5GMED

Sustainable **5G deployment model for future mobility** in the Mediterranean Cross-Border Corridor

The **5GMED project** is an innovation action funded by **the European Union's Horizon 2020 research and innovation programme** under the **5G Public Private Partnership (5GPPP)**. 5GMED aims to **bring a sustainable 5G deployment model for future mobility in the Mediterranean Cross-Border Corridor.** The services to be tested will rely on a broad range of **technologies beyond 5G**, including **on-board sensors and Artificial Intelligence (AI)**, providing advanced connectivity services in a scalable and replicable manner across transport paths.

Methodology

- Cross operator service orchestration.
- Innovations in multi-connectivity supporting high-speed vehicles and trains.
- Self-sustainable 5G access network infrastructure that can be deployed when power and backhauling resources are scarce.
- Enhancements to speed up roaming transitions across MNOs and neutral hosts.
- Novel high-speed access network architectures for railways.
- The ability to support AI- enabled functions executing at the edge of the network.

Technical objectives

1. Specify and validate a scalable, cross-border and multi-stakeholder 5G and AI-enabled system architecture supporting CCAM and FRMCS services that can be replicated across Europe.

2. Design and develop cross-operator service orchestration that enables MNOs, neutral hosts and road/railways Infrastructure Operators to deliver service continuity to end-users.

3. Propose and establish novel practices on how MNOs, neutral hosts, OEMs and road operators can cooperate to deliver Remote Driving, Advanced Traffic Management and Infotainment use cases in cross-border scenarios.

4. Identify and establish MNOs and railways operators' cooperation priorities to deliver advanced FRMCS performance and business use cases across cross-border scenarios.

Impact objectives

1. Contribute to standardization activities through key 5G, automotive and FRMCS SDOs, while collaborating with relevant joint public-private platforms run by industry and public authorities, building a harmonized voice towards the implementation of CCAM.

2. Perform a cost/benefit analysis of 5G infrastructure deployment involving MNOs, neutral hosts and infrastructure operators in the Figueras-Perpignan cross-border corridor, considering the impact on other business stakeholders.

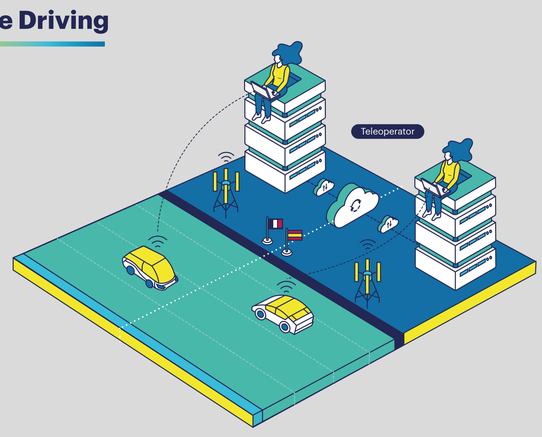
3. Define innovative business models for CCAM/FRMCS service provisioning, involving MNO and road/railways infrastructure operators, while providing new market opportunities for third-parties beyond the automotive/railways sectors and positioning the role of Public Authorities.

4. Spread the word about the far-reaching and sustainable impact of 5GMed's outcomes, through dissemination, communication activities, and the active engagement of industry.

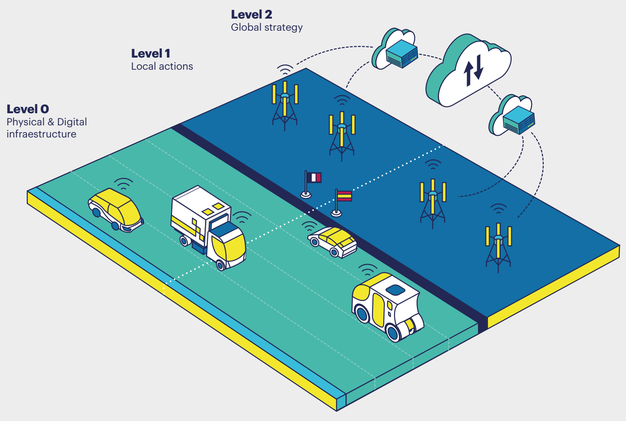
5. Ensure the scalability and replication of 5GMed technical and policy outcomes, accelerating and shaping the deployment of 5G cross-border corridors across Europe.

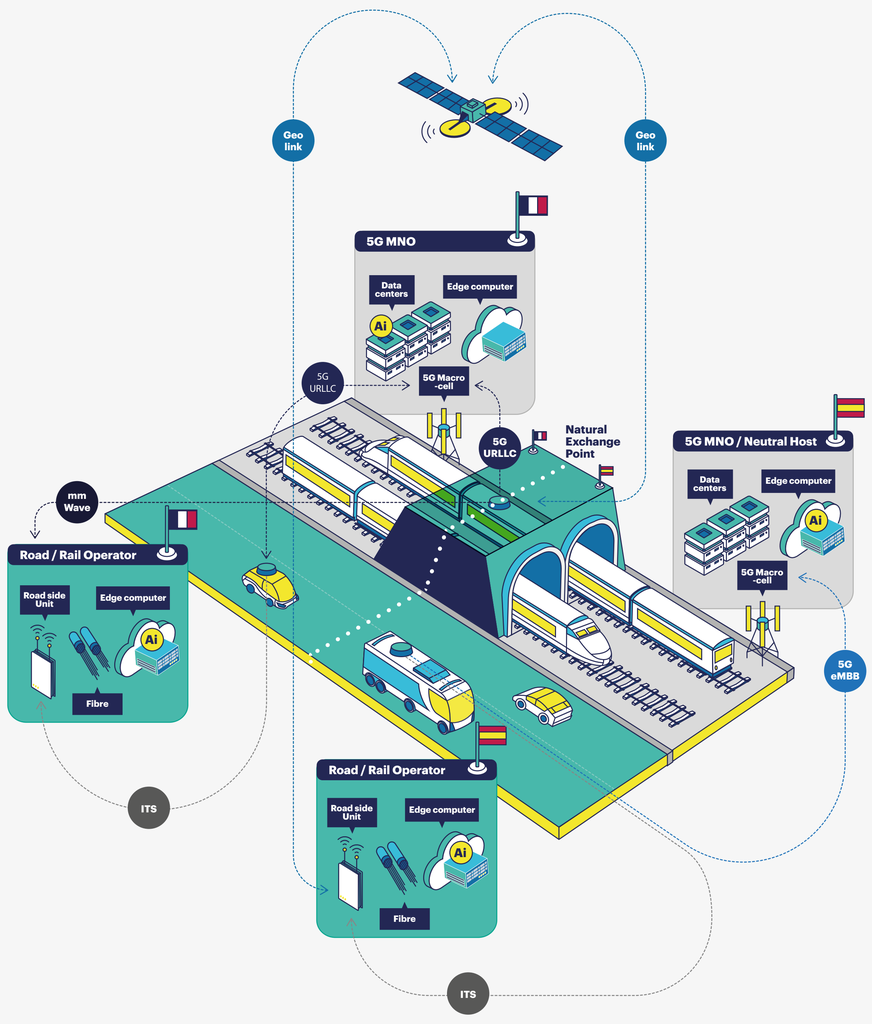
5GMED has defined **four use cases** to represent the challenges related to both CCAM and FRMCS: **1) remote driving, 2) road infrastructure digitalization, 3) future railways mobile communications, and 4) follow-me infotainment**. The validation of these use cases in 5GMED will derive interesting insights and recommendations that can be valid for **future deployment** of other use cases that will enhance **road safety, traffic efficiency, and passengers' comfort.**

Remote Driving

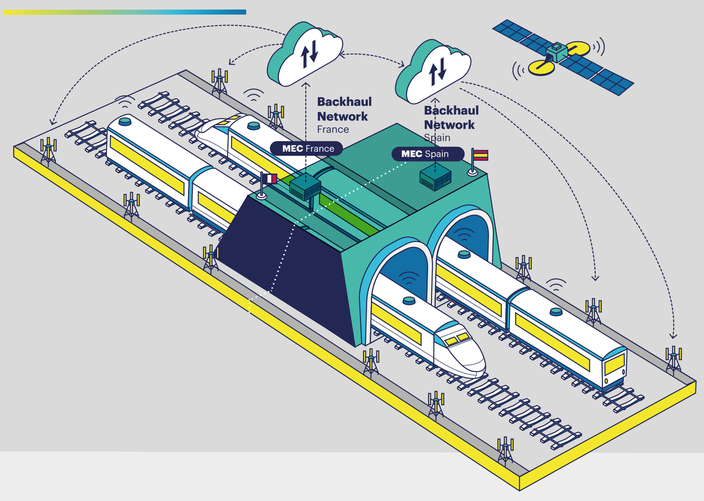


Road infrastructure digitalization

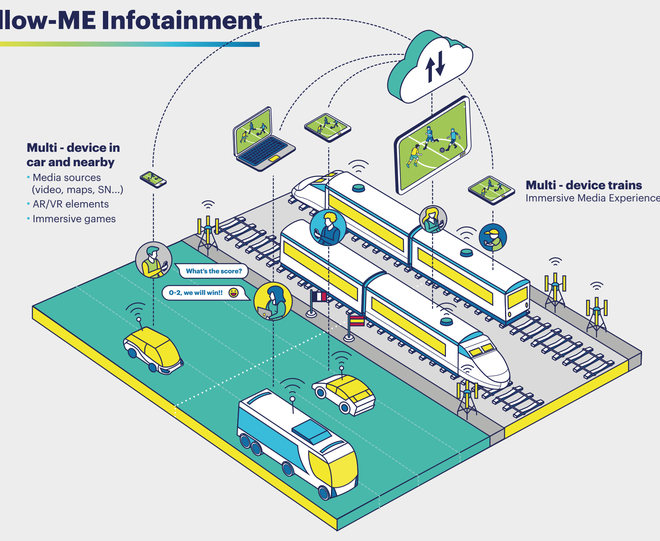




FRMCS applications



Follow-ME Infotainment



Results

Cross-operator 5G Orchestration for MEC and Radio: 1) Introducing a cross-operator service orchestrator that is able to interact with MNOs, neutral hosts and road/rail operators. Up-to-date, vertical slices have only been demonstrated in a single administrative domain. 2) Ensuring isolation of CCAM/FRMCS services by means of specific resource allocations in the RAN and MEC domains. 3) Pooling resources from multiple operators to provide a distributed compute platform enabling AI-powered services.

Multi-connectivity: 1) Developing a solution capable of aggregating bandwidth from 5G slices, side link connections, mm-wave links in railways environment and satellite links. 2) Validating said multi-connectivity solution at high speed both in railways and automotive environments. 3) Demonstrating coordination of satellite backup links with terrestrial resources on the coverage gaps. 4) Leveraging AI for optimal technology selection in multi-connectivity environment.

Transport networks for railways: 1) Proposing a novel SDN based core transport network with built-in support for fast mobility. 2) Demonstrating an mm-wave based Train Access Network able to provide Gbps aggregate bandwidth to the train moving at high speeds. 3) Demonstrating the delivery of critical and passenger services over a shared 5G infrastructure with slicing capabilities.

Development of mobile communications architecture to support CCAM: 1) Demonstrating tele-operation on motorways in open traffic at 50-70 km/h speed with a distance > 50 km, using a cellular network slice involving two different MNOs. 2) Demonstrating secure Automated Driving Level 4 on motorways without passenger intervention. 3) On-demand setup of a dedicated URLLC 5G slice that minimises the latency with the transport of extensive video streaming and teleoperation cockpit signals. 4) Developing a predictive QoS software module for the cellular network slice, which will allow the remote driver to modify the vehicle speed to a safe value depending on network conditions.

Design of self-sustainable network infrastructure: 1) Integrating GEOSAT links on self-sustainable small cells, hence providing a 5G infrastructure solution that can be deployed across corridors where power and backhaul resources are scarce. 2) Collocating edge computing capabilities with self-sustainable small cells. 3) Demonstrating self-sustainable small cells that support multi-tenancy, i.e. can radiate the signal of different MNOs, and can also be configured to operate as RSUs. 4) Developing SDN/NFV interfaces to minimise operational costs of remote small cells. 5) Validating the 5GMed self-sustainable infrastructure concept in operational conditions in a cross-border scenario.

Conclusions

This poster aims at presenting 5GMED project which will bring to life **a sustainable 5G deployment model for future mobility in the Mediterranean Cross-Border Corridor.** The services to be tested will rely on a broad range of **technologies beyond 5G**, including **on-board sensors and Artificial Intelligence (AI),** providing advanced connectivity services in a scalable and replicable manner across transport paths. It will demonstrate advanced **Cooperative Connected and Automated Mobility (CCAM)** and **Future Railway Mobile Communications System services (FRMCS)** along the "Figueres - Perpignan" cross border corridor between Spain and France. The project is carried out by a multi-stakeholder computer and network infrastructure deployed **by MNOs, neutral hosts, and road and rail operators, based on 5G and offering support for AI functions.**

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