Dynamic Coverage Extension And Distributed Intelligence For Human Centric Applications With Assured Security, Privacy And Trust: From 5G To 6G

5G PPP Test Measurement and KPI Validation work group (TMV WG)

Workshop on 6G KPIs and how to measure them
September 28, 2022

Vera Stavroulaki
WINGS ICT Solutions

DEDICAT 6G

THIS PROJECT IS PART OF THE 5G PUBLIC AND PRIVATE PARTNERSHIP

5G PPP   WWW.5G-PPP.EU

Overview

- Project overview

- Use cases

- KPIs

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DEDICAT 6G - Challenges and vision

Transform Beyond 5G networks into a smart connectivity platform that is dependable/resilient, highly adaptive, ultra-fast, green for supporting securely innovative, human-centric applications.

- **Dynamic distribution of intelligence and computation** for reduced energy and resource consumption

- **Dynamic coverage and connectivity extension** in support of digital inclusion

  - *support service continuity also in more "remote" areas*

- **Enhanced security, privacy and trust**

- **Human in the loop**

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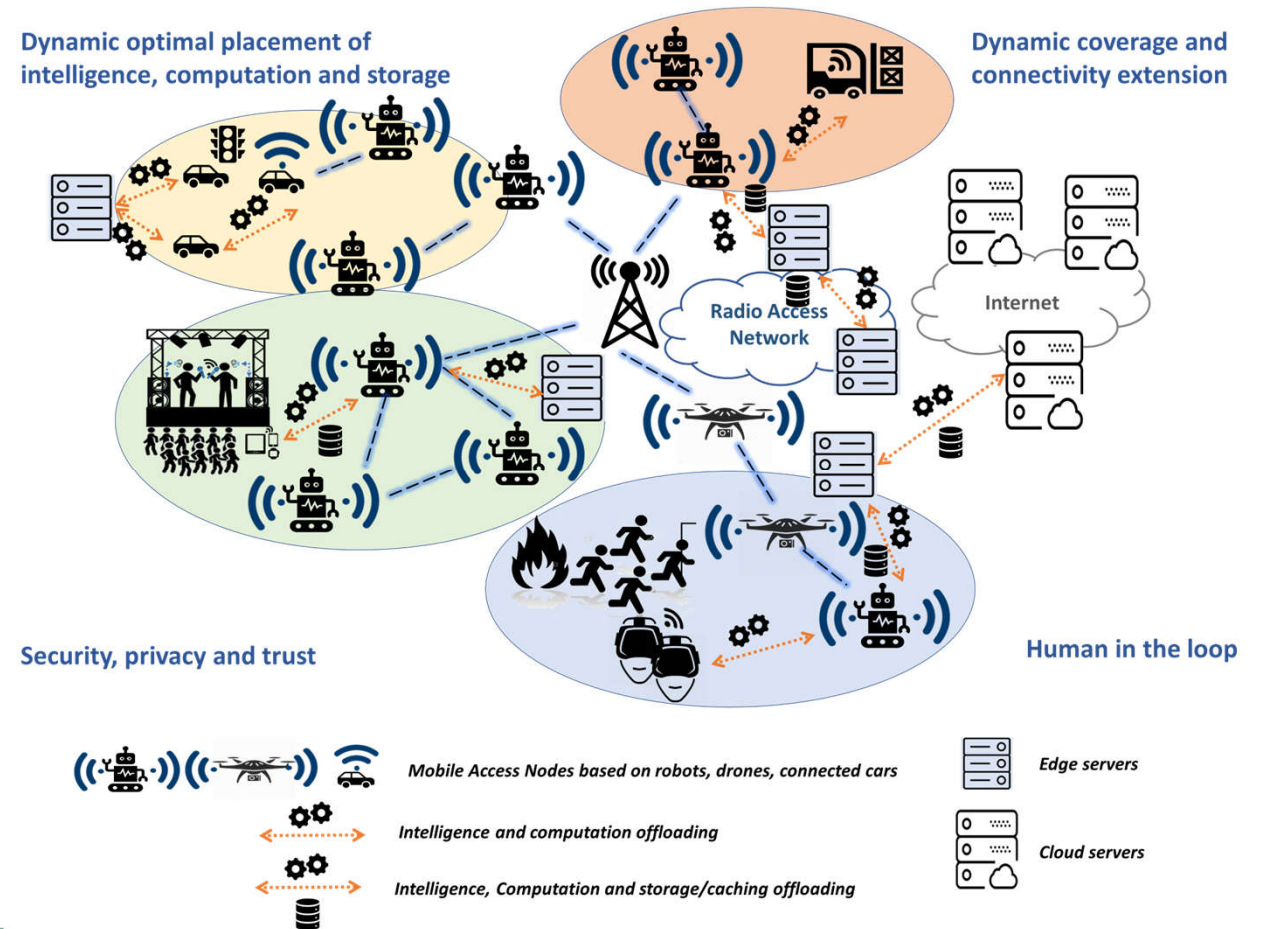
Technical enablers

Mechanisms for dynamic distribution of intelligence and storage in conjunction with predictive caching

Mechanisms for dynamic coverage and connectivity extension

Security, privacy and trust assurance especially for mobile edge services

Applications with novel interaction between humans and digital systems through innovative interfaces and devices (AR, smart glasses, connected cars, robots, drones)

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Key project information

Project Information

DEDICAT 6G
Grant agreement ID: 101016499

DOI
10.3030/101016499 ☑

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1 January 2021	31 December 2023

Funded under
INDUSTRIAL LEADERSHIP - Leadership in enabling and industrial technologies - Information and Communication Technologies (ICT)

Total cost
€ 6 461 391,25

EU contribution
€ 6 461 391,25

Coordinated by
WINGS ICT SOLUTIONS INFORMATION & COMMUNICATION TECHNOLOGIES IKE

⬛ Greece

DEDICAT 6G consortium consists of **14 partners** in total from **8 countries**

- **1 Operator:** ORANGE
- **3 Technology vendors:** NOKIA, AIRBUS, ATOS
  3 SMEs: WINGS, TTI, OPTIN
- **1 Logistics operator:** DIA
- **6 internationally recognized universities and**
- **research centres**: VTT, VLF, CEA, UoS, IMEC and TUC

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Use case pilots

- **Smart warehousing**
  - AI based optimization of warehousing operations
  - assisting training and maintenance through 3D augmented reality
  - enhancing safety of personnel and goods
  - remote inspection and diagnostics;
  - identification and tracking of goods throughout value chains
- **Enhanced Experiences**
  - *Live streaming with extremely low latency locally in public events and remotely (virtual participation)*
- **Public Safety**
  - *Reliable and efficient connectivity everywhere and anytime to drive the digital transformation plan for Augmented First Responders*
    - *demonstrated through natural disasters in non-urban settings and man-made in urban settings*
- **Smart Highway**
  - Connected and autonomous mobility with the smallest possible delay and ultra-reliability for live alerts

Enhanced experiences

Smart Highway

Public Safety

Smart warehousing

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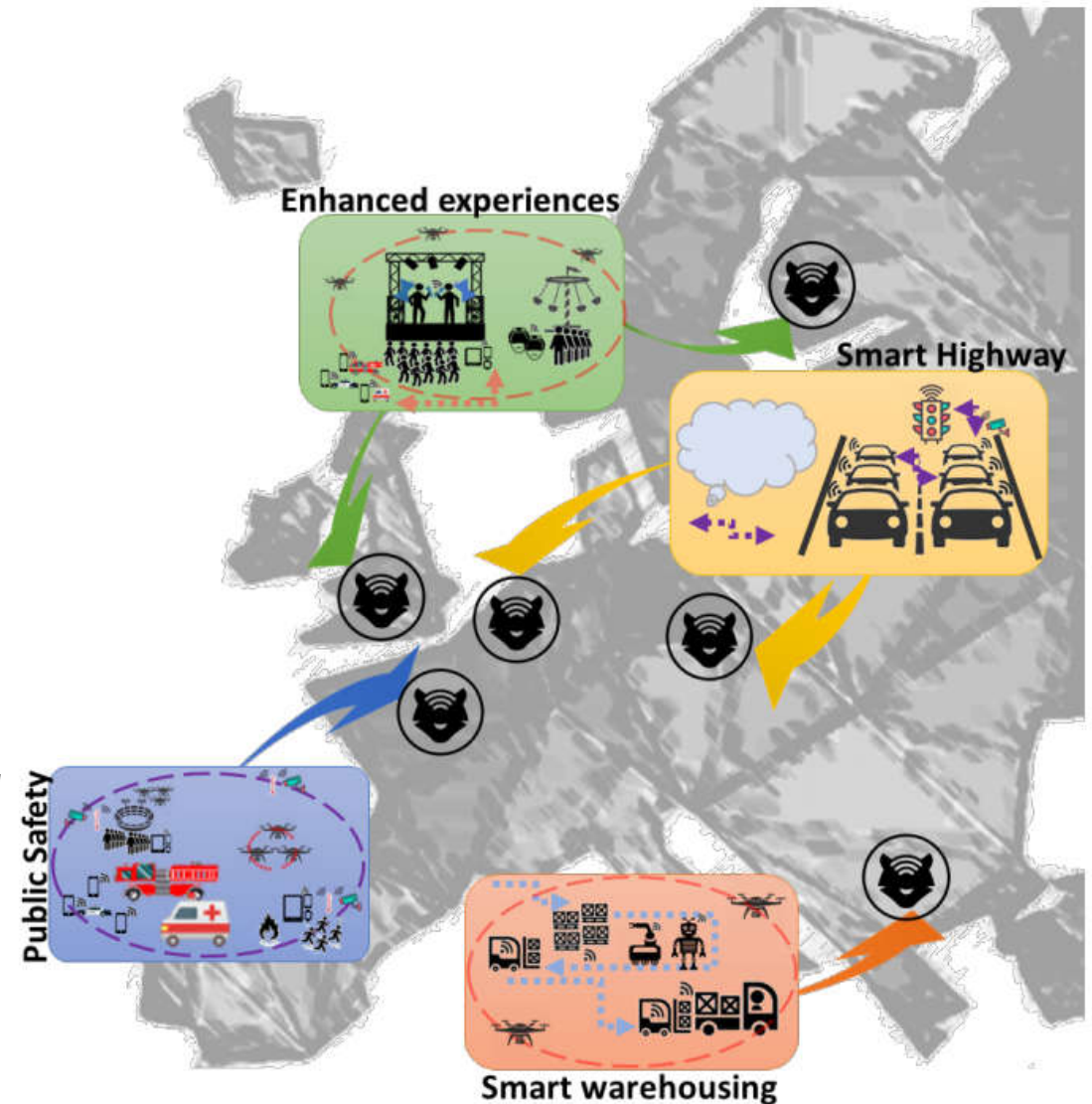
UC1: Smart Warehousing

Need for B5G/6G

- **Low latency** and **high reliability** for timely delivery of data and interactions with robots
- **High throughput** for video streaming for remote surveillance
- **High location accuracy** to guarantee correct positioning of robots and assets

- **Enhance warehouse automation towards significant increase of operations' efficiency** (elimination of time wastes, decrease of product damages)
- **Enhance safety and security of goods and personnel** with indoor positioning and asset tracking
- **Increase efficiency in use of resources** (AVs, humans, other equipment) through predictive analytics by distributed AI and data analytics functionalities.
- **Assisting training and maintenance through 3D augmented reality**
- **Enable remote monitoring** of processes and remote handling by a human operator in case of equipment failure through multiple UHD streams
- **Identification and tracking of goods**

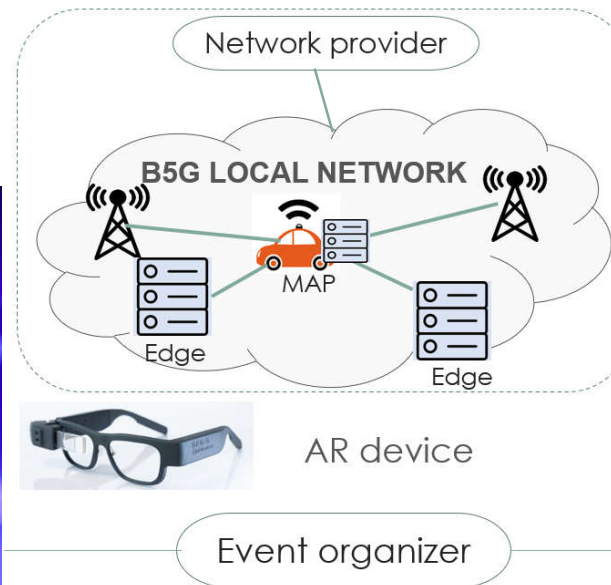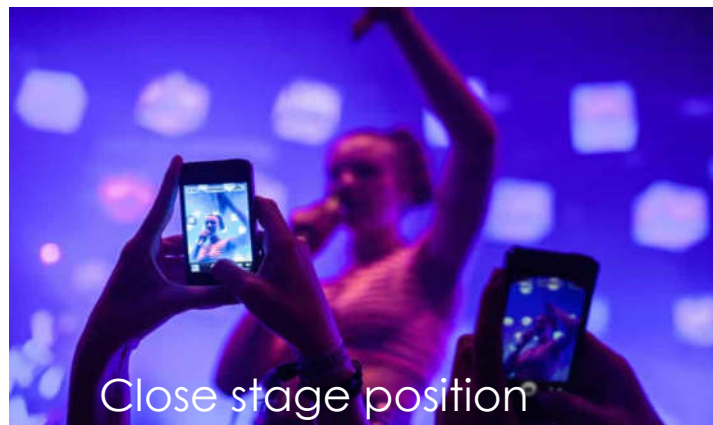DEDICAT 6G
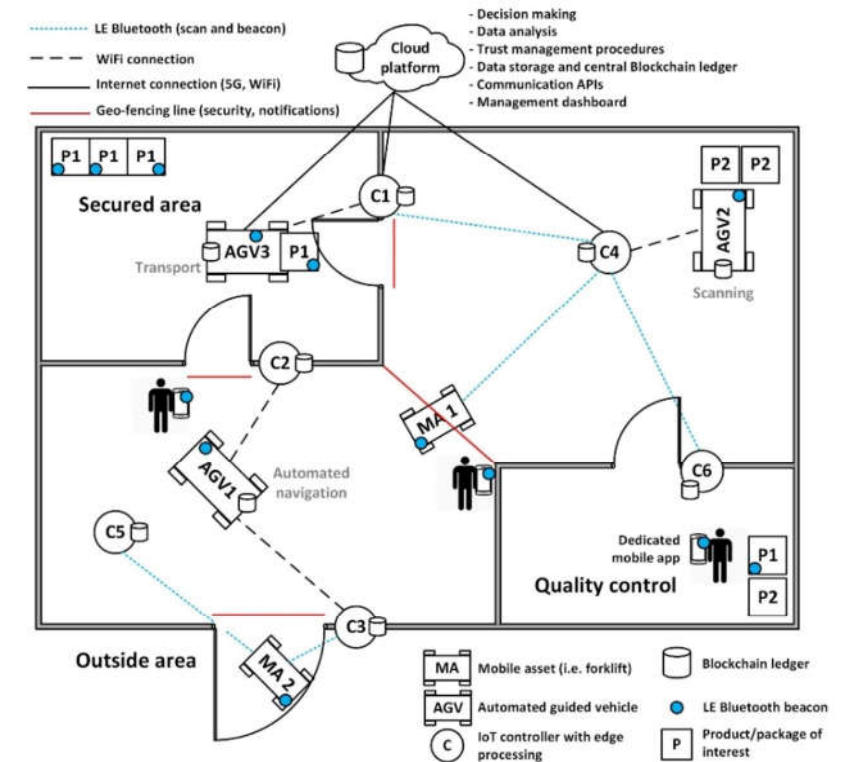
UC1: Smart Warehousing

The Smart Warehousing pilot will take place in Athens, Greece

UC2: Enhanced Experience

Enhance video streaming in live events with key innovations

- ✓ Smart user devices and applications in public events from enhanced viewpoints
- ✓ Network AI/ML algorithms and resource allocation for improved video service availability and energy efficiency (simulations interconnecting with other WPs)
- ✓ Dynamic video adaptation and edge placement for computation offloading
- ✓ Extending the coverage in the event site
- ✓ **Enhanced user experience**

Smartphone   VR device

Remote site

Network provider

B5G LOCAL NETWORK

MAP

Edge

Edge

AR device

Event organizer

Close stage position

Outdoor music concert

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UC2: Enhanced Experience

- The Enhanced Experience live pilot will take place in Oulu, Finland and it is planned Q1/2023

- VTT 5G Test Network(5GTN) infrastructure will be used for the live experiments

- The current status includes first measurements in the 5GTN using the pilot HW, MAP development and integration , and visualization of the overall pilot scenario

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UC3: Public Safety

Need for B5G/6G

- *Need for **extremely** reliable and efficient communications* to respond to natural or man-made disasters.
- Infrastructure **availability anytime**, **anywhere**

Public Safety use case

- **Mobile access points (MAPs)** deployed in the area of interest in order to create an ad-hoc mobile network for dynamic coverage and connectivity extension.

  - **Monitoring** of the area of interest while alleviating the congestion of public networks

- **End-to-end management** of events threatening public safety

- **Innovative devices and human interfaces**, such as AR vision, and AI enabled applications to provide First Responders with augmented connectivity and interactions capabilities for situational awareness and mission efficiency.
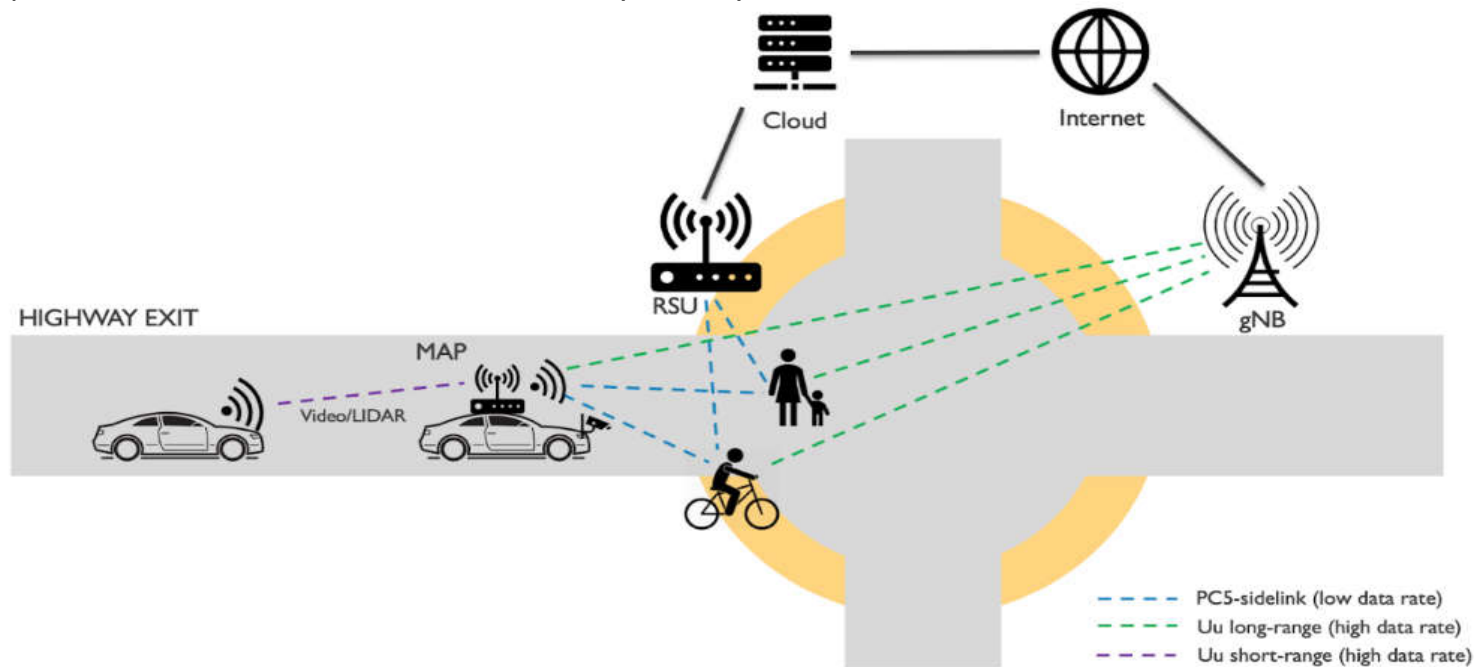
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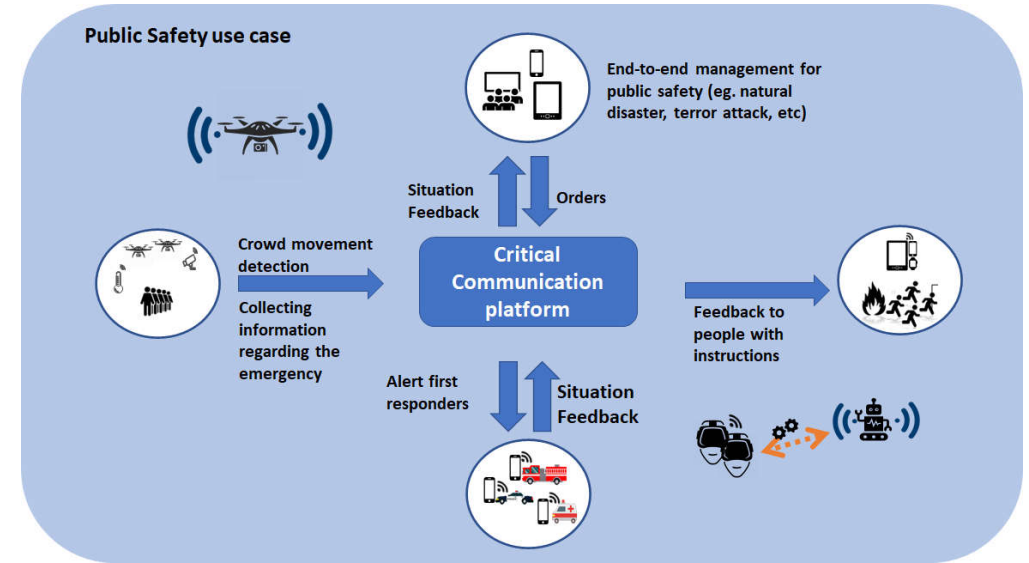
UC3: Public Safety

The Public Safety pilot will take place in Elancourt, France

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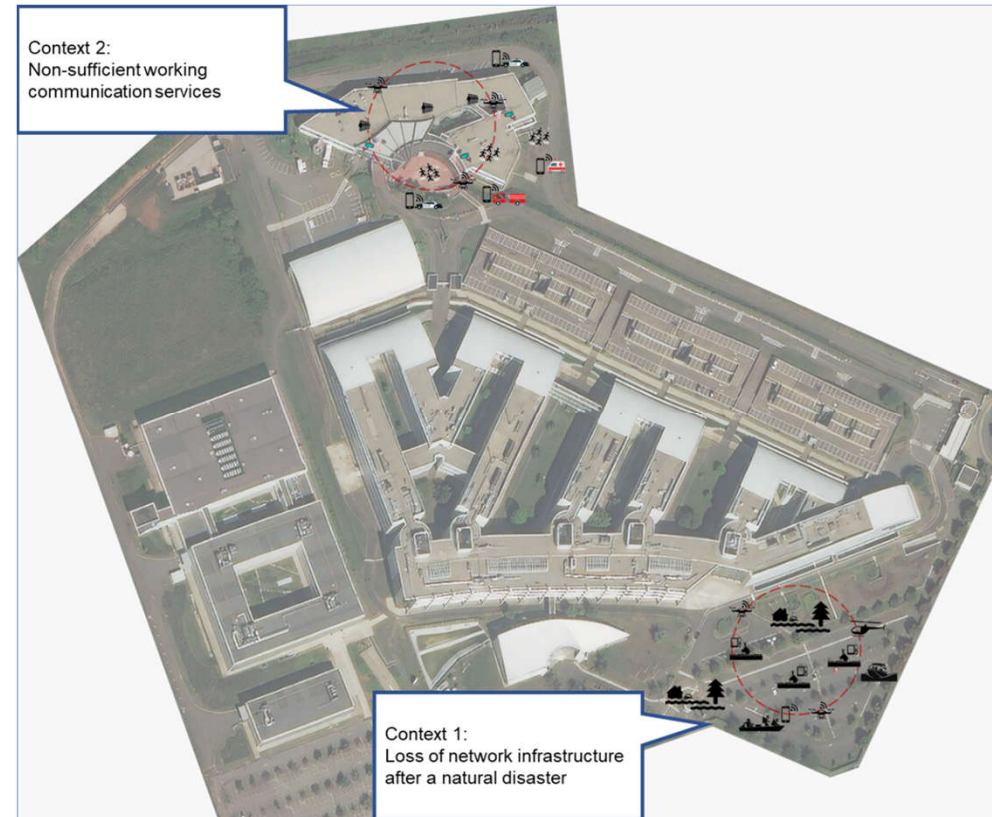
UC4: Smart Highway

Smart Highway is a use case that benefits from beyond 5G connectivity for connected and autonomous mobility. In this use case, the **smallest possible delay and ultra-reliability in communications between road users are expected to allow safety on the roads**. This use case will leverage the use of cars and roadside infrastructures as edges. In addition, cars that are by nature mobile, will also be exploited as *Mobile Access Points* (MAPs).

Cloud

Internet

RSU

gNB

HIGHWAY EXIT

MAP

Video/LIDAR

- - - - PC5-sidelink (low data rate)
- - - - Uu long-range (high data rate)
- - - - Uu short-range (high data rate)

Safety at the intersection

Need for B5G/6G

Imperceptible end-to-end latency and response time

Minimal energy and resource consumption

Smart distribution of road services in a multi-level edge infrastructure

Expansion of the communication environment in an ultra-real time

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UC4: Smart Highway

The Smart Highway pilot will take place in E313 highway, Antwerp, Belgium and B101, Ore Mountains, Germany.

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KPIs

KPI name	Use cases	Definition	Target value
E2E Service Latency	All	ITU-R M.2410-0 Report (2017): User plane latency is the contribution of the radio network to the time from when the source sends a packet to when the destination receives it (in ms). Control plane latency refers to the transition time from a most "battery efficient" state (e.g. Idle state) to the start of continuous data transfer (e.g. Active state).	1 ms - 10ms
E2E Application Latency - for Video processing services	Enhanced Experience	Calculation of time difference between camera capture and appearance in video playback.	E2E 200ms at application level
Mission critical QoS of services - latency related	Public Safety	In accordance with ETSI Technical Specification 122,179 (2020) related to 3GPP MCX	MC-PTT access time less than 300 ms for 95% of all requests; End-to-End MC-PTT access time less than 1000 ms for all MCX mobile application under the same network coverage; Mouth-to-ear latency less than 300 ms for 95% of all voice bursts Max late call entry time shall be 150 ms for 95% of all late call request. End-to-End Delay (time required for IP packets to be transmitted) shall be less than 10 ms; User Data Rate shall be 100 Mbps in downlink and 50 Mbps in uplink 99.999% of success for the transmission of a packet of 32 bytes within 1ms

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KPIs

KPI name	Use cases	Definition	Target value
User data rate	Smart warehousing, Enhanced experience	ITU-R M.2410-0 Report (2017): user experienced data rate is the minimum data rate required to achieve a sufficient quality experience, with the exception of scenario for broadcast like services where the given value is the maximum that is needed.	Minimum user data rate (5th percentile) in bit/s: 100 Mbit/s (DL); 50 Mbit/s (UL).
Network Capacity	Smart warehousing, Enhanced experience	ITU-R M.2410-0 Report (2017): Area traffic capacity is the total traffic throughput served per geographic area (in Mbit/s/m2). The throughput is the number of correctly received bits, i.e. the number of bits contained in the SDUs delivered to Layer 3, over a certain period of time.	Area traffic capacity in Mbit/s/m^2: 10 Mbit/s/m^2 (DL) (Bandwidth: 100MHz)
Network energy efficiency and Device energy efficiency	All	Decreased energy consumption (incl. communication and computation) in order to increase the operation lifetime of a mobile station or server	Reduction of energy consumption by a factor of 10
Service reliability	All	ITU-R M.2410-0 (11/2017): Reliability relates to the capability of transmitting a given amount of traffic within a predetermined time duration with high success probability	Packet Loss Rate < 10^{-3} Public Safety: 99.999% of success for the transmission of a packet of 32 bytes within 1ms
Location accuracy	Smart Warehousing, Smart Highway	Difference of estimated location and actual location	10 cm to 20 cm

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Thank you!

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