights**

  - Ensured developed technology considers **implementation aspects and potential limitations**
  - Enabled innovative research by leveraging **access to existing Samsung 5G network** products and trials
  - Promoted research **alignment with relevant standardization frameworks** and contributed to their development
  - Continuously supported **communication, dissemination, standardization and exploitation** activities

Thank You