



Special Session #1:
5G Connected Car

The 5GCAR Project

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Objectives

Develop an overall 5G V2X system architecture

Interworking of multiple Radio Access Technologies

Develop an efficient, secure and scalable sidelink interface

5G radio-assisted positioning techniques

Identify innovative business models

Demonstrate and validate the developed V2X concepts

Contribute to 5G Standardization and regulation

Integrate of the 5GCAR concepts in the 5G PPP



Methodology

A. Definition of V2X scenarios, requirements and KPIs

B. Design and validation of innovative technical solutions

C. Proof-of-concept and demonstration



Demonstrate three advanced V2X use cases

- ✓ Lane merge
- ✓ Cooperative perception for manoeuvres of connected vehicles
- ✓ Vulnerable road user protection



R&I Activities

- Business models for 5G V2X
- Spectrum for 5G V2X
- Infrastructure-based communication for 5G V2X
- Sidelink-based communications for 5G V2X
- Positioning for 5G V2X
- 5G Architecture for V2X
- Demonstrations for 5G V2X

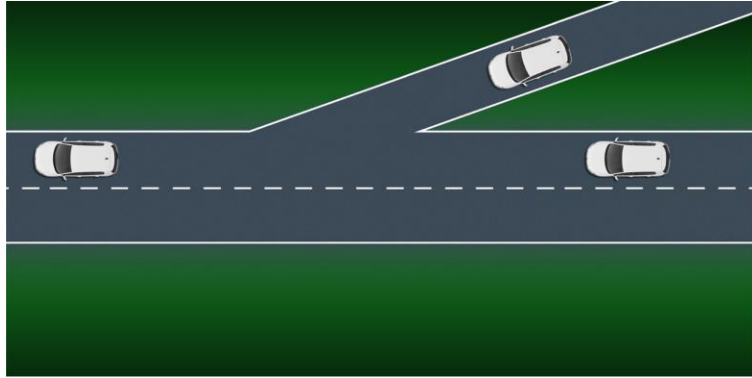


1. End-to-end latencies, below 5 ms
2. Ultra-high reliability, close to 10^{-5}
3. Very large density of connected vehicles
4. Positioning accuracy (VRUs: 10 cm, Vehicles: 30 cm)



Ambitions

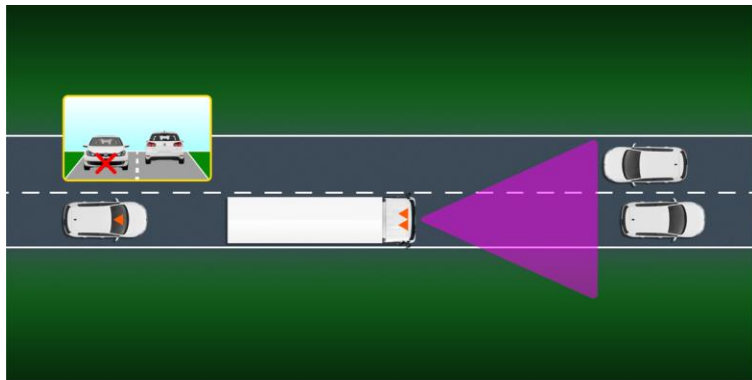
The 5GCAR use cases



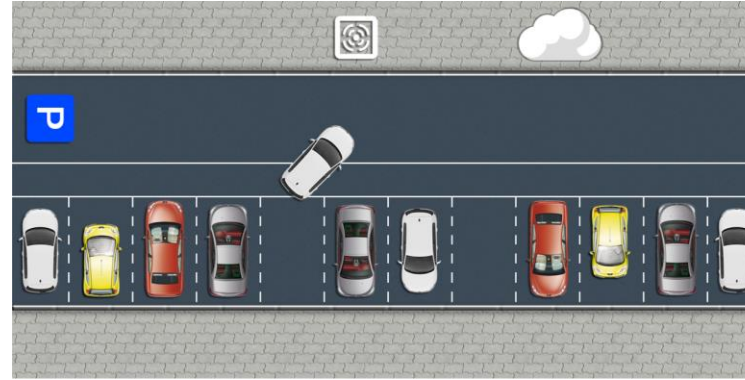
Lane merge



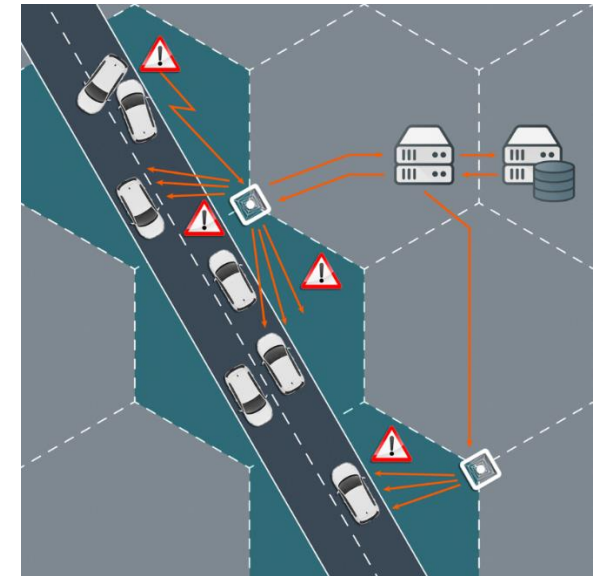
Network assisted vulnerable pedestrian protection



See-through



Remote driving for automated parking

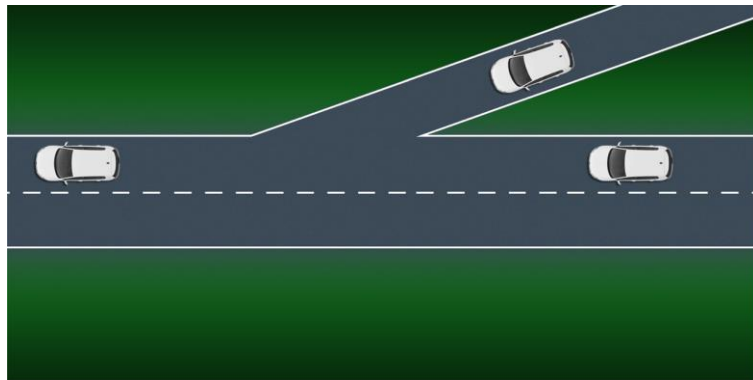


High definition local map acquisition

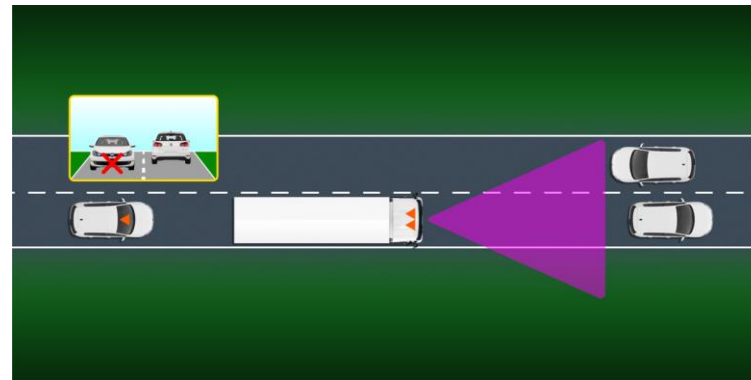
5GCAR use cases (and use case classes)



- **Cooperative maneuver:** sharing local awareness and driving intentions and negotiating the planned trajectories
 - Lane merge
- **Cooperative perception:** perception extension is built on the basis of exchanging data from different sources, e.g., radars, laser sensors, stereo-vision sensors from on-board cameras
 - See-through
- **Cooperative safety:** achieved by exchanging the information about detection of the presence of road users
 - Network assisted vulnerable pedestrian protection



Lane merge



See-through

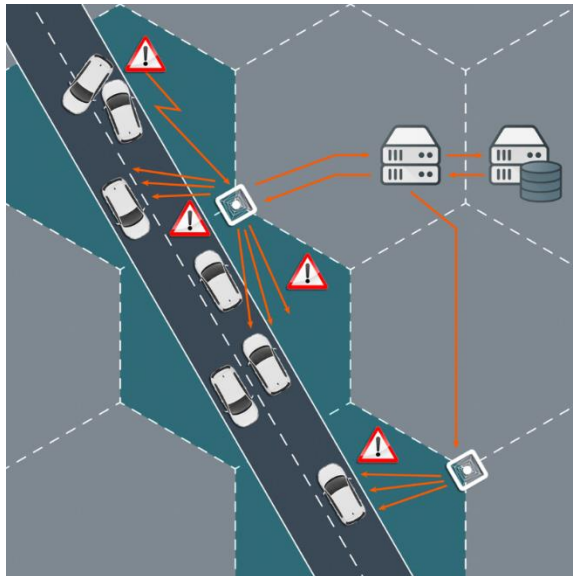


Network assisted vulnerable pedestrian protection

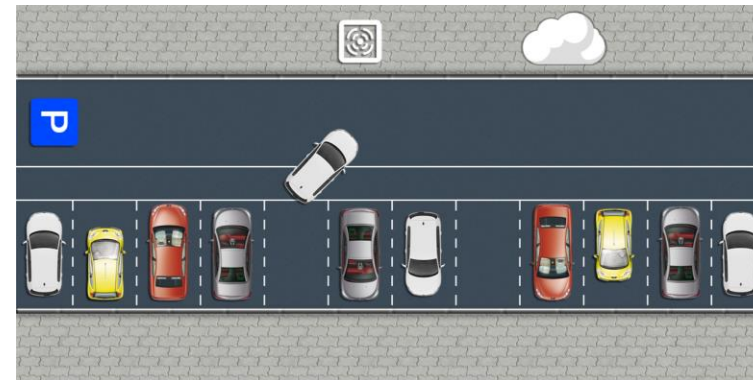
5GCAR use cases (and use case classes)



- **Autonomous navigation:** construction and distribution of real-time intelligent HD map
 - High definition local map acquisition
- **Remote driving:** control the different actuators of the car (steering wheel, brake and throttle) from outside the vehicle through wireless communication
 - Remote driving for automated parking



High definition local map acquisition



Remote driving for automated parking

5GCAR requirements



- **Automotive requirements**
 - Localization, minimum car distance, mobility, relevance area, etc.
- **Network requirements**
 - Availability, communication range, data rate, latency, reliability, service data unit (SDU) size
 - Latency may be considered from different perspectives (for different use cases)
 - (Layer-based) latency: similar with user plane latency in 3GPP
 - End-to-end latency: the time it takes to transmit an application message from the application layer of the source node to the application layer of the destination node
- **Qualitative requirements**
 - Cost, power consumption, security

<https://5gcar.eu/>



Appendix

