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

Stefanos Tsantilas, stefanos.tsantilas@8bellsresearch.com
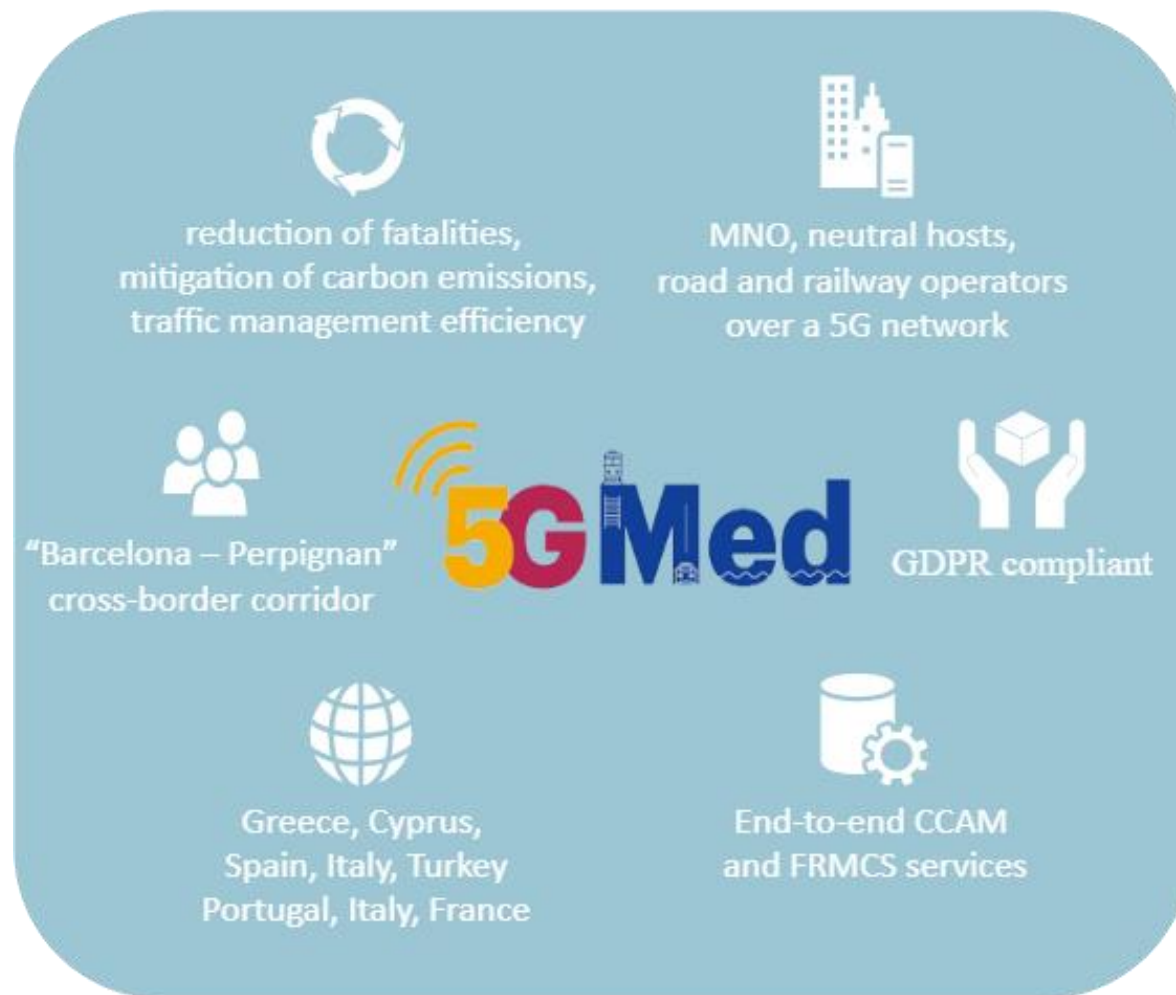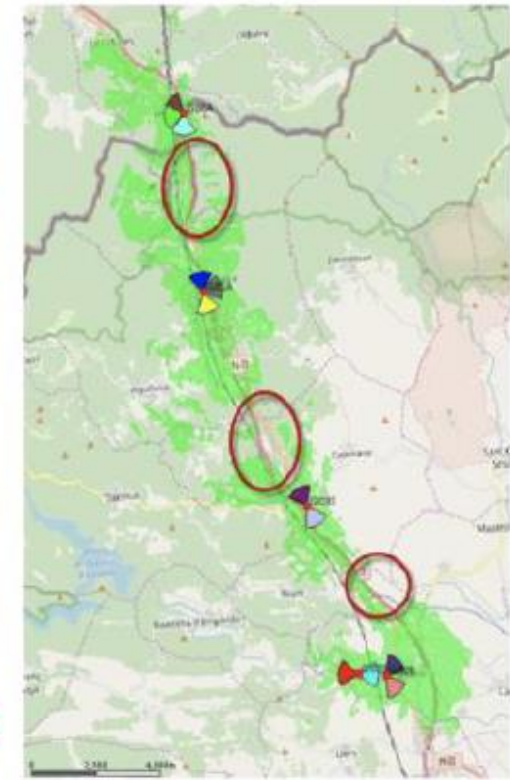
Overview

reduction of fatalities, mitigation of carbon emissions, traffic management efficiency

MNO, neutral hosts, road and railway operators over a 5G network

"Barcelona – Perpignan" cross-border corridor

GDPR compliant

Greece, Cyprus, Spain, Italy, Turkey Portugal, Italy, France

End-to-end CCAM and FRMCS services

Fig.1 Highway and rail track in corridor.

1 POLIGON 1 PARCELA 19, SN. La Jonquera
2 Dipósit d'Aigua. La Jonquera
3 N-II Km 744 / GI-602. Capmany
4 GIV-5041 (a Boadella). (Torre de Tradia). Pont de Molins
5 Dipósit d'Aigua. Pont de Molins

Potential sites on Spanish side

Preliminary coverage analysis at 3.5 GHz

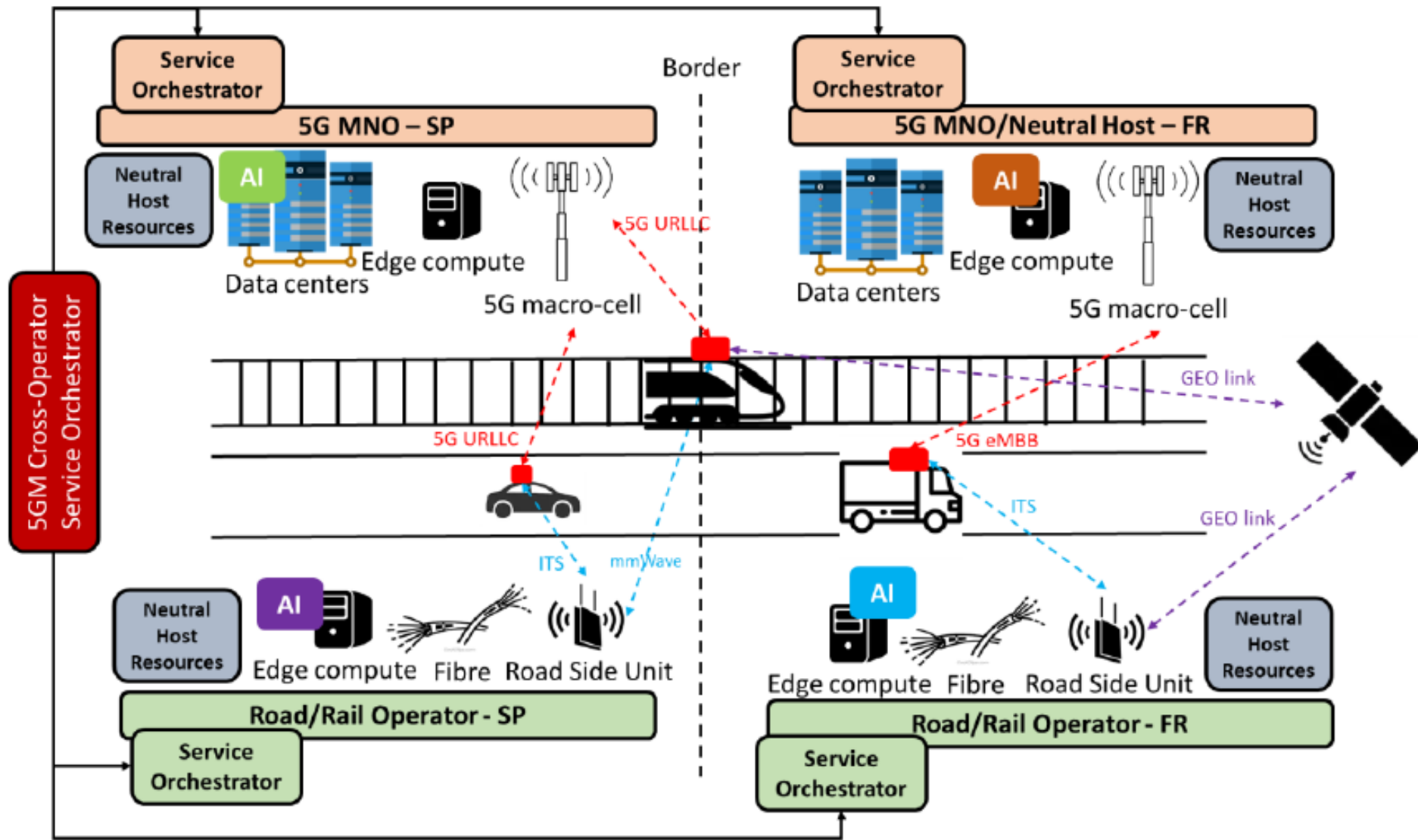Fig.2 Potential sites and preliminary coverage in the Spanish side.

Fig.3 5G Med high-level system vision – an overview of the project.

Objectives

Scalable, **cross-border** and **multi-stakeholder 5G** and **AI-enabled** system architecture supporting **CCAM** and **FRMCS** services that can be **replicated** along Europe, envisaged for **CEF Digital**.

Cross-operator service orchestration enabling service continuity for end-users, Remote Driving, Advanced Control Traffic and Infotainment UCs in cross-border scenarios and enhanced FRMCS performance.

Standardization activities, collaboration with relevant joint public-private platforms of industry and public authorities, to build a **harmonized voice towards the implementation of CCAM.**

Wide and sustainable impact of 5GMed outcomes, through **dissemination**, **active engagement** of industry, public authorities, government bodies towards operational deployment models and **communication campaigns**.

Cost/benefit analysis of the 5G infrastructure deployment, considering the **impact on other business stakeholders**.

Innovative business models for CCAM/FRMCS service provisioning, **new market opportunities for third-parties** and **positioning** the role of Public Authorities.

Objectives

Scalable, **cross-border** and **multi-stakeholder 5G** and **AI-enabled** system architecture supporting **CCAM** and **FRMCS** services that can be **replicated** along Europe, envisaged for **CEF Digital**.

Cross-operator service orchestration enabling service continuity for end-users, Remote Driving, Advanced Control Traffic and Infotainment UCs in cross-border scenarios and enhanced FRMCS performance.

Standardization activities, collaboration with relevant joint public-private platforms of industry and public authorities, to build a **harmonized voice towards the implementation of CCAM**.

Wide and sustainable impact of 5GMed outcomes, through **dissemination**, **active engagement** of industry, public authorities, government bodies towards operational deployment models and **communication campaigns**.

Cost/benefit analysis of the 5G infrastructure deployment, considering the **impact on other business stakeholders**.

Innovative business models for CCAM/FRMCS service provisioning, **new market opportunities for third-parties** and **positioning** the role of Public Authorities.

Objectives

Scalable, **cross-border** and **multi-stakeholder 5G** and **AI-enabled** system architecture supporting **CCAM** and **FRMCS** services that can be **replicated** along Europe, envisaged for **CEF Digital**.

Cross-operator service orchestration enabling service continuity for end-users, Remote Driving, Advanced Control Traffic and Infotainment UCs in cross-border scenarios and enhanced FRMCS performance.

Standardization activities, collaboration with relevant joint public-private platforms of industry and public authorities, to build a **harmonized voice towards the implementation of CCAM.**

Wide and sustainable impact of 5GMed outcomes, through **dissemination**, **active engagement** of industry, public authorities, government bodies towards operational deployment models and **communication campaigns**.

Cost/benefit analysis of the 5G infrastructure deployment, considering the **impact on other business stakeholders**.

Innovative business models for CCAM/FRMCS service provisioning, **new market opportunities for third-parties** and **positioning** the role of Public Authorities.

Objectives

Scalable, **cross-border** and **multi-stakeholder 5G** and **AI-enabled** system architecture supporting **CCAM** and **FRMCS** services that can be **replicated** along Europe, envisaged for **CEF Digital**.

Cross-operator service orchestration enabling service continuity for end-users, Remote Driving, Advanced Control Traffic and Infotainment UCs in cross-border scenarios and enhanced FRMCS performance.

Standardization activities, collaboration with relevant joint public-private platforms of industry and public authorities, to build a **harmonized voice towards the implementation of CCAM.**

Wide and sustainable impact of 5GMed outcomes, through **dissemination**, **active engagement** of industry, public authorities, government bodies towards operational deployment models and **communication campaigns**.

Cost/benefit analysis of the 5G infrastructure deployment, considering the **impact on other business stakeholders**.

Innovative business models for CCAM/FRMCS service provisioning, **new market opportunities for third-parties** and **positioning** the role of Public Authorities.

Objectives

Scalable, **cross-border** and **multi-stakeholder 5G** and **AI-enabled** system architecture supporting **CCAM** and **FRMCS** services that can be **replicated** along Europe, envisaged for **CEF Digital**.

Cross-operator service orchestration enabling service continuity for end-users, Remote Driving, Advanced Control Traffic and Infotainment UCs in cross-border scenarios and enhanced FRMCS performance.

Standardization activities, collaboration with relevant joint public-private platforms of industry and public authorities, to build a **harmonized voice towards the implementation of CCAM.**

Wide and sustainable impact of 5GMed outcomes, through **dissemination**, **active engagement** of industry, public authorities, government bodies towards operational deployment models and **communication campaigns**.

Cost/benefit analysis of the 5G infrastructure deployment, considering the **impact on other business stakeholders**.

Innovative business models for CCAM/FRMCS service provisioning, **new market opportunities for third-parties** and **positioning** the role of Public Authorities.

Objectives

Scalable, **cross-border** and **multi-stakeholder 5G** and **AI-enabled** system architecture supporting **CCAM** and **FRMCS** services that can be **replicated** along Europe, envisaged for **CEF Digital**.

Cross-operator service orchestration enabling service continuity for end-users, Remote Driving, Advanced Control Traffic and Infotainment UCs in cross-border scenarios and enhanced FRMCS performance.

Standardization activities, collaboration with relevant joint public-private platforms of industry and public authorities, to build a **harmonized voice towards the implementation of CCAM.**

Wide and sustainable impact of 5GMed outcomes, through **dissemination**, **active engagement** of industry, public authorities, government bodies towards operational deployment models and **communication campaigns**.

Cost/benefit analysis of the 5G infrastructure deployment, considering the **impact on other business stakeholders**.

Innovative business models for CCAM/FRMCS service provisioning, **new market opportunities for third-parties** and **positioning** the role of Public Authorities.

Main Deliverables

An integrated system of **advanced CCAM, FRMCS and Infotainment services along the "Barcelona – Perpignan" cross-border corridor, enabled by a multi-stakeholder compute and network infrastructure deployed by MNOs, neutral hosts, and road and rail operators.** The system will support the test cases derived from the project UCs, including **multi-connectivity** aspects, **orchestration, slicing** and offering support for **AI functions**.

Joint end-to-end CCAM and FRMCS services, provided by the **multiple entities** involved, **resulting in sustainable and scalable 5G deployment models that can be replicated across Europe.**

Integration of **In-car V2X** extensions and **media functions** required in railways environment to support the Infotainment services.

Validation of use cases in small-scale test beds and in the cross-border corridor.

Market analysis and business models, **standardization** plan and **impact maximization** strategy.

Use Cases

❑ UC1: Remote Driving

❑ UC2: Road infrastructure digitalization for intelligent management of the connected and automated vehicles mobility

❑ UC3: FRMCS applications and business service continuity

❑ UC4: Follow-ME Infotainment
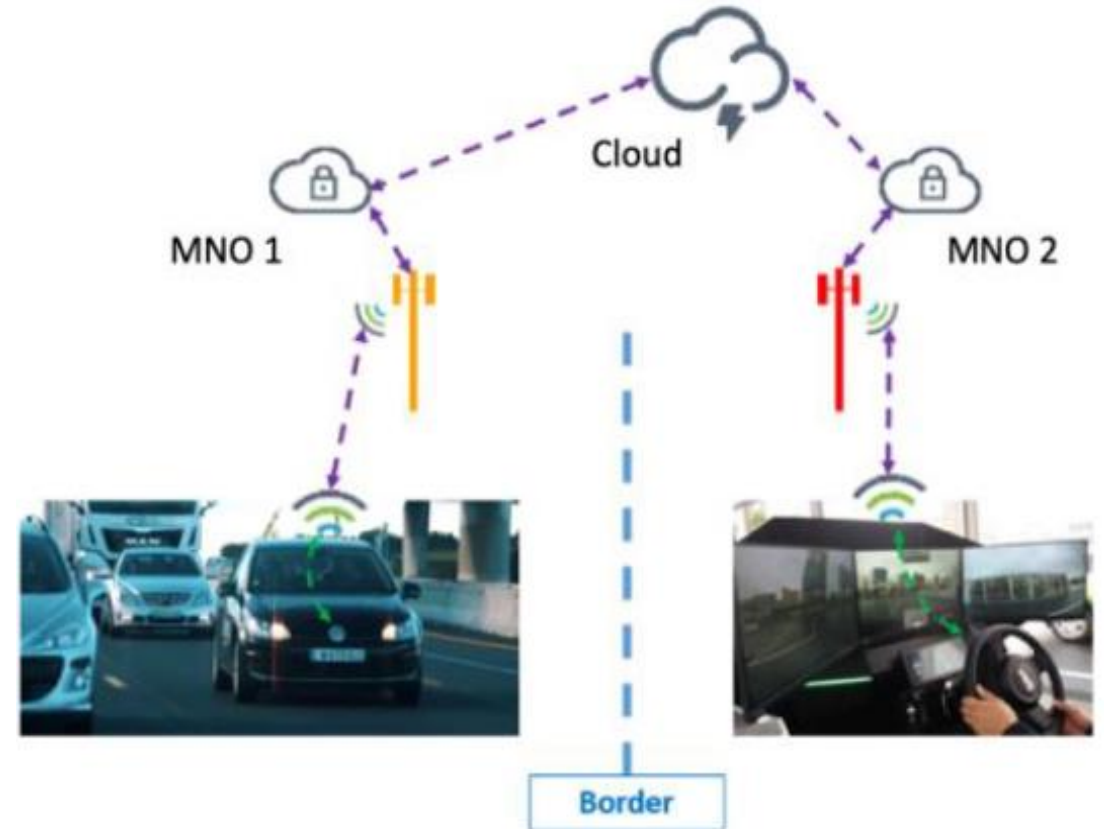
UC1: Remote Driving

Remote control of the vehicle ensuring Dynamic Driving Task (DDT) through 5G cellular network.

- Automated execution of the Minimum Risk Manoeuvre (MRM)

- Teleoperation of the vehicle to reach a safe harbor.

UC2: Road infrastructure digitalization for intelligent management of the connected and automated vehicles mobility

Digitalization of road infrastructure using sensors.

Level 2	Global Strategy

- Innovative Traffic Management Center (TMC2.0)
- Strategies using AI

Level 1	Local Actions

- Low latency network
- **Edge pre-processing**
- Security messages

Level 0	Physical and digital infrastructure

- Cameras using a single sensor
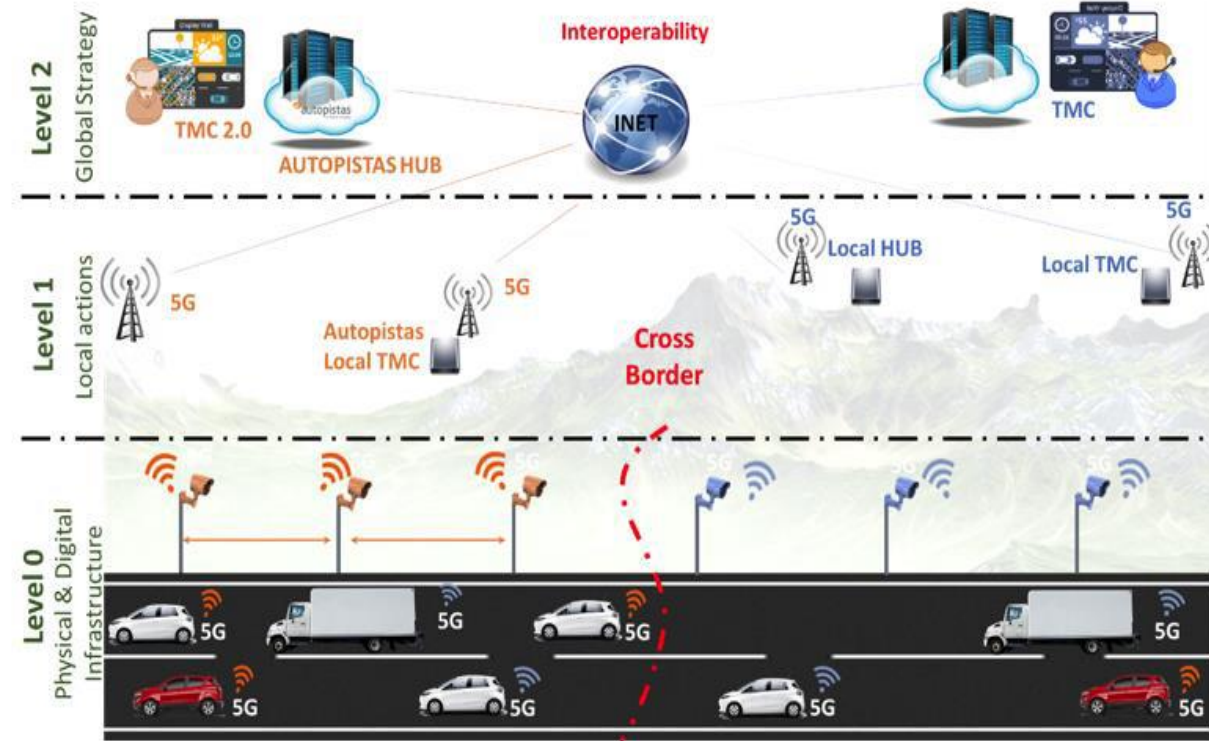- End-end communication

Figure 1-9: Road operator management levels

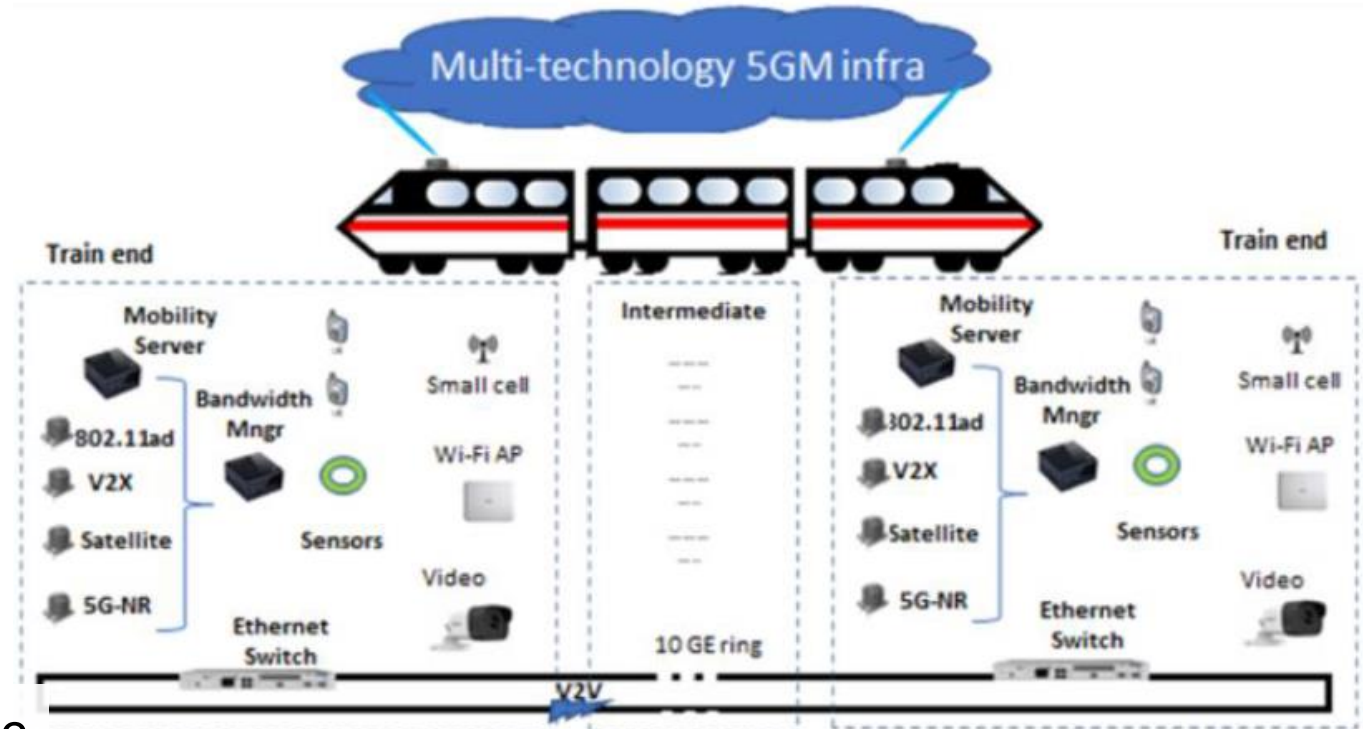# UC3: FRMCS applications and business service continuity

Service types

Critical

- AI computer vision and sensors
- Dedicated Infrastructure

Performance

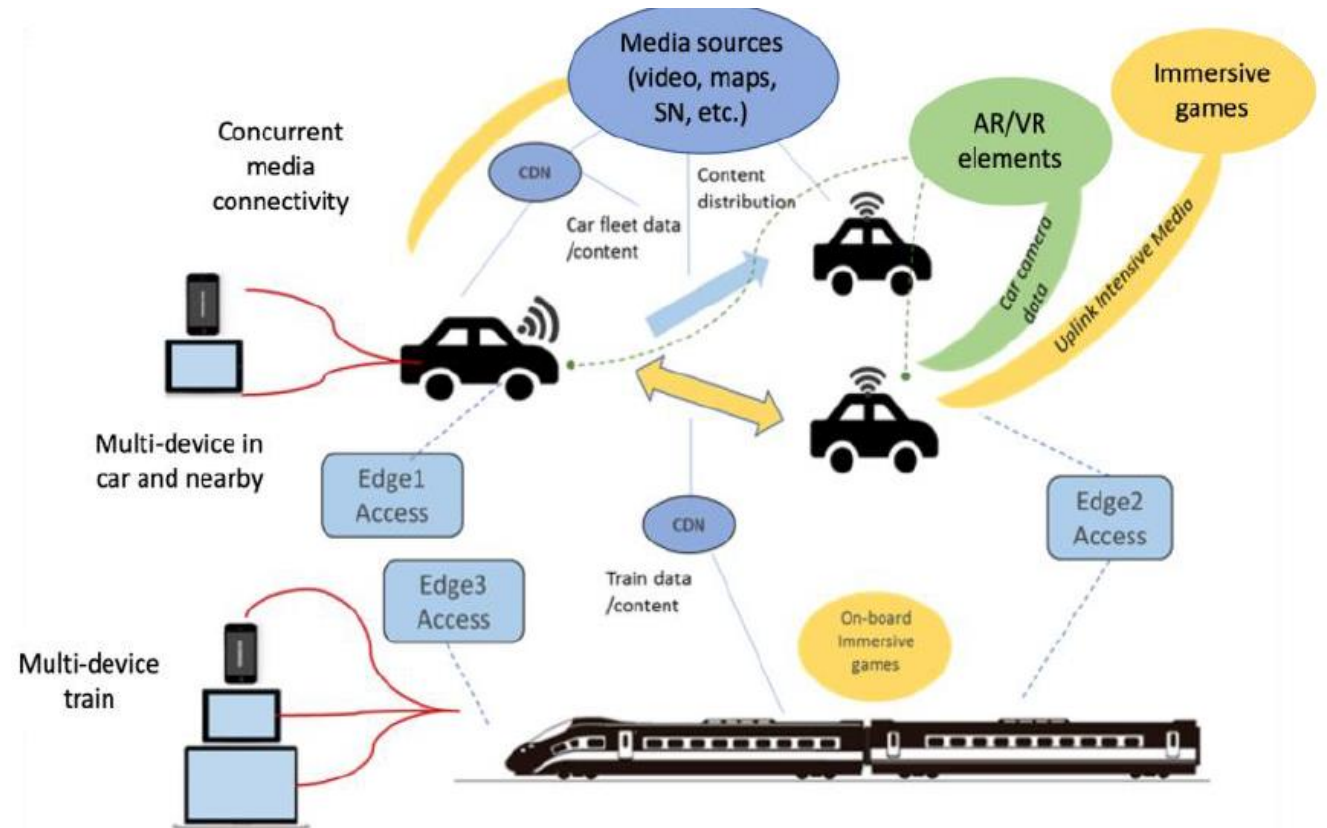- AI computer vision
- IoT monitoring

Business

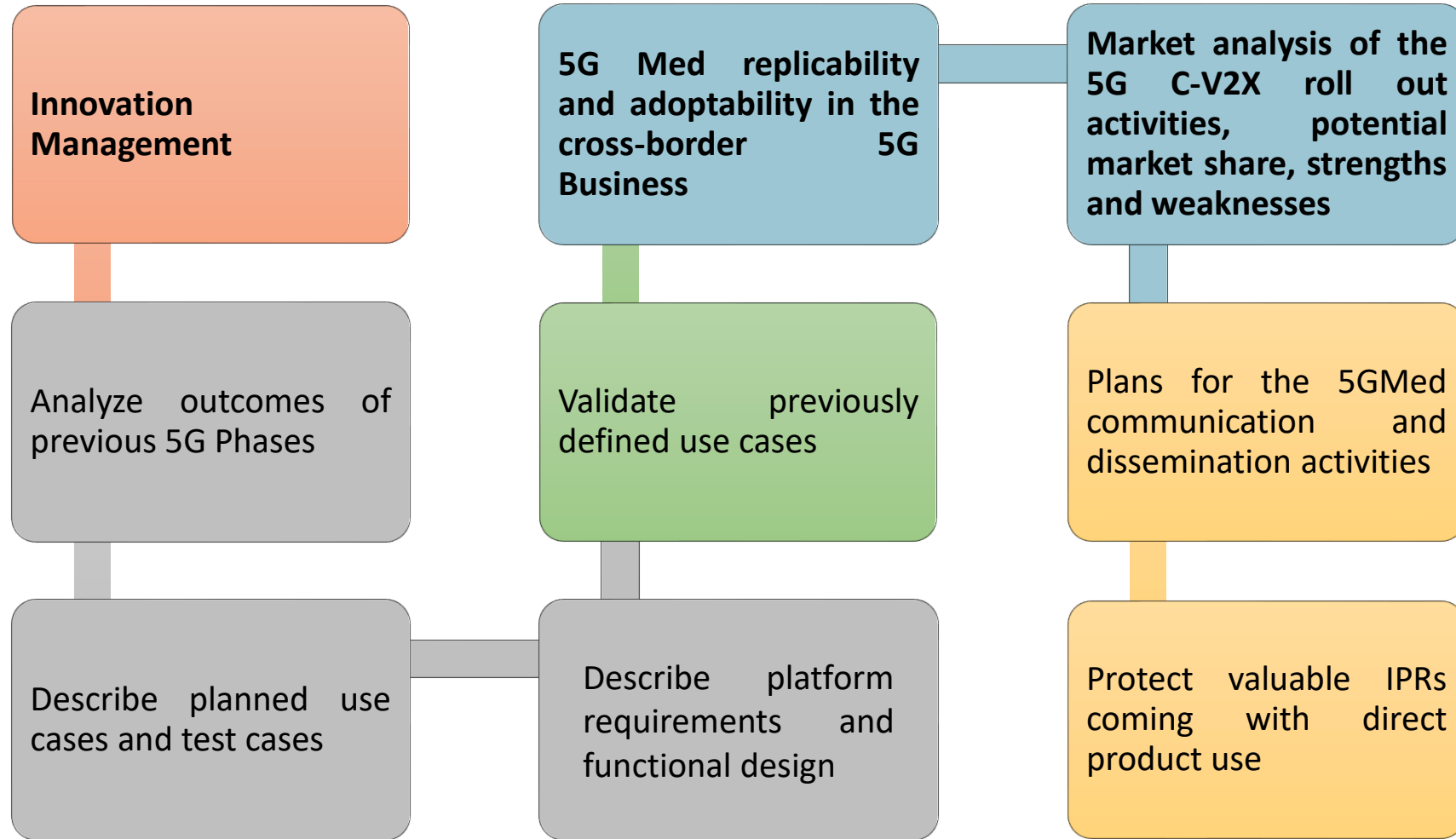- On-board 5GNR network. MNOs become potential clients of train operators.

UC4: Follow-ME Infotainment
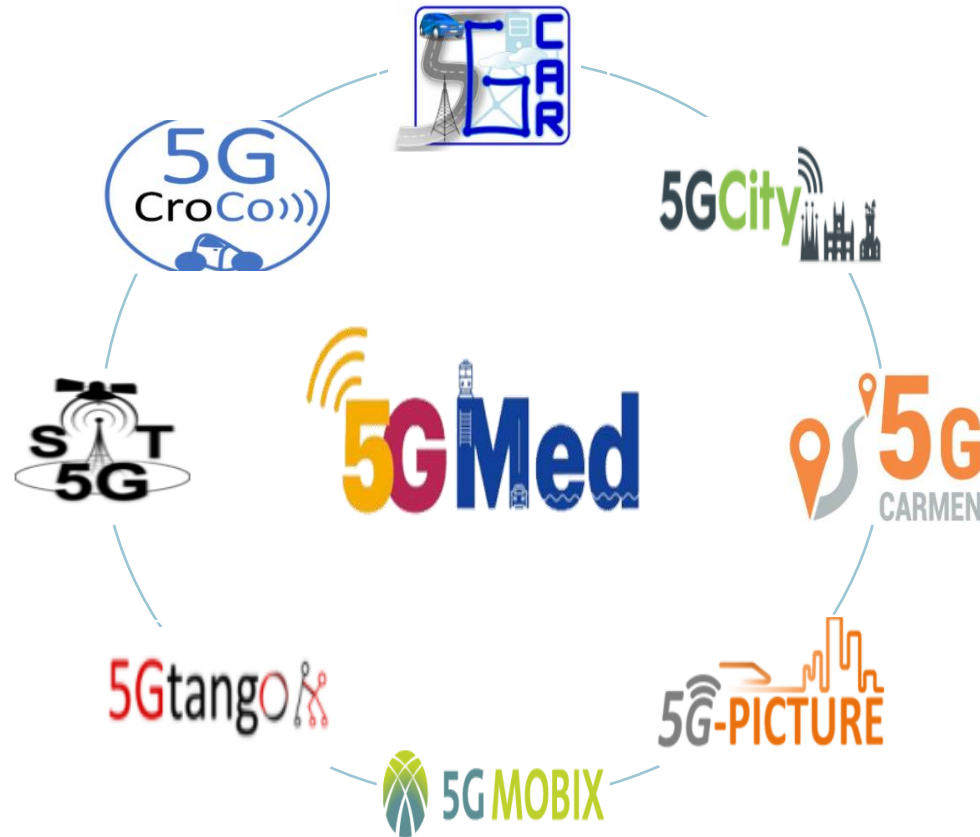
Information regarding surroundings and road conditions

❑ Virtual reality applications

❑ Enriched 3D map models

❑ Media modules for content distribution through network edge nodes (Multi-access Edge Computing).

Eight Bells Role in the Project

Innovation Management	5G Med replicability and adoptability in the cross-border 5G Business	Market analysis of the 5G C-V2X roll out activities, potential market share, strengths and weaknesses
Analyze outcomes of previous 5G Phases	Validate previously defined use cases	Plans for the 5GMed communication and dissemination activities
Describe planned use cases and test cases	Describe platform requirements and functional design	Protect valuable IPRs coming with direct product use

European projects relevant to 5GMed

Thank you!

Stefanos Tsantilas, stefanos.tsantilas@8bellsresearch.com