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Deliverable D3.3

Analysis of EU 5G projects Use Cases

Coordination of 5G edge and distributed cloud integration for European corridors and smart communities

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V1.0	20/10/2025	Monotch	First version with incorporation of internal feedback
V1.1	14/11/2025	Monotch	Extension with other use cases
V1.2	15/04/2026	Monotch	Comments and external feedback, intro.

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1 Introduction and Reading guide

The rapid evolution of 5G and Multi-access Edge Computing (MEC) technologies continues to drive transformative applications across European corridors and smart communities, particularly in mission-critical domains such as Connected, Cooperative, and Automated Mobility (CCAM), rail (FRMCS), and vertical industries. Building on prior analyses, this deliverable provides a structured evaluation of real-world 5G use cases.

Deliverable 3.3 Analysis of EU 5G Projects Use Cases

This Deliverable 3.3 focuses on the systematic analysis of EU-funded 5G project use cases, applying a standardized template to extract technical requirements, performance metrics, and interoperability insights.

Unlike Deliverable 3.1, which cataloged project overviews and high-level use case descriptions, and Deliverable 3.2, which established deployment scenario modeling and best practices for mobility services, Deliverable 3.3 extends these foundations through detailed, template-based dissection of 25+ representative use cases from flagship projects.

2 Overview of the projects analyzed and their use cases:

Project Name	Use Case Title	H2020 or CEF	Description/Objective
5GCroCo	Tele-Operated Driving	H2020	Remotely control vehicles across borders with low latency and high reliability links, enabling seamless vehicle teleoperation in complex traffic environments.
5GCroCo	High-Definition Map Generation	H2020	Real-time HD map creation using crowdsourced sensor data from vehicles, improving map accuracy and supporting automated driving systems.
5GCroCo	Anticipated Cooperative Collision Avoidance (ACCA)	H2020	Cooperative detection and prediction of hazards ahead via V2V and V2N communication to avoid collisions proactively.
5G-MOBIX	Urban Driving with MEC Offloading	H2020	Urban trials for 5G V2X with real-time local edge computing (MEC) for perception sharing, enhancing situational awareness in urban driving scenarios.
5G-MOBIX	Remote Driving via 5G	H2020	Enable operators to remotely manage vehicles under complex traffic using high-bandwidth, ultra-reliable 5G connections with minimal latency.
5G-CARMEN	Cooperative Maneuvering	H2020	Enable coordinated lane changes and merging through V2V and V2I communication for safer and more efficient traffic flow.

PoDIUM	Tunnel Safety and Cooperative Awareness	H2020	Maintain CCAM connectivity inside GNSS-denied environments like tunnels using hybrid localization and communication systems for safety.
5G NETC	Improve cross-border network service continuity for established services)	CEF	Adopt 5G infrastructure in public environments to support new 5G services and applications
5G SEAGULL	Cross-Border 5G Corridor for Connected Mobility	CEF	Deploy and validate continuous, high-performance 5G connectivity along cross-border road corridors to support Connected and Automated Mobility (CAM).
5G DeLux	Seamless 5G Cross-Border Mobility	CEF	Ensures seamless 5G handover and connectivity for vehicles crossing the Germany-Luxembourg border, maintaining uninterrupted data and voice sessions for CAM services.
MEDCOR5G	Mediterranean Corridor 5G and V2X Network	CEF	Deploy continuous 5G coverage along cross-border roads between France and Spain to support CCAM and rail safety communication services like FRMCS.
BaltCOR5G	Cross-border 5G and V2X Infrastructure	CEF	Provides seamless 5G network coverage and handover across the Poland-Czech Republic border corridor to support real-time IoT data streaming and connected mobility.

5G CarolinaPlus	Secure 5G Highway Corridor for Autonomous Vehicles	CEF	Deploys a secure, reliable 5G corridor between Munich and Prague supporting connected and automated mobility applications, including teleoperation and cooperative driving.
BE-CONNECTOW	5G Connectivity for Smart Communities in Wavre	CEF	Implements a private 5G network in Wavre, Belgium supporting emergency services, smart energy, traffic and parking control, and public connectivity.
SE-ED5GE	Sweden Edge 5G for Green Economy	CEF	Deploys 5G edge computing testbeds across Sweden enabling real-time data processing to support public safety, precision agriculture, smart cities, ports, and industrial automation.
5GENIUS	Next-Generation Network for University College Ghent	CEF	Private 5G deployment across university campuses in Ghent, Belgium, supporting education, research, and innovation with high-speed connectivity for AR/VR, AI, IoT applications.
IT-5G4ASSAC	5G for a Smart Sicilian Academic Campus	CEF	Deploys comprehensive 5G and MEC infrastructure at the University of Palermo, Sicily to enable advanced education and research applications with high device density and low latency.
EL-5G-TERRA	5G Infrastructure for Rural Greece	CEF	Extends 5G coverage in rural Greece supporting telemedicine, AR/VR education, and AI-based wildfire and flood detection services via MEC-enabled networks.

Flanders Smart Fields	5G-enabled Digital Transformation in Rural Westhoek	CEF	Private 5G deployment in Westhoek, Belgium, to support healthcare, emergency services, and education for children with long-term illnesses in rural areas.
5G WAT ERR	5G for Water Supply Management and Emergency Response	CEF	Use 5G for resilient monitoring, alerting, and coordination of municipal water infrastructure and emergency services in Ilirska Bistrica.
5G Healthcare Northern Portugal	Connected Emergency Medical Services	CEF	Enable real-time remote diagnostics and high-definition video streaming from emergency vehicles to hospital specialists for enhanced patient care.
5G SMILE	Smart Mobility and Inclusive Living Environments	CEF	Create inclusive and safe urban environments using 5G-enabled smart public services, advanced mobility, and accessibility technologies.
Hi5	High Connectivity via 5G in Toulouse Metropolitan Area	CEF	Deploy 5G across Toulouse metropolitan area to support smart mobility, public safety, healthcare, and e-administration.
Eugenia	5G Connectivity for Emergency Services in Madrid	CEF	Provide mission-critical 5G communications for Madrid's emergency medical services within the M-30 tunnel network.
5G Valenciaport	Private 5G Standalone Network for Smart Port Operations	CEF	Deploy private 5G SA network to enhance port security, logistics, environmental monitoring, and operational efficiency at Valencia port.

5G SESAMO	Secure, Smart Applications and Services at the Mobile Edge	CEF	Enable secure and flexible 5G edge applications with dynamic orchestration for various vertical markets.
5G Rural	Expanding 5G Connectivity to Spain's Rural Areas	CEF	Extend 5G to rural Spain to improve economic, social, and public service conditions through targeted rural connectivity projects.
5G-PHINGE	Flexible and Programmable 5G Network Infrastructure	CEF	Provide flexible 5G network slicing and orchestration for customized vertical industry applications including manufacturing and smart cities.
5G Connect Danube Delta	5G-CDD for Remote Communities	CEF	5G SA and Edge Cloud deployment to improve healthcare, education, environment, and tourism in rural Danube Delta.

Cross-Project Observations

- All projects prioritize low-latency (<50 ms) and high reliability (>99.99%) as prerequisites for CCAM safety operations.
- Network slicing and MEC (Multi-access Edge Computing) recur as enablers for local, real-time decision support across borders.
- Emphasis on interoperability across national networks (a core 5GSC objective) ensures seamless connectivity for vehicles moving between jurisdictions.
- Metrics such as Packet Delivery Ratio (PDR) and handover time are central to performance validation and standardization efforts.

3 Use Case Analyses Methodology, Table Structure and Template Example

This analysis employs a standardized, comprehensive template for defining CCAM (Connected and Automated Mobility) and ITS (Intelligent Transport Systems) use cases, ensuring all critical aspects, from business objectives to technical validation, are systematically documented. The methodology combines three established frameworks:

- COCKBURN Fully Dressed Use Case Template: Adds rigor through structured elements including goal-in-context, preconditions, main success scenarios, alternative flows, extensions, and stakeholder analysis, providing complete operational clarity.
- SUNRISE Framework (EU H2020 project): Emphasizes ITS service categorization, detailed scenario modeling, and validation methodologies specifically tailored for V2X communication use cases, ensuring alignment with European cooperative systems standards.
- MOVE2CCAM Framework: Focuses on harmonized CCAM scenario descriptions to facilitate consistent testing, validation, and deployment across European test infrastructures, promoting interoperability and scalability.

This hybrid approach enables systematic extraction of technical requirements (latency, reliability, message types), performance KPIs, system architectures, and standardization references from diverse project documentation. By applying this template consistently across 30+ EU 5G projects, the analysis facilitates cross-project comparisons, identifies common architectural patterns, and highlights gaps standardization alignment critical for 5GMEC4EU deployment objectives.

Complete table structure:

Section	Description	Example Elements
Title	Describes the goal or scenario clearly.	“Vehicle-to-Infrastructure Communication for Intersection Safety”
ITS Service Category	Describes the Category of Service	Road Safety – Collision Avoidance
Scenario Description	Describes the use-case Scenario	Connected and Automated Mobility Safety; Collision Avoidance
Primary Actor(s)	Entities initiating or primarily affected by communication.	Connected Vehicle, Roadside Unit (RSU), Traffic Management Center
Goal in Context	The communication goal within the CCAM environment.	Ensure cooperative awareness and collision avoidance at intersections.
Scope and Level	Defines if the case is system-level, sub-system-level, or operational.	Road network level
Stakeholders & Interests	Key participants and their motivations.	Drivers, city authorities, ITS platform providers

Preconditions	States that must be true before the use case starts.	Vehicles equipped with V2X modules; RSU active
Trigger	The event initiating the scenario.	Vehicle detects approach to intersection
Main Success Scenario (Basic Flow)	Step-by-step interaction between communication entities.	1) Vehicle sends CAM; 2) RSU validates message; 3) Traffic signal adjusts phase
Extensions / Alternative Flows	Communication failures or latency handling.	RSU not responding; fallback to onboard perception
Metrics & KPIs	Quantitative and qualitative evaluation indicators.	Delay (ms), packet delivery rate, message validity accuracy
Data Requirements	Required message sets, sensors, and datasets.	ETSI ITS-G5 message logs; recorded CAM, DENM data
Validation Methods	Testing procedures and analysis tools.	Offline message validation, real-world trials, simulation
System Architecture	Defines the functional and communication layers used to support the use case, including vehicle, roadside, and back-end components and their message exchange paths.	On-board unit (OBU), Roadside Unit (RSU), Traffic Management Center, V2X communication link, CAM/DENM message flow, intersection signal controller
Communication Impact Analysis	Measures how effectively communication supports safety, efficiency, and reliability.	Impact on collision risk, traffic flow, and user trust
References / Standards	Key standards, specifications, and documents underpinning the use case, including communication protocols and safety requirements.	ETSI EN 302 637 (CAM/DENM), ETSI EN 302 663 (ITS-G5), IEEE 1609.2 (Security), ISO/TS 19091 (V2I), SAE J2735 (Basic Safety Messages)

Key Benefits of This Structure

- Completeness: Covers business, technical, and validation perspectives.
- Interoperability: Aligns with European CCAM testing frameworks.
- Traceability: Links requirements to standards and KPIs for certification.
- Creates consistent, auditable documentation for development, testing, and deployment

EXAMPLE of a CCAM Use Case Template – Emergency Brake Warning (V2V)

Section	Content
Title	Cooperative Emergency Brake Warning (V2V)
ITS Service Category	Road Safety – Collision Avoidance
Scenario Description	When a leading vehicle performs an emergency brake, it sends a V2V message (via ITS-G5 or 5G NR-V2X). The following vehicle receives the alert before detecting the brake visually or through radar, allowing faster driver or system response to prevent rear-end collisions.
Primary Actors	Vehicle A (lead vehicle), Vehicle B (following vehicle)
Goal in Context	Improve reaction time and accident prevention through real-time cooperative communication between vehicles.
Scope / Level	System level (V2V communication application layer)
Stakeholders	OEMs, telecom operators, road safety agencies, standardization bodies (ETSI, C2C-CC)
Preconditions	Both vehicles equipped with V2V communication modules and compliant with ETSI ITS-G5 or 5G NR-V2X. GPS time sync and basic CAM exchange are already active.
Trigger	Sudden deceleration (>7 m/s^2) detected by Vehicle A's sensors.
Main Success Scenario	1. Vehicle A detects rapid deceleration. 2. Vehicle A sends an Emergency Brake Warning (EBW) via broadcast. 3. Vehicle B receives message within latency <100 ms. 4. Vehicle B warns the driver or triggers automated braking.
Alternative Flows	If packet loss or signal degradation occurs (>10%), fallback on radar/lidar detection. If latency >300 ms, EBW ignored to avoid false reaction.
Communication Requirements	- Message size: 300 B. - Broadcast frequency: ≤ 10 Hz. - Communication type: V2V direct link (ITS-G5 or 5G sidelink PC5).
Data Requirements	CAM (Cooperative Awareness Messages), DENM (Decentralized Environmental Notification Messages). Parameters include speed, acceleration, position, and braking status.
KPIs / Metrics	- Latency <100 ms. - Packet Delivery Ratio ≥ 95%. - Effective range ≥ 300 m. - Driver reaction time reduction ≥ 30%.

Validation Method	Simulation via SUMO + Veins + Artery for IEEE 802.11p or NS-3 for 5G-V2X. Real-world validation during test track experiments.
System Architecture	Vehicles communicate directly over the control channel (CCH) of IEEE 802.11p or 5G NR-V2X sidelink. Application layer handles EBW message generation and prioritization.
Communication Impact Analysis	Significantly reduces the probability of rear-end collisions in dense traffic by improving awareness propagation time. Verified improvement in safety performance and message reliability under varying channel loads.
References / Standards	ETSI EN 302 637-2/3, 3GPP Release 14+ NR-V2X; C2C-CC UC_00003 template, 5GAA Day-1 Use Cases; 5G-MOBIX D2.1 specifications.

This filled use-case example demonstrates how CCAM V2V communication is characterized by quantifiable performance metrics, standardized message types, and reproducible validation conditions. It provides a model suitable for policy analysis, infrastructure planning, or pilot trial documentation in European cooperative mobility initiatives.

4 Detailed tables for each project/use case:

4.1 Tele-Operated Driving (5GCroCo)

Section	Content
Title	Tele-Operated Driving (ToD)
ITS Service Category	Connected and Automated Vehicles (CAVs); Remote Control; Cross-border Connectivity
Scenario Description	In the 5GCroCo project, Tele-Operated Driving enables remotely controlling vehicles across borders via 5G networks. The remote operator can maneuver the vehicle in low-speed (<15 km/h) scenarios within a limited range (<100 m), typically for navigating obstacles, performing maneuvers, or handling special cases such as road blockages or complex traffic situations.
Primary Actors	Vehicle equipped with V2X modules, Remote Control Center (VCoC), MEC nodes, Network Operators, Standardization Bodies (ETSI, 3GPP).
Goal in Context	Reduce reaction times, improve safety, ensure seamless cross-border vehicle control, and enable new CCAM business models leveraging high-reliability, low-latency 5G connectivity.
Scope / Level	Cross-border, multi-operator system level. Focus on real-time vehicle control and connectivity, with support for handover across network boundaries.
Stakeholders	Automotive OEMs, telecom providers, regulators, standardization bodies, vehicle owners, and infrastructure providers involved in cross-border mobility.
Preconditions	Vehicles are equipped with 5G NR and MEC-enabled communication modules; operational 5G coverage along cross-border corridors; vehicle

Section	Content
	sensors and advanced teleoperational modules (ATAS™); synchronization of vehicle sensors and control signals.
Trigger	Vehicle approaching an obstacle, road blockage, or low-automatic-control confidence; operator initiates remote control.
Main Success Scenario	1. Vehicle approaches a challenging scenario (e.g., obstacle). 2. Control center establishes a 5G connection. 3. Operator sends real-time control commands. 4. Vehicle responds with low latency (<20 ms), performs maneuvers, and resumes automatic operation when safe. 5. Seamless handover across borders ensures continuous control.
Alternative Flows	Network degradation exceeding latency thresholds (>50-100 ms), handover failures; fallback to onboard sensors/Maneuvering Assist; system alerts operator or switches to automated mode temporarily.
Communication Requirements	- Latency: < 20 ms. - Bandwidth: Sufficient for real-time video and control commands. - Reliability: > 99.999%. - Seamless handover across borders and network operators. - Support for MEC and network slicing for QoS guarantees.
Data Requirements	Real-time sensor data streams, control commands, video feeds, vehicle telemetry. Use of 3GPP/ETSI standards for control and multimedia exchange.
KPIs / Metrics	- End-to-end latency < 20 ms. - Handover success rate > 99%. - Throughput > 100 Mbps. - Control response time < 20 ms. - Cross-border service continuity.
Validation Method	Large-scale cross-border trials along the Metz-Merzig-Luxembourg corridor; simulation and field testing of handover performance, latency, control stability, and safety.

Section	Content
System Architecture	Distributed MEC nodes acting as local control and processing points, connected via multi-operator 5G core networks; vehicle control modules interfaced with 5G NR and MEC; application layer manages control commands, video streams, and handover management, ensuring end-to-end reliability and security.
Communication Impact Analysis	Enables safe, reliable remote vehicle control in cross-border scenarios, significantly reducing reaction times and enabling fully connected CCAM services with seamless handover, ensuring safety, efficiency, and new business opportunities in European cross-border mobility.
References / Standards	ETSI ITS-G5, 3GPP Release 16+ (5G NR), MEC standards, 5GCroCo project reports, cross-border handover and QoS validation documents, and 5GPPP R&I frameworks.

4.2 High-Definition Map Generation (5GCroCo)

Section	Content
Title	High-Definition Map Generation
ITS Service Category	Intelligent and Connected Vehicles; Automated Driving Assistance
Scenario Description	Real-time creation of high-definition (HD) maps via crowdsourcing sensor data from vehicles. Vehicles share sensor data over5Gnetworks to update a cloud-based HD map, reflecting dynamic features such as lane line repainting, barriers, and road works. The updated HD maps enable tactical and operational planning for autonomous or semi-autonomous vehicles.
Primary Actors	Connected vehicles equipped with sensors and5Gcommunication modules, cloud-based map providers, roadside infrastructure.
Goal in Context	Ensure that vehicles have timely access to up-to-date, accurate environmental information through dynamic HD map updates to improve autonomous driving safety and performance.
Scope / Level	Cross-border cloud-edge system for HD map data generation and dissemination with network coverage continuity.
Stakeholders	Automotive OEMs, telecom operators, mapping service providers, infrastructure managers, standardization organizations such asETSI.
Preconditions	Vehicles and infrastructure equipped with5GV2X modules supporting real-time sensor data transmission; operational cloud platforms for map aggregation and distribution; synchronized localization data.

Section	Content
Trigger	Vehicles continuously collect and send sensor data relevant for updating HD map data when entering or traversing mapped areas.
Main Success Scenario	1. Vehicles gather local sensor data during travel. 2. Sensor data uploaded to cloud or MEC-based map servers in near real-time over5Guplink. 3. Map servers process and correct existing static map features and add dynamic content. 4. Updated HD maps provided to vehicles timely before entering new map regions. 5. Vehicles use updated maps for enhanced autonomous operations.
Alternative Flows	If network connectivity is lost or degraded, vehicles rely on cached HD maps and onboard sensors until communications are restored. Map updates deferred and synchronized at better coverage points.
Communication Requirements	High uplink throughput > 100 Mbps; low latency for timely updates; reliable cross-border coverage with seamless handover; support for edge-cloud hybrid architectures to minimize update delay.
Data Requirements	Sensor data streams including lidar, radar, cameras; localization data; map update messages using standardized formats such asETSI ITS-G5.
KPIs / Metrics	Timeliness (update latency < 1s), data accuracy and completeness; network throughput for sensor data upload; seamless coverage measured by handover success rate; service continuity across borders.
Validation Method	Large-scale cross-border field trials on highways and urban corridors between France, Germany, Luxembourg; performance monitoring of update latency, map accuracy, and network continuity; simulations using SUMO and network emulators.

Section	Content
System Architecture	Hybrid cloud-edge map generation system with vehicles uploading sensor data via5Gnetworks to MEC nodes or cloud servers; edge processing for fast local aggregation; fully synchronized map services between countries allowing uninterrupted updates during border crossing.
Communication Impact Analysis	Real-time HD map updates significantly enhance autonomous vehicle operational safety and flexibility by informing vehicles of dynamic changes in their environment; seamless cross-border network handover ensures updates are timely and consistent, reducing risks of outdated map data causing errors or unsafe driving decisions.
References / Standards	ETSI ITS-G5, 3GPP Release 15+ NR V2X, 5GCroCo project deliverables including D1.4 and D4.3 trial reports, 5GAA technology white papers.

4.3 Anticipated Cooperative Collision Avoidance (5GCroCo)

Section	Content
Title	Anticipated Cooperative Collision Avoidance (ACCA)
ITS Service Category	Connected and Automated Mobility Safety; Collision Avoidance
Scenario Description	ACCA enables cooperative detection and prediction of hazards ahead through Vehicle-to-Vehicle (V2V) and Vehicle-to-Network (V2N) communication. It anticipates potentially critical events like traffic jams, emergency braking, or unexpected maneuvers beyond the line of sight or sensor range, enabling earlier warnings to vehicles approaching hazardous conditions. This leads to smoother and safer driving reactions and prevents collisions, especially in scenarios with limited sensor visibility.
Primary Actors	Connected vehicles, Roadside Units (RSUs), backend cloud/MEC servers handling cooperative hazard processing and warning dissemination, infrastructure operators.
Goal in Context	To anticipate dynamic road hazards and inform vehicles in advance via cooperative communications, reducing collision risk and enabling smoother, more homogeneous traffic flow under real-world traffic conditions including cross-border corridor scenarios.
Scope / Level	System level spanning V2V direct communications and V2N cloud/MEC-assisted cooperation with support for cross-border interoperability.
Stakeholders	Automotive OEMs, telecom operators, road safety authorities, infrastructure providers, standardization entities (ETSI, 5GAA, C2C-CC).

Section	Content
Preconditions	Vehicles and RSUs equipped with ETSI ITS-G5 or 5G NR-V2X compliant communication modules; cloud/MEC platforms deployed for real-time hazard analysis and message dissemination; synchronized time and localization available.
Trigger	Detection of a hazardous event by a vehicle or infrastructure (e.g., sudden deceleration, stationary obstacle, or onset of traffic jam) triggering hazard notification generation.
Main Success Scenario	1. Vehicle A or infrastructure detects hazard. 2. Event information encoded in CAM/DENM messages. 3. V2V broadcast and V2N transmission delivers hazard warning to approaching vehicles with latency <10 ms. 4. Receiving vehicles react appropriately by alerting drivers or triggering automated deceleration. 5. System maintains connectivity and cooperation across borders ensuring continuous hazard management.
Alternative Flows	In case of communication disruptions, vehicles fallback to local sensors; cloud processing delays degrade timeliness of warnings; system prioritize critical messages to maintain safety integrity.
Communication Requirements	Latency below 10 ms; packet delivery ratio > 99%; reliable V2V sidelink and multi-radio 5G NR connectivity; MEC-enabled edge processing for minimal response delay; support for cross-border roaming and service continuity.
Data Requirements	CAM (Cooperative Awareness Message) and DENM (Decentralized Environmental Notification Message) message sets containing vehicle status, event type, position, speed, and hazard details.
KPIs / Metrics	Latency < 10 ms; Packet Delivery Ratio ≥ 99%; hazard detection accuracy > 95%; message validity; cooperative warning coverage and reliability across corridors.

Section	Content
Validation Method	Cross-border corridor testbeds including Barcelona small-scale trials deploying ACCA backend on MEC and cloud platforms; system-level simulations combining SUMO traffic scenarios with Veins/Artery or NS-3 communication models; measurement of hazard event detection, message dissemination timing, and vehicle reaction performance.
System Architecture	Hybrid system combining V2V direct sidelink communication using ETSI ITS-G5 or 5G NR-V2X, with V2N cellular connectivity supporting MEC/cloud-based hazard processing and information fusion; distributed MEC nodes enable near-real-time hazard evaluation; end application layers generate and prioritize warning messages sent over control channels.
Communication Impact Analysis	ACCA enables early cooperative awareness beyond on-board sensor limits, reducing crash risk and smoothing traffic flow by mitigating abrupt braking events; improves the reliability and accuracy of hazard warnings in complex, multi-operator and cross-border environments, contributing to higher overall road safety and connectivity readiness for CCAM deployment.
References / Standards	ETSI EN 302 637, 3GPP Release 14+ NR-V2X; C2C-CC UC_00003 use case template; 5GCroCo deliverables including D3.2, 5GAA Day-1 Use Cases; 5G-MOBIX D2.1 specifications; public reports on Barcelona ACCA trials.

4.4 Urban Driving with MEC Offloading (5GMobix)

Section	Content
Title	Urban Driving with MEC Offloading
ITS Service Category	Urban Connected and Automated Mobility; Cooperative Perception
Scenario Description	Conduct urban trials where automated vehicles offload heavy perception and sensor data processing to local Multi-access Edge Computing (MEC) nodes via 5G NR V2X and mmWave communications. This reduces onboard computational load and latency, enabling real-time sharing and fusion of environmental perception data among vehicles and infrastructure within dense urban settings.
Primary Actors	Automated vehicles equipped with 5G NR V2X and mmWave radios, roadside units (RSUs) with MEC servers, edge cloud platforms, telecom operators.
Goal in Context	Enhance automated driving safety and efficiency in urban environments by leveraging real-time edge computing for perception data processing and sharing, reducing latency and increasing system responsiveness.
Scope / Level	Urban testbeds and cross-border corridors involving MEC infrastructure closely integrated with 5G radio access networks.
Stakeholders	Automotive OEMs, edge cloud and telecom operators, public authorities, infrastructure providers, researchers.
Preconditions	Urban areas instrumented with MEC-enabled RSUs and 5G NR/ mmWave coverage; vehicles capable of high-rate sensor data transmission; interoperable MEC platforms; real-time data fusion algorithms running at the edge.

Section	Content
Trigger	Vehicles enter MEC-equipped urban zones and begin data offloading for cooperative processing; triggered by complex urban traffic scenarios requiring advanced perception.
Main Success Scenario	1. Vehicle collects sensor data (lidar, radar, cameras). 2. Sensor data streamed in real-time over 5G NR/ mmWave to nearby MEC nodes. 3. MEC aggregates, fuses, and shares processed perception data back to vehicles and infrastructure. 4. Automated driving systems improve situational awareness and decision making. 5. Reduced perception processing load on vehicles. 6. System maintains low latency (<15 ms) and high reliability.
Alternative Flows	If MEC or mmWave link quality deteriorates, vehicles rely on onboard processing and/or fallback to ITS-G5 communication; data offloads buffered and resumed when connectivity improves.
Communication Requirements	Low latency (<15 ms total round-trip), high throughput (>100 Mbps uplink), robust handover between MEC nodes and across multiple radio access technologies (5G NR, mmWave, ITS-G5); support for multi-operator environments and privacy-compliant data sharing.
Data Requirements	High-volume raw and processed sensor data streams (lidar point clouds, radar data, video); location and timing synchronization data; MEC service orchestration information.
KPIs / Metrics	End-to-end latency < 15 ms, MEC processing time < 5 ms, packet loss < 1%, throughput > 100 Mbps, edge resource utilization efficiency, vehicle reaction time improvements in urban scenarios.
Validation Method	Real-world urban testbeds in cities including Berlin, Paris, and cities in Greece, Spain, and China; comprehensive trials measuring latency, throughput, MEC

Section	Content
	processing performance, vehicle decision accuracy, and system robustness under varying traffic and network conditions.
System Architecture	Edge-cloud hybrid design with MEC servers hosted at roadside units; use of 5G NR and mmWave for high-bandwidth communication; integration with centralized cloud backends for non-real-time processing; service orchestration for MEC resource allocation and multi-operator cooperation; vehicle subsystem integrating MEC communications and sensor data processing interfaces.
Communication Impact Analysis	MEC offloading drastically reduces computation delay in sensor data processing, allowing faster threat detection and improved vehicle control responses in complex urban environments; more efficient bandwidth and network resource usage; enables scalable deployment of automated driving features with real-time cooperative perception.
References / Standards	5G-MOBIX project deliverables (D4.4, D5.3), ETSI MEC standards, 3GPP Release 16+ NR V2X specifications, IEEE ITS standards, academic papers on edge computing for connected vehicles, public reports from 5G-MOBIX urban trials.

4.5 Remote Driving via 5G (5GMobix)

Section	**Content**
Title	Remote Driving via 5G
ITS Service Category	Connected and Automated Vehicles; Remote Operation
Scenario Description	Enables operators to remotely manage and control vehicles under complex traffic conditions using highly reliable, low-latency 5G connections. Setups include multiple cameras streaming real-time 360° video from the vehicle to the remote operator, who uses steering wheel and pedals to control the vehicle remotely. High-bandwidth, low-latency connectivity is established using5G NRstandalone networks with Multi-access Edge Computing (MEC) support for minimal delay.
Primary Actors	Remote vehicle operator, connected vehicle with drive-by-wire and sensor systems, MEC nodes, 5G network operators, fleet management systems.
Goal in Context	Provide safe, low-latency, reliable remote vehicle control across urban and corridor scenarios, including cross-border operation, enhancing vehicle safety and assisting in situations where local autonomy or presence is impaired or unavailable.
Scope / Level	Multi-operator, cross-border system-level demonstration and validation of real-time teleoperation over 5G networks; integration of vehicle control and video streaming with network slicing and MEC orchestration.
Stakeholders	Automotive OEMs, telecom operators, regulatory bodies, emergency response teams, service providers, research institutions.

Section	Content
Preconditions	Vehicles equipped with multiple wide-angle cameras (e.g., four 120° FoV cameras capturing 360°), drive-by-wire control systems, 5G NR modems; remote stations equipped with multiple monitors and control peripherals; low latency and high bandwidth 5G network coverage; secure authentication and session management; MEC nodes located close to radio access network sites.
Trigger	Operator initiates remote driving session in response to vehicle requiring teleoperation support, such as in complex traffic, obstacle scenarios, or automation fallback.
Main Success Scenario	1. Vehicle cameras capture and encode 360° video streams. 2. Video and telemetry data sent via RTP/UDP over 5G uplink to remote operator. 3. Operator views video across multiple displays and controls vehicle using steering wheel and pedals. 4. Control commands sent downstream with latency <20 ms. 5. Vehicle executes commands and provides real-time feedback. 6. Seamless service continuity maintained during cross-border handover.
Alternative Flows	Network degradation causing increased latency or packet loss triggers fallback to autonomous or pre-programmed vehicle behavior; partial operator control if video quality reduces; system alerts operator on connectivity changes.
Communication Requirements	Ultra-low latency (<20 ms end-to-end), high uplink bandwidth (~100 Mbps) for video streaming, high reliability (>99.999%), network slicing for prioritized teleoperation traffic, rapid cross-border handover support, MEC-enabled local breakout for efficient data routing.
Data Requirements	High-definition multi-camera video streams encoded with H264/H265; control command streams; vehicle telemetry and sensor data; synchronization data for video and controls.

Section	Content
KPIs / Metrics	End-to-end latency < 20 ms; handover success rate > 99%; video streaming frame rates 60 fps at 1280x720 resolution; throughput > 100 Mbps; control responsiveness comparable to direct physical driving.
Validation Method	Cross-border trials on multiple corridors connecting European countries, testing network handovers, control latency, video quality, and operator effectiveness; network and application-level monitoring with simulation and real-world testbeds using multiple vehicle and remote station pairs.
System Architecture	Multi-operator 5G standalone core network with MEC for low latency; fleet manager and secure gateway managing vehicle-operator connections; vehicles equipped with drive-by-wire and video subsystems connected to 5G NR modems; remote operator stations receive video via local breakout; service orchestration supports handover and QoS.
Communication Impact Analysis	Demonstrates feasibility of cross-border teleoperated driving with performance comparable to local control; enables new CCAM applications including remote assistance and failsafe driving; highlights importance of network slicing and MEC for ensuring latency and reliability; advances EU harmonization for cross-border connected mobility under multi-operator environments.
References / Standards	3GPP Releases 15/16 for 5G NR and V2X; ETSI MEC standards; 5G-MOBIX project deliverables and white papers; academic publications detailing remote driving test results; 5GAA tele-operated driving guidelines.

4.6 Cooperative Maneuvering (5G Carmen)

Section	Content
Title	Cooperative Maneuvering
ITS Service Category	Cooperative, Connected and Automated Mobility (CCAM) – Safety and Traffic Efficiency
Scenario Description	Cooperative maneuvering enables vehicles to exchange speeds, positions, intended trajectories, and maneuvers in real-time via V2V and V2I communications to negotiate safe and efficient lane changes, merging, overtaking, and intersection navigation. This cooperation goes beyond conventional visual signals (brake lights, indicators) by allowing early, optimized coordination, either directly via localized vehicle communication or through centralized decision-making supported by 5G MEC infrastructure. This ensures smoother transitions and reduces dangerous situations on highways and complex traffic environments.
Primary Actors	Vehicles equipped with V2V communication modules, Roadside Units (RSUs) with MEC capabilities, infrastructure managers, network operators, drivers, and automated driving systems.
Goal in Context	Improve traffic safety and efficiency by enabling vehicles to negotiate maneuvers cooperatively with optimized timing and coordinated motion, reducing traffic conflicts and accident risk during lane changes and merges. Aim for high automation readiness (Level 4) in complex cross-border European corridors.
Scope / Level	System-level use case integrating distributed V2V direct communication and centralized MEC-supported cooperative maneuver planning across multi-operator, cross-border corridors (e.g., Bologna-Munich corridor spanning Bavaria, Tirol, Trentino).

Section	Content
Stakeholders	Automotive OEMs, telecom operators, local and regional transport authorities, standardization bodies (ETSI, C2C-CC), infrastructure providers, research institutes.
Preconditions	Vehicles and RSUs compliant withETSI ITS-G5 or 5G NR-V2Xstandards, multi-access edge computing infrastructure deployed along corridors for centralized maneuver coordination, real-time location and trajectory sharing enabled, synchronized timing among deployed units, secure communications established.
Trigger	Initiation of a lane change, merge, or other maneuver by an equipped vehicle, requiring cooperative exchange of intentions and contextual data with neighboring vehicles and control infrastructure.
Main Success Scenario	1. Vehicle A intends to change lanes or merge. 2. Vehicle A broadcasts maneuver intent, speed, position via V2V sidelink. 3. Nearby vehicles and RSUs receive and process data locally or send to MEC node. 4. MEC-based centralized coordination determines safe and optimal maneuver timing. 5. Recommendations sent to involved vehicles and drivers or executed by automated systems. 6. Vehicles perform coordinated, smooth maneuvers reducing conflicts. 7. Maneuver completed safely within traffic flow.
Alternative Flows	In case of network outages or degraded V2V signals, fallback to direct sensor perception and manual negotiation by drivers; MEC-based coordination limited to available nodes; safety systems react autonomously if conflict detected.
Communication Requirements	- V2V direct interface with latency < 25 ms. - High packet delivery ratio (>95%). - MEC-based centralized coordination with low delay. - Secure, low-latency communication over 5G NR sidelink and up/downlink. - Cross-border seamless handover and multi-operator support.

Section	Content
Data Requirements	Exchange of CAM (Cooperative Awareness Messages), DENM (Decentralized Environmental Notification Messages) including speed, position, intended trajectory, maneuver intent, and status information submitted frequently (up to 10 Hz). MEC nodes aggregate, fuse, and process data for system-wide coordination.
KPIs / Metrics	Latency < 25 ms, Packet Delivery Ratio ≥ 95%, maneuver success rate, reduction in traffic conflicts, user acceptance, system stability under dense traffic, handover success rate in cross-border scenarios.
Validation Method	Cross-border corridor trials across Italy, Austria, Germany focusing on cooperative lane merging; data collection on communication metrics, maneuver success and safety outcomes; simulations using SUMO, Veins, and 5G NR-V2X emulators; real-time MEC coordination performance evaluation.
System Architecture	Hybrid architecture integrating localized distributed V2V communication and centralized MEC-based maneuvering coordination services; MEC servers receive real-time vehicle data, execute cooperative algorithms, and instruct vehicles or drivers; 5G NR sidelink and uplink/downlink enable data exchange; infrastructure supports multiple operators with secure interoperability.
Communication Impact Analysis	Cooperative maneuvering enabled by 5G networks reduces traffic conflicts and hazards by allowing vehicles to anticipate and coordinate maneuvers ahead of time, improving traffic flow and safety; MEC-based coordination provides system-wide orchestration enhancing efficiency and robustness, while distributed direct V2V communications ensure low-latency critical data exchange; multi-operator corridors achieve seamless handover ensuring continuous operations across borders.
References / Standards	ETSI ITS-G5 standards, 3GPP Release 15/16 for 5G NR-V2X, C2C-CC cooperative maneuvering use case specifications, 5G-CARMEN project deliverables and trial reports, European Commission 5GPPP CCAM guidelines.

4.7 Tunnel Safety and Cooperative Awareness (PoDIUM)

Section	Content
Title	Tunnel Safety and Cooperative Awareness
ITS Service Category	Connected, Cooperative and Automated Mobility (CCAM) Safety
Scenario Description	Maintains CCAM connectivity inside tunnels whereGNSSsignals are unavailable. The PoDIUM project deploys an innovative hybrid communication and localization system on the Brenner Motorway (A22) tunnel near Trento, Italy. This includes roadside cameras monitoring vehicle flow, infrastructure-based V2X positioning combining vehicle signals and roadside units (RSUs), and onboard dead-reckoning systems with high-definition maps and inertial measurement units. Real-time risk assessments and warnings support vehicles and drivers inside the tunnel.
Primary Actors	Connected and automated vehicles (CAVs), roadside infrastructure (RSUs and cameras), infrastructure operators, telecommunication providers, emergency services.
Goal in Context	Ensure continuous, reliable CCAM services inside tunnels for cooperative awareness, safety, and emergency risk management despite absence of satellite positioning, thereby advancing automated vehicle operations and traffic safety in complex enclosed environments.
Scope / Level	System-level deployment focused on tunnels on a major highway corridor, integrating multi-technology localization and hybrid radio communications (5G FR1/FR2, ITS-G5, WLAN).

Section	Content
Stakeholders	Road operators, infrastructure providers, automotive OEMs, telecom operators, regulatory bodies, emergency responders, research partners.
Preconditions	Operational sensor infrastructure including cameras, RSUs with 5G and ITS-G5 radios; installed hybrid localization modules on vehicles; deployed edge or cloud-based Digital Twin for traffic and risk assessment; reliable communication networks covering tunnel interior; synchronized timing across systems.
Trigger	Vehicle entry into the tunnel; detection of traffic density or risk factors inside the tunnel triggering data aggregation and risk evaluation.
Main Success Scenario	1. Vehicles and infrastructure sensors continuously exchange data via hybrid V2X networks. 2. Infrastructure cameras monitor and count vehicles entering and inside the tunnel. 3. Edge/cloud Digital Twin computes real-time risk assessments. 4. Vehicles receive dynamic warnings about traffic conditions, safety restrictions, or required maneuvers. 5. Vehicle positioning sustained via V2X and onboard dead reckoning maintains cooperative awareness. 6. Traffic flow and safety are managed effectively despite GNSS denial.
Alternative Flows	Partial communication failures fallback on onboard sensor fusion and inertial navigation; warnings may be reduced to local interception levels; increased caution advised for system users.
Communication Requirements	Supports multi-connectivity including5G FR1 cm-wave,5G FR2 mmWave, ITS-G5, WLAN (60 GHz) ensuring low latency and high reliability inside tunnel; precise timing and location data exchange; edge/cloud processing capability; secure and resilient data links.
Data Requirements	Real-time vehicle counts, speed and classification data from infrastructure cameras; V2X CAM and DENM messages; onboard sensor data including

Section	Content
	inertial measurement and lidar/radar input; Digital Twin inputs for risk modelling.
KPIs / Metrics	Localization accuracy better than 0.5 meters; latency under 50 ms for warning messages; reliability > 99.9%; risk assessment update frequency adequate to changing tunnel traffic; reduced safety incidents in tunnel operations.
Validation Method	Live trials at Brenner Motorway tunnel with extensive monitoring; integration testing of positioning module accuracy, communication network performance, and Digital Twin risk management outputs; feedback from vehicle sensors and infrastructure is cross-verified; safety warnings tested on connected vehicles.
System Architecture	Hybrid architecture combining V2X communications over5G FR1,5G FR2, ITS-G5, and WLAN; onboard dead reckoning fused with V2X localization; infrastructure camera sensors connected to edge or cloud Digital Twin servers; multi-layer connectivity ensures availability and accurate positioning in GNSS-denied tunnel environment.
Communication Impact Analysis	Provides uninterrupted CCAM service inside tunnels, critical to safety and automated driving; enhances cooperative awareness and risk mitigation despite absence of GPS; supports higher automation levels (SAE level 3-4) reliably in complex environments; infrastructure-vehicle cooperation leads to more efficient traffic management and reduces incident risks in confined spaces.
References / Standards	PoDIUM project documentation; 5GAA standards; ETSI Intelligent Transport Systems (ITS); 3GPP 5G NR standards for FR1 and FR2; Digital Twin frameworks; tunnel safety protocols in European road infrastructure.

4.8 5G NETC – Seamless Intelligent Transport Across Northern Europe

Section	Content
Title	5G NETC – Seamless Intelligent Transport Across Northern Europe
ITS Service Category	Connected and Automated Mobility (CAM); Intelligent Transport Systems (ITS); Cross-Border Connectivity; Multimodal Transport Digitalisation
Scenario Description	5G NETC focuses on deploying advanced 5G infrastructure to enable seamless, intelligent transport services across Northern Europe, particularly along key transport corridors and multimodal logistics hubs. The project supports real-time data exchange between vehicles, infrastructure, and logistics systems, enabling use cases such as cooperative driving, smart traffic management, port and logistics optimisation, and cross-border mobility services. It addresses challenges related to interoperability, latency, and integration of digital transport ecosystems across countries.
Primary Actors	Connected and automated vehicles, logistics operators, port authorities, mobile network operators, infrastructure managers, public authorities, technology providers, multimodal transport platforms.
Goal in Context	To enable seamless, interoperable, and high-performance 5G connectivity across Northern European transport corridors and hubs, supporting intelligent, safe, and efficient mobility and logistics services.
Scope / Level	Deployment and validation across cross-border corridors and multimodal nodes (e.g., ports, logistics centers), focusing on V2X communication (V2N, V2I, V2V), integration with logistics platforms, and edge/cloud computing for real-time applications.
Stakeholders	Telecom operators, transport and infrastructure authorities, port and logistics operators, automotive and mobility service providers, research institutions, public administrations.
Preconditions	Availability of 5G coverage in transport corridors and nodes; interoperability between national networks; integration of edge computing (MEC); digitally equipped vehicles and infrastructure; harmonised regulatory frameworks across participating countries.

Trigger	A vehicle, logistics operation, or transport process enters a 5G-enabled corridor or hub requiring real-time connectivity for mobility, automation, or logistics optimisation services.
Main Success Scenario	1. Transport asset (vehicle or logistics unit) enters a 5G-enabled corridor or hub. 2. Reliable 5G connectivity is established. 3. Seamless cross-border or cross-domain handover occurs. 4. Real-time data exchange takes place between vehicles, infrastructure, and logistics systems. 5. Edge/cloud platforms process data to support intelligent services. 6. Mobility and logistics operations are optimised (e.g., traffic flow, port operations, automated driving).
Alternative Flows	Temporary fallback to legacy networks (e.g., 4G); degraded service levels in case of partial coverage; local/onboard processing when connectivity is insufficient; delayed synchronization of non-critical logistics data.
Communication Requirements	Ultra-reliable low-latency communication (URLLC); high bandwidth for data-intensive applications; seamless roaming and interoperability across borders; support for network slicing; integration with MEC and cloud platforms; secure and scalable communication infrastructure.
Data Requirements	Vehicle sensor data; logistics and cargo data; traffic and infrastructure information; cooperative awareness messages (CAM); environmental and situational data; operational control and command data.
KPIs / Metrics	Low latency (< 20–50 ms for critical services); high availability (> 99%); seamless handover success rate (> 95%); high data throughput; reliability of mission-critical communication; efficiency gains in logistics and traffic operations.
Validation Method	Field trials across Northern European corridors and logistics hubs; validation of CAM and logistics use cases; performance testing of cross-border handover; measurement of latency, reliability, and service continuity.
System Architecture	5G infrastructure including base stations, core networks, and MEC nodes; integration with transport and logistics platforms; connected vehicle systems; interoperable cross-border network interfaces; cloud-edge hybrid computing environment.

Communication Impact Analysis	5G NETC enhances intelligent transport and logistics by enabling seamless communication across Northern Europe; improves efficiency of multimodal transport systems; supports automation and safety; strengthens cross-border interoperability and digitalisation of transport ecosystems.
References / Standards	3GPP 5G and V2X standards; ETSI ITS specifications; EU CEF Digital programme; TEN-T policy framework; EU CCAM initiatives; cross-border interoperability and data-sharing standards.

4.9 5G SEAGUL – Cross-Border 5G Corridor for Connected Mobility

Section	Content
Title	5G SEAGUL – Cross-Border 5G Corridor for Connected and Automated Mobility
ITS Service Category	Connected and Automated Mobility (CAM); Cross-Border Corridor Connectivity; Cooperative Driving Services
Scenario Description	5G SEAGUL aims to deploy and validate continuous, high-performance 5G connectivity along cross-border road corridors to support Connected and Automated Mobility (CAM). The project addresses challenges such as seamless handover between network domains, ultra-low latency communication, and service continuity across borders. It enables use cases including cooperative driving, real-time traffic information exchange, remote driving support, and enhanced situational awareness for vehicles operating in corridor environments.
Primary Actors	Connected and automated vehicles, road users, mobile network operators, road infrastructure operators, public authorities, automotive OEMs, technology providers.
Goal in Context	To ensure uninterrupted, low-latency, and reliable 5G connectivity along cross-border transport corridors, enabling safe and efficient operation of connected and automated vehicles and supporting advanced CAM services.
Scope / Level	Deployment and validation along cross-border road corridors (including TEN-T networks), focusing on vehicle-to-network (V2N), vehicle-to-vehicle (V2V), and vehicle-to-infrastructure (V2I) communication; integration of edge computing capabilities for real-time processing.

Section	Content
Stakeholders	Telecom operators, transport infrastructure managers, automotive industry stakeholders, public authorities, corridor operators, research and innovation partners.
Preconditions	Availability of continuous 5G coverage along corridor routes; interoperability between national network operators; deployment of MEC (Multi-access Edge Computing) nodes; equipped connected vehicles; regulatory alignment across borders.
Trigger	Vehicle entering a cross-border corridor requiring continuous connectivity for automated driving, cooperative maneuvers, or real-time traffic and safety services.
Main Success Scenario	1. Vehicle enters a 5G-enabled corridor. 2. Continuous high-quality 5G connection is established. 3. Seamless handover occurs between network operators across borders. 4. Vehicle exchanges real-time data with infrastructure and other vehicles. 5. MEC platforms process data locally to support low-latency applications. 6. Automated or assisted driving functions operate safely and efficiently throughout the journey.
Alternative Flows	Temporary degradation to 4G/LTE where 5G coverage is incomplete; fallback to onboard decision-making if connectivity is interrupted; buffering and delayed synchronization of non-critical data.
Communication Requirements	Ultra-reliable low-latency communication (URLLC); seamless cross-border handover; high data throughput for sensor and video data; MEC integration for edge processing; network slicing for CAM services; interoperability across multiple operators and countries.

Section	Content
Data Requirements	Vehicle sensor data (camera, radar, lidar), cooperative awareness messages (CAM), decentralized environmental notification messages (DENM), traffic and infrastructure data, control and command signals.
KPIs / Metrics	Latency < 20–50 ms for critical services; handover success rate > 95%; service continuity across borders; high availability (> 99% in corridor coverage areas); throughput sufficient for real-time data exchange; reliability of safety-critical communication.
Validation Method	Field trials along cross-border corridors; testing of handover performance between operators; validation of CAM use cases (e.g., cooperative driving, traffic management); measurement of latency, reliability, and service continuity.
System Architecture	5G corridor infrastructure including roadside base stations, MEC nodes, and core network integration across countries; vehicle onboard units; interoperable network interfaces enabling cross-border roaming and service continuity.
Communication Impact Analysis	5G SEAGUL enhances cross-border mobility by enabling seamless, reliable communication for connected and automated vehicles; supports safer and more efficient transport; facilitates interoperability across European networks; contributes to the deployment of pan-European CAM corridors.
References / Standards	3GPP V2X and 5G standards; ETSI ITS-G5 specifications; CEF Digital 5G Corridor framework; TEN-T corridor policies; EU CCAM initiatives; relevant cross-border interoperability guidelines.

4.10 5G DeLux Seamless 5G Cross-Border Mobility Between Germany and Luxembourg

Section	Content
Title	5G DeLux – Seamless 5G Cross-Border Mobility Between Germany and Luxembourg
ITS Service Category	Connected and Automated Mobility (CAM); Seamless Cross-Border Connectivity
Scenario Description	The 5G DeLux project focuses on providing high-performing 5G network coverage and a seamless handover of connected devices when crossing the German-Luxembourg border. The goal is to ensure uninterrupted calls, data sessions, video conferencing, and continuous 5G connectivity for connected vehicles, enabling cooperative automated mobility with high-quality digital experience across borders.
Primary Actors	Deutsche Telekom, Post Luxembourg, BMW Group, mobile network operators, automotive OEMs, regulatory bodies, connected vehicle drivers.
Goal in Context	To define and implement a blueprint solution for seamless handover and uninterrupted 5G connectivity across intra-EU borders for connected cars and mobility services, facilitating smoother cross-border travel and enhancing CAM service availability and performance.
Scope / Level	Cross-border motorway corridor approximately 98 km long covering the Frisange (Luxembourg) - Aspelt/Altwies - Saarbrucken (Germany) motorway section including border area near Schengen.
Stakeholders	Telecommunications providers, automotive OEMs, network infrastructure providers, regulators, and end users participating in connected mobility services.

Section	Content
Preconditions	5G NR infrastructure in place or being deployed on both sides of the border; integrated network management systems supporting cross-operator handover; vehicles equipped with multi-operator compatible 5G communication devices.
Trigger	Vehicle crossing the border between Germany and Luxembourg requiring seamless network handover without interruption of ongoing communication sessions.
Main Success Scenario	1. Vehicle approaches border region. 2. Network handover initiated between Deutsche Telekom and Post Luxembourg networks. 3. Ongoing sessions remain uninterrupted during handover. 4. Continuous 5G connectivity maintained with high quality and stable connections. 5. Vehicle and user experience remain seamless for voice, data, and video services.
Alternative Flows	Possible handover failures or delays may cause temporary signal loss, fallback to 4G or other means; temporary service degradation; recovery automated via network protocols.
Communication Requirements	Support for multi-operator mobility and handover protocols; high coverage reliability; low latency for communication continuity; packet loss minimization; QoS management; secured lawful interception compliance.
Data Requirements	Telecommunications metadata (handover messages, session continuity parameters); vehicle communication session data (voice, video, telemetry).
KPIs / Metrics	Seamless handover success rate > 99%; call drop rate near zero; latency < 50 ms during handover; throughput maintaining > 100 Mbps; user satisfaction metrics for uninterrupted sessions.

Section	Content
Validation Method	Network drive tests and real-life trials along the German-Luxembourg corridor; quantitative measurement of handover performance, latency, and session continuity; usability testing with connected vehicles; performance data collection from telecom operators and vehicle systems.
System Architecture	Parallel 5G infrastructures deployed by Deutsche Telekom and Post Luxembourg coordinated via inter-operator interface; solutions for core network integration, RAN cooperation, and session continuity; vehicle multi-IMSI and multi-PLMN support for seamless roaming; dynamic QoS and resource allocation enforced by network slicing.
Communication Impact Analysis	Guarantees continuous and high-quality 5G communication for cross-border mobility, critical for enabling advanced Connected and Automated Mobility services; reduces disruptions and enhances user experience; supports EU digital single market progress by demonstrating interoperable multi-operator networks and cross-border framework harmonization.
References / Standards	3GPP Release 15+, ETSI network management standards, CEF Digital EU funding frameworks, 5G PPP CAM white papers, project deliverables published via the European 5G Corridors initiative.

4.11 MEDCOR5G – Mediterranean Corridor 5G and V2X Network for Future CAM and FRMCS Services

Section	Content
Title	MEDCOR5G – Mediterranean Corridor 5G and V2X Network for Future CAM and FRMCS Services
ITS Service Category	Connected and Cooperative Automated Mobility (CCAM); Cross-border 5G Coverage
Scenario Description	The MEDCOR5G project aims to deliver uninterrupted and continuous 5G coverage along the cross-border Mediterranean corridor between France and Spain, addressing 5G coverage gaps where market investment is lacking. The initiative enables robust support for Connected, Cooperative and Automated Mobility (CCAM) services and rail communication services such as FRMCS. The project includes deployment of passive and active infrastructure over a 328 km stretch in France and 220 km in Spain to guarantee seamless service and support Traffic Incident Management.
Primary Actors	Mobile Network Operators (MNOs), road and rail infrastructure operators, Original Equipment Manufacturers (OEMs), regulatory authorities, CCAM service providers.
Goal in Context	To provide seamless 5G and V2X connectivity along the Mediterranean cross-border corridor to support mobility services, enhance traffic safety and efficiency, and enable future rail communication services, ensuring connectivity continuity and quality of service essential for CCAM and FRMCS deployment.
Scope / Level	Cross-border corridor network infrastructure deployment and operational service level including rigorous performance management on 5G coverage continuity in 700 MHz and 3.5 GHz bands, targeting reduction of coverage black spots.

Section	Content
Stakeholders	MNOs (e.g., Orange, Telefónica), infrastructure owners, governmental and regulatory bodies, automotive and rail OEMs, public transport authorities.
Preconditions	Pre-existing partial 5G infrastructure; regulatory approvals for cross-border network coordination; ecosystem readiness for CCAM and FRMCS standard adoption; technical alignment across operators for network slicing and handover mechanisms.
Trigger	Identification of coverage gaps leading to performance degradation in CCAM and rail safety-critical communication services, triggering investment and deployment of infrastructure upgrades.
Main Success Scenario	1. Full deployment of new radio sites fills coverage gaps. 2. Seamless coverage achieved across border segments. 3. Continuous, high-quality 5G connectivity enables CCAM applications and FRMCS cloud connectivity. 4. Traffic Incident Management services successfully operate with minimal latency and handover disruptions. 5. Cross-border roaming and service continuity validated in field trials.
Alternative Flows	Partial coverage improvements leading to interim fallback on 4G; service performance issues corrected progressively; phased deployments to avoid service interruptions.
Communication Requirements	High reliability and coverage continuity at 700 MHz and 3.5 GHz; low latency (<50 ms); seamless handover and roaming capabilities; support for both road vehicle V2X and rail FRMCS services; network slicing for critical safety applications.
Data Requirements	Real-time traffic and vehicle data streams; FRMCS signaling messages; V2X safety messages; network monitoring data for performance management.

Section	Content
KPIs / Metrics	Network coverage reliability > 99.9%; latency < 50 ms; handover success rate > 99%; throughput suitable for CCAM video and sensor data; service availability aligned with safety-critical requirements.
Validation Method	Field measurement and performance tests along the Spain-France corridor; continuous KPIs monitoring; interoperability and cross-border handover testing; simulations of incident management scenarios.
System Architecture	Coordinated deployment of active and passive radio sites along corridor; multi-operator core network interworking; MEC-enabled edge computing clusters for low latency processing; adherence to ETSI ITS and 3GPP specifications for V2X and FRMCS.
Communication Impact Analysis	MEDCOR5G ensures critical extension of 5G coverage enabling safe and efficient cross-border CCAM and rail operations by closing coverage gaps and harmonizing network functions between countries; paves the way for wider CCAM deployment and the transition from GSM-R to 5G-based FRMCS rail communication, enhancing European transport integration.
References / Standards	CEF-DIG-2021-5GCORRIDORS-WORKS program; ETSI ITS-G5 and 3GPP Rel.15+; 5G PPP CAM and FRMCS guidelines; official MEDCOR5G deliverables; European Commission digital transport policies.

4.12 BaltCOR5G – Cross-border 5G and V2X Infrastructure Deployment Between Poland and Czech Republic

Section	Content
Title	BaltCOR5G – Cross-border 5G and V2X Infrastructure Deployment Between Poland and Czech Republic
ITS Service Category	Connected and Automated Mobility (CAM), Intelligent Transport Systems (ITS), Cross-border 5G Connectivity
Scenario Description	The BaltCOR5G project deploys 5G and cellular vehicle-to-everything (C-V2X) infrastructure for a 125 km stretch along the A1 road corridor at the Poland-Czech Republic border region between Częstochowa and Ostrava. It aims to provide seamless 5G network coverage and handover for connected mobility use cases, including real-time video streaming from IoT sensors and HD cameras for traffic and road management. The project creates a neutral host shared infrastructure to support multiple stakeholders such as telecom operators and road administrators.
Primary Actors	Towerlink Poland (part of Cellnex Poland), CETIN a.s. (Czech telecom infrastructure provider), mobile network operators, road authorities, connected vehicle users, IoT solution providers.
Goal in Context	To establish high-quality, seamless network coverage for cross-border connected mobility, enabling real-time data exchange for smart traffic and road safety management while supporting future automated and connected driving applications.
Scope / Level	Cross-border road corridor deployment on Polish and Czech sides including active and passive 5G infrastructure supporting multi-operator access, aimed for smooth handover and connectivity over 125 km along the A1 motorway.

Section	Content
Stakeholders	Telecom infrastructure providers, mobile network operators, road and transport authorities, vehicle manufacturers, equipment developers, EU regulatory bodies.
Preconditions	Areas with limited or no 5G coverage identified, permitting targeted deployment; collaboration between multiple national telecom and infrastructure partners; regulatory approvals for deployment; availability of IoT and connected mobility use cases requiring 5G.
Trigger	Need for reliable, continuous 5G coverage and V2X communication along cross-border corridor, addressing connectivity gaps and supporting CAM and ITS applications.
Main Success Scenario	1. Successful deployment of 5G infrastructure on both sides of the border. 2. Seamless network handover for vehicles crossing the border. 3. High reliability and low latency communication enabling HD video streaming from IoT sensors. 4. Improved traffic monitoring and management through real-time data analytics. 5. Interoperability and shared infrastructure benefits multiple service providers and stakeholders.
Alternative Flows	Partial coverage gains with gradual infrastructure rollout; temporary fallbacks on legacy mobile technologies; incremental service improvements; fallback plans for network interruptions.
Communication Requirements	High network reliability and continuity; low latency for real-time data streams; multi-operator neutrality (shared infrastructure); support for V2X messaging; ability to handle HD video streams for traffic analysis; seamless handover capabilities.

Section	Content
Data Requirements	IoT sensor data including HD video streams; V2X safety and status messages; infrastructure traffic monitoring data; network performance and handover state information.
KPIs / Metrics	Network coverage availability > 99%; continuous connection handover success rate > 99%; latency below 50 ms in corridor segments; throughput sufficient for HD video streaming; multi-operator service quality maintenance; user satisfaction with connectivity continuity.
Validation Method	Deployment monitoring; drive testing with connected vehicles performing cross-border mobility; live video streaming and analytics testing; cross-operator interoperability assessments; KPIs data collection and analysis by project partners.
System Architecture	Neutral host shared 5G infrastructure with active base stations and passive equipment deployed along the corridor; multi-operator core network integration; edge computing platforms for traffic data processing; V2X messaging supported via direct sidelink and network-assisted communication; seamless RAN and core handover procedures supported by telecom partners.
Communication Impact Analysis	Ensures continuous high-performance connectivity supporting cross-border CAM use cases; enables real-time traffic and road management via IoT sensor integration; reduces service interruptions and enhances user experience; promotes multi-stakeholder collaboration and efficient use of infrastructure resources enhancing scalability and sustainability.
References / Standards	European Commission CEF Digital programme documents; ETSI and 3GPP V2X and 5G communication standards; project reports from Cellnex and CETIN; EU 5G Corridor initiatives; cross-border mobility regulation and framework guidelines.

4.13 5GCarolinaPlus (CarolinaPlus) – Secure 5G Highway Corridor for Autonomous Vehicles

Section	Content
Title	5GCarolinaPlus (CarolinaPlus) – Secure 5G Highway Corridor for Autonomous Vehicles
ITS Service Category	Connected, Cooperative, and Automated Mobility (CCAM); Secure 5G Corridor Deployment
Scenario Description	5GCarolinaPlus is a three-year deployment project started in January 2025 by T-Mobile Czech Republic and Deutsche Funkturm GmbH. It continues the earlier 5GCarolina inception study aimed at creating a secure 5G highway corridor along the "Via Carolina" corridor between Munich and Prague. The corridor aims to support Connected and Automated Mobility (CAM) with high-performance 5G connectivity, enabling secure and seamless cross-border mobility services including autonomous vehicle operation, teleoperation, and cooperative applications between Germany and the Czech Republic.
Primary Actors	T-Mobile Czech Republic, Deutsche Funkturm GmbH, automotive OEMs (ŠKODA, Audi, BMW), mobile network operators, infrastructure providers, regulatory bodies, connected vehicle operators.
Goal in Context	To define, deploy, and operate a secure, reliable, and high-performance 5G corridor along the Munich-Prague axis that supports emerging CAM services, ensuring seamless connectivity for autonomous and connected vehicles in a cross-border environment, facilitating environmentally friendly passenger and freight transport, enhancing traffic safety, and enabling real-time data exchange and teleoperation.
Scope / Level	Cross-border highway corridor spanning approximately 35 km in initial deployment and subsequent extensions towards seamless operator and technology integration; secure and reliable 5G connectivity and service orchestration across multi-operator, multi-technology infrastructure.

Section	Content
Stakeholders	Telecommunications operators (T-Mobile, Deutsche Funkturm), automotive OEMs (ŠKODA, Audi, BMW), regulatory agencies in Germany and Czech Republic, research organizations, connected vehicle developers, transport authorities.
Preconditions	Availability of 5G NR coverage and MEC infrastructure along corridor; deployment of multi-operator infrastructure with roaming and handover capabilities; vehicles equipped with 5G communication modules; supported regulatory framework ensuring security and interoperability.
Trigger	Increasing demand for secure, seamless, and high-quality connectivity for advanced CAM applications including automated driving and teleoperation on European corridors; European Union funding and regulatory support encouraging corridor deployments.
Main Success Scenario	1. Deployment of interoperable 5G infrastructure along the corridor. 2. Vehicles maintain uninterrupted, secure 5G connections across the Germany-Czech Republic border. 3. CAM services (e.g., cooperative maneuvering, remote driving) operate reliably. 4. User experience is seamless with low latency, high throughput, and robust security. 5. Continuous operation supports environmentally friendly, safe passenger and freight transportation. 6. Data collected and analyzed for optimization and scaling.
Alternative Flows	Network interruptions or handover failures trigger fallback to 4G or local autonomous safety modes; incremental network rollouts; temporary security or interoperability challenges mitigated by network orchestration and updates.
Communication Requirements	Low latency (<20 ms), high throughput (multiple 100 Mbps), ultra-reliable connectivity (> 99.999%), secure communications including encrypted sessions; seamless inter-PLMN handover; support for MEC for edge processing; multiple operator support for roaming and service continuity.

Section	Content
Data Requirements	Telemetry, sensor data and video streams from vehicles; control and command data for teleoperation and cooperative functions; network management and handover signaling; security and authentication data.
KPIs / Metrics	Service interruption duration <150 ms for handovers; latency < 20 ms; data throughput > 100 Mbps; network uptime > 99.999%; roaming and security effectiveness; user satisfaction; successful cross-border CAM service deployments.
Validation Method	Field trials along the Munich-Prague corridor; drive tests measuring connectivity, latency, handover performance; security and interoperability assessments; real-time CAM service demonstrations including teleoperation and cooperative maneuvers; continuous KPI monitoring and reporting.
System Architecture	Distributed MEC-enabled 5G NR sites managed by multiple operators; inter-PLMN interfaces facilitating secure, seamless handovers; vehicles equipped with advanced multi-IMSI modules; integration of vehicle, network, and application layers to ensure service continuity and security; application orchestration ensures QoS and supports cloud-edge computations; multi-tenant infrastructure supporting various services including teleoperation, mapping, and safety applications.
Communication Impact Analysis	The 5GCarolinaPlus corridor project enhances connected and automated mobility by enabling secure, high-performance, and seamless 5G cell and service handovers across borders; it improves safety and efficiency of automated transport, reduces human driver workload, enables new business models for mobility services, and supports EU digital single market objectives by removing connectivity barriers in cross-border transport. The project's advanced network orchestration and MEC use cases demonstrate critical lessons for future pan-European CAM deployments.

Section	Content
References / Standards	EU's Connecting Europe Facility funding program; 3GPP Release 15/16 standards; ETSI ITS-G5 and 5G NR-V2X standards; project documentation from 5GCarolinaPlus; European Union digital transport policies; CAM white papers from 5G PPP initiatives; cross-border corridor deployment guidelines.

4.14 BE-CONNECTOW – 5G Connectivity for Smart Communities in Wavre, Belgium

Section	**Content**
Title	BE-CONNECTOW – 5G Connectivity for Smart Communities in Wavre, Belgium
ITS Service Category	Smart City; Public Protection and Disaster Relief (PPDR); Energy Management; IoT and Connected Public Services
Scenario Description	BE-CONNECTOW is a flagship EU-funded project deploying a city-wide 5G private network in Wavre, Belgium, supporting innovative smart city applications. The project leverages 5G technology to empower local public services including emergency response (firefighters, police drones), smart energy management, traffic and parking control, air quality monitoring, and public connectivity for residents, schools, and businesses. It aims to transform Wavre into one of Europe's leading smart cities by driving sustainability, efficiency, and enhanced public safety.
Primary Actors	Citymesh Belgium (MNO and project lead), City of Wavre, Réseau d'Énergies de Wavre (energy company), emergency services, local government, residents, schools, cultural venues, businesses.
Goal in Context	To provide a robust, secure, and high-performance 5G network infrastructure enabling digital transformation of municipal services, supporting social economic drivers and sustainable development goals, and improving quality of life through enhanced public safety, energy efficiency, and connectivity.
Scope / Level	City-wide private 5G network in urban and suburban zones of Wavre including districts Bierges and Limal, servicing public buildings, emergency response, smart meters, IoT deployments, and public users
Stakeholders	Municipal government of Wavre, Citymesh Belgium, energy providers, emergency services, regional regulators, EU Digital Fund, local citizens and businesses benefiting from smart city services

Section	Content
Preconditions	Deployment of 5G infrastructure compliant with national and EU regulations; collaboration between city and private enterprises; adequate spectrum and technical resources; installation of smart meters and IoT devices; engagement of emergency services and public entities
Trigger	Need to improve emergency response, energy management, and municipal service delivery through modern digital infrastructure; EU funding incentivizing smart community developments
Main Success Scenario	1. Establishment of a city-owned 5G network covering key districts. 2. Deployment of advanced smart meters across public buildings transmitting real-time energy data. 3. Integration of IoT sensors for environmental monitoring and traffic control. 4. Emergency services utilize 5G-connected drones and devices for improved situational awareness. 5. Residents and public venues gain affordable or free 5G connectivity improving digital inclusion. 6. Efficient city management and improved sustainability indicators realized.
Alternative Flows	Network rollout delays; partial coverage or service interruptions; gradual integration of IoT and smart meter systems; alternative connectivity modes applied in early phases
Communication Requirements	Private 5G network with high throughput and low latency for critical services; secure and reliable transmission; capability to handle dense IoT device traffic; quality of service differentiation for emergency and municipal applications; interoperability with public networks
Data Requirements	Energy consumption and grid data from smart meters; high-definition video from emergency response drones; IoT sensor data for air quality, traffic flow, parking status; public user connectivity data

Section	Content
KPIs / Metrics	Network availability > 99%; latency suitable for real-time emergency services; number of connected smart meters; data throughput supporting multiple IoT and public applications; user adoption and satisfaction; measurable improvements in energy efficiency and emergency response times
Validation Method	Field operational testing in Wavre with performance monitoring of network parameters; user experience evaluations; emergency service drills using 5G-connected drones; energy usage analytics; stakeholder feedback sessions
System Architecture	A city-wide private 5G network operated by Citymesh Belgium; integrated IoT gateways and sensor networks; MEC-enabled edge computing supporting low-latency municipal applications; secure access protocols for public and emergency services; hybrid deployment covering urban and suburban zones
Communication Impact Analysis	BE-CONNECTOW demonstrates how dedicated 5G private networks empower smart city transformations by enhancing municipal service efficiency, sustainability, and public safety. The integration of emergency drones, smart energy meters, and public connectivity offers a replicable blueprint for urban digitalization supporting economic and social development.
References / Standards	European Union Connecting Europe Facility (CEF) Digital Funding; ETSI 5G standards; Citymesh and City of Wavre project documentation; public smart city and IoT communication standards; 5GSC support platform resources

4.15 SE-ED5GE – Sweden Edge 5G for Green Economy Developer Community

Section	Content
Title	SE-ED5GE – Sweden Edge 5G for Green Economy Developer Community
ITS Service Category	5G Edge Computing; Smart Communities; Industry Digitization; Public Safety; Sustainable Development
Scenario Description	The SE-ED5GE project strengthens Sweden's position in future digital solutions by combining edge computing and 5G technology. The project enables real-time data processing close to data sources by deploying four testbeds across Sweden — including Skellefteå, Luleå, Uppsala, and Boden — offering platforms for use cases in public safety, sustainable agriculture, smart city management, port and logistics operations, and autonomous vehicles. The project fosters a developer community to accelerate technological progress for both public and private sectors.
Primary Actors	RISE Research Institutes of Sweden AB (coordinator), Telia Sverige AB, Skellefteå municipality, Skellefteå Kraft, local businesses, researchers, public sector partners.
Goal in Context	To establish a 5G edge ecosystem that supports low-latency, high-bandwidth applications critical for smart community services and sustainable economic growth — such as emergency response enhancement, precision agriculture, traffic monitoring, and industrial automation — enabling real-time interaction and decision making via integrated 5G and edge computing infrastructures.
Scope / Level	Multi-site testbeds and developer community across urban, industrial, agricultural, and port environments in Sweden, offering replicable infrastructures and fostering innovation ecosystems.

Section	Content
Stakeholders	Governmental research agencies, telecom operators, municipalities, technology companies, academic institutions, developers, and end-users involved in smart community applications.
Preconditions	Deployment of 5G NR and edge computing platforms at testbed sites; ecosystem engagement for collaborative development; sufficient spectrum availability and regulatory support for public and private 5G networks; readiness of application developers and industry users for pilot trials.
Trigger	Need for fast, reliable, and localized data processing to implement advanced digital services that enhance sustainability, safety, and efficiency in community and industrial operations in Sweden.
Main Success Scenario	1. Infrastructure deployed and operational at four testbed locations. 2. Developers utilize 5G edge capabilities to build applications across smart city, emergency services, and agriculture. 3. Real-time data analytics and control improve operational outcomes. 4. Collaborative developer community accelerates innovation. 5. Demonstrated benefits in public safety, waste management, traffic control, and precision farming. 6. Project outcomes guide future scalable smart community deployments.
Alternative Flows	Delays in infrastructure deployment or ecosystem adoption; incremental pilot projects prior to full operational scale; fallback to centralized cloud processing if edge computing resources limited.
Communication Requirements	Low latency (<20 ms), high throughput for sensor and video data; reliable 5G NR coverage at test sites; edge computing capabilities tightly integrated with radio infrastructure; secure and flexible network slicing; multi-tenant orchestration for public/private applications.

Section	Content
Data Requirements	High-volume sensor data (video, lidar, environmental sensors); telemetry for autonomous systems; emergency response communications; industrial IoT data streams; platform telemetry for network management.
KPIs / Metrics	Network latency and throughput metrics; application responsiveness; developer engagement and innovation rate; improvements in targeted sectors such as safety or agriculture; operational uptime and reliability; environmental and economic impact assessments.
Validation Method	Continuous pilot testing across four diverse testbeds; user studies on new applications; performance monitoring of edge and 5G systems; feedback through developer community forums; benchmarking against smart city and industrial KPIs.
System Architecture	Joint 5G NR and MEC infrastructure with local data processing nodes; cloud-edge hybrid architecture; integration with municipal IoT and industrial systems; collaborative platform for developers; cross-sector data sharing supporting diverse applications.
Communication Impact Analysis	SE-ED5GE drives Sweden's smart community aspirations through advanced edge-enabled 5G networking facilitating low latency and high data rate applications; improves public safety, supports sustainable agriculture, and enhances industrial automation; creates a vibrant ecosystem accelerating digital innovation across sectors, employing decentralized real-time computing close to data sources.
References / Standards	Funded by EU CEF2 Digital; coordinated by RISE Sweden; aligned with ETSI MEC and 3GPP standards; reports and publications disseminated via Swedish innovation networks; integration with national digital strategy initiatives.

4.16 5GENIUS – Next-Generation Network for University College Ghent (HOGENT), Belgium

Section	Content
Title	5GENIUS – Next-Generation Network for University College Ghent (HOGENT), Belgium
ITS Service Category	Education and Research; Smart Communities; Digital Innovation
Scenario Description	The 5GENIUS project is deploying a private 5G non-standalone network across three HOGENT campuses in Ghent, Belgium, to create a digital ecosystem supporting education, research, and operational activities. The network enables innovative digital services and applications in healthcare, agriculture, logistics, mobility, and industry. This fully operational campus-wide network fosters development and practical use of emerging technologies such as augmented and virtual reality, AI, machine learning, and IoT, empowering students, researchers, and entrepreneurs.
Primary Actors	HOGENT University College, Citymesh Belgium (network operator and project lead), students, researchers, staff, external companies and start-ups collaborating on digital innovation, EU funding bodies.
Goal in Context	To accelerate digital transformation in higher education and research by providing a reliable, high-speed, low-latency private 5G network supporting cutting-edge applications, enhancing learning experiences and collaborative innovation, and bridging academia with industry standards.
Scope / Level	Private 5G network deployed on multiple campuses, covering educational, research, and operational domains. Network provides baseline for future expansion and adapts to emerging use cases across diverse sectors.

Section	Content
Stakeholders	HOGENT management and academic staff, Citymesh, students, researchers, local innovation ecosystem including startups and companies, European Commission (CEF Digital funding), BELNET.
Preconditions	Availability of suitable 5G spectrum and infrastructure; regulatory approvals for private network deployment; engagement by academic and research communities; availability of compatible user devices and applications.
Trigger	The need for high-performance digital infrastructure to support innovative teaching, research, and entrepreneurship in evolving technological domains.
Main Success Scenario	1. Private 5G network fully deployed and operational across HOGENT campuses. 2. Users access high-speed, secure connectivity enabling real-time data-intensive applications. 3. Successful launch and adoption of innovative digital services in healthcare training, precision agriculture, logistics, and mobility simulations. 4. Enhanced research capabilities and student learning outcomes achieved. 5. Strong collaboration and technology transfer between academia and industry facilitated. 6. Roadmap established for network growth and technology evolution.
Alternative Flows	Phased deployment with partial initial coverage; incremental application rollout; fallback to existing networks for legacy devices or services; continuous feedback and network optimization cycles.
Communication Requirements	Reliable low-latency 5G connectivity (non-standalone initially), network slicing for application prioritization; high throughput (up to 400 Mbps reported); secure data transmission; coverage across multiple campus buildings and outdoor areas; support for mobility and multi-device connection density.

Section	Content
Data Requirements	Real-time video and AR/VR streaming; sensor data from agricultural equipment and logistics devices; telemetry and user data for education and research; collaborative platform data streams.
KPIs / Metrics	Network latency below 20 ms; throughput up to 400 Mbps; high network availability and uptime; user satisfaction; number of innovative applications deployed; acceleration of research outputs and educational impact metrics.
Validation Method	Real-world deployment on operational campuses; continuous performance monitoring; user feedback via surveys; demonstrator projects and academic publications; collaboration with industry partners for applied research outcomes.
System Architecture	Campus-wide private 5G network (non-standalone initially) with infrastructure operated by Citymesh; integration with campus IT systems; MEC capabilities for edge processing; multi-tenant capabilities supporting diverse academic and research groups; secure access and data privacy ensured.
Communication Impact Analysis	5GENIUS project demonstrates the value of dedicated private 5G networks in higher education and research environments, accelerating digital transformation by enabling advanced applications and bridging the gap between academia and industry; supports sustainable innovation ecosystems; provides a replicable model for other educational institutions aiming to embed next-generation connectivity and computing resources.
References / Standards	European Commission's CEF Digital funding program; ETSI 5G standards; 3GPP Rel. 15/16; Project documentation and public releases from HOGENT and Citymesh; academic and industry reports on private 5G networks for education.

4.17 IT-5G4ASSAC – 5G for a Smart Sicilian Academic Campus

Section	Content
Title	IT-5G4ASSAC – 5G for a Smart Sicilian Academic Campus
ITS Service Category	Education and Research; Smart Campus Deployment; 5G and Edge Computing Integration
Scenario Description	The IT-5G4ASSAC project deploys a new 5G infrastructure with Multi-Access Edge Computing (MEC) to support smart campus environments at the University of Palermo, Sicily. It consists of installing 5 base stations and 18 Distributed Antenna Systems (DAS) to provide comprehensive indoor and outdoor 5G coverage. This infrastructure enables high-speed connectivity, device density, and low latency to facilitate emerging applications in education, research, and innovation, including augmented reality, IoT, and AI-based services.
Primary Actors	University of Palermo, Vodafone Italy (network operator), academic researchers, students, technology developers, application providers, EU funding bodies.
Goal in Context	To create a first-class 5G-enabled academic environment fostering digital innovation in education and research with extreme network performance (up to 100x higher device density, 10x faster than 4G data rates, and 15-20 ms latency) supporting advanced smart campus applications.
Scope / Level	University campus-based deployment covering indoor and outdoor areas, integrating state-of-the-art 5G and MEC technologies to create a sustainable and scalable model for digital transformation in education.
Stakeholders	University administration, Vodafone Italy, students and staff, local innovation ecosystem, regional and national regulators, European Union digital and research programs.

Section	Content
Preconditions	Spectrum availability including DAS installation permissions, technical readiness at the university, cooperation between telecom and academic partners, presence of compatible devices and emerging application use cases.
Trigger	Growing demand for campus-wide ultra-high-speed wireless connectivity enabling the next generation of education and research services; EU support via Connecting Europe Facility (CEF) Digital funding.
Main Success Scenario	1. Deployment of 5 base stations and 18 DAS completed. 2. Reliable high-speed 5G coverage indoors/outdoors. 3. Students and researchers use 5G-powered applications such as AR/VR, real-time video processing, and AI research. 4. MEC infrastructure supports low-latency edge computing. 5. Increased digital innovation and educational impact. 6. Project results serve as a best-practice model for other academic institutions.
Alternative Flows	Gradual phase-in of infrastructure; fallback on 4G in some areas; incremental application trials; continuous optimization based on user feedback.
Communication Requirements	High device density support (up to 100x of 4G), network throughput up to 10x faster than 4G, end-to-end latency 15-20 ms facilitated by MEC; secure connectivity and network slicing for diverse uses; comprehensive DAS and base station coverage.
Data Requirements	Real-time video and sensor data for AR/VR and AI applications; telemetry and control data from research devices; user authentication and identity management data; network usage statistics.
KPIs / Metrics	Network latency below 20 ms; coverage completeness; throughput targets met consistently; user satisfaction and adoption rates; innovation outputs and academic publications; ecosystem growth indicators.

Section	Content
Validation Method	Live testbed monitoring and network performance measurement; application demonstrations by students and researchers; stakeholder surveys; comparison with similar campus deployments; reports to funding agencies.
System Architecture	Distributed 5G base stations and DAS integrated with MEC servers for edge computing; private and public network components; seamless indoor and outdoor coverage; secure multi-tenant operation supporting academic and research applications; operator and university IT system integration.
Communication Impact Analysis	IT-5G4ASSAC significantly enhances the University of Palermo's capability to support innovative research and education through powerful 5G and edge computing, creating new opportunities for digital teaching, scientific experiments, and cross-sector collaboration, while demonstrating a scalable model of digital campus development in line with EU digital strategy.
References / Standards	EU Connecting Europe Facility (CEF) Digital program documents; Vodafone Italy project releases; ETSI 5G and MEC standards; 3GPP 5G NR Release 16/17 standards; University of Palermo research publications on digital transformation.

4.18 EL-5G-TERRA – 5G infrastructure and services for public interest and social inclusion in rural Greece

Section	**Content**
Title	EL-5G-TERRA – 5G infrastructure and services for public interest and social inclusion in rural Greece
ITS Service Category	5G Infrastructure for Public Services – Healthcare, Education, Civil Protection
Scenario Description	EL-5G-TERRA focuses on extending COSMOTE's 5G network by deploying nearly 50 new 5G base stations in rural, sparsely populated areas of central Greece and the islands. Its goal is to provide high-capacity, reliable 5G connectivity to support advanced public interest use cases like telemedicine, immersive learning with AR/VR, and public protection through enhanced wildfire and flood monitoring using AI and IoT devices. The project deploys 5G non-standalone network migrating to standalone, combined with fiber and wireless backhaul upgrades.
Primary Actors	WINGS ICT Solutions (lead), COSMOTE, Digital Cities of Central Greece, Region of Crete, local governments, emergency services, educational institutions, healthcare providers.
Goal in Context	To reduce digital divide and provide high-quality 5G-enabled public services in healthcare, education, and civil protection sectors for residents of remote, underserved Greek regions by leveraging advanced 5G RAN infrastructure and emerging digital technologies.
Scope / Level	Infrastructure deployment of 5G New Radio at 700 and 2100 MHz bands with fiber or wireless backhaul; nearly 50 base stations covering multiple rural locations; demonstration of use cases involving static and mobile scenarios for public sector applications.

Section	Content
Stakeholders	Telecommunications operators, regional authorities, healthcare and educational organizations, civil protection agencies, IoT technology providers, local populations.
Preconditions	Spectrum allocation and regulatory clearances; technical upgrades of backhaul networks; installation of 5G radio equipment including MIMO capable antennas; readiness of public organizations and users to adopt 5G-enabled services; collaboration among stakeholders.
Trigger	Identified need for enabling high-performing digital public services in rural/remote Greek areas with insufficient mobile broadband connectivity.
Main Success Scenario	1. 5G base stations installed and integrated with existing network by COSMOTE. 2. Deployment of digital public services such as telemedicine remote monitoring of vital signs, live paramedic video streaming, AR/VR immersive education. 3. Enhanced public protection through AI-assisted wildfire detection and multi-sensor environmental monitoring. 4. Stable connectivity and low latency services demonstrated. 5. Public adoption and stakeholder satisfaction lead to sustainable digital inclusion.
Alternative Flows	Partial network coverage during phased deployment; fallback to existing 4G networks where 5G signals unavailable; gradual increase of service portfolio; adaptive infrastructure scaling.
Communication Requirements	High capacity and reliable 5G wireless connectivity with up to 10 Gbps speeds; multi-antenna MIMO; low latency supporting real-time critical services; fiber and wireless backhaul enhancements; MEC integration expected; multi-band (700 and 2100 MHz) radio access.

Section	Content
Data Requirements	High-resolution video (e.g., paramedic feeds), sensor data for health monitoring, telemetry from environmental sensors, AR/VR traffic and education data streams, real-time alerts for civil protection.
KPIs / Metrics	Network throughput and coverage area; latency under 50 ms for critical services; service availability > 99%; number of deployed base stations; quality and effectiveness of telemedicine and civil protection applications; user adoption and feedback.
Validation Method	Field trials in central Greece and Crete, continuous monitoring of network performance, use case demonstrations involving healthcare, education, and safety services, impact assessments of digital inclusion and emergency response, stakeholder feedback.
System Architecture	5G non-standalone RAN constructed with MIMO technology, connected through upgraded fiber and wireless backhaul; initial deployment on 700 and 2100 MHz bands; integration with existing COSMOTE network; provision for transition to 5G standalone mode; edge computing for latency-sensitive services; cloud management platforms; cooperation with local public entities for service delivery.
Communication Impact Analysis	EL-5G-TERRA bridges the digital gap in rural Greece, enabling public interest services with advanced 5G capabilities critical for health, education, and disaster management; hybrid infrastructure and AI-driven solutions deliver safer, smarter communities, facilitating broader EU digital transformation goals for social inclusion and territorial cohesion.
References / Standards	5G-TERRA EU project documentation; COSMOTE infrastructure plans; European Commission CEF Digital guidelines; ETSI 5G standards; 3GPP Release 15+; Greek Ministry of Digital Governance reports.

4.19 Flanders Smart Fields – 5G-enabled Digital Transformation in Rural Westhoek, Belgium

Section	Content
Title	Flanders Smart Fields – 5G-enabled Digital Transformation in Rural Westhoek, Belgium
ITS Service Category	Healthcare, Emergency Services, Education, Smart Communities
Scenario Description	The Flanders Smart Fields project implements a private 5G mobile network covering most of the rural Westhoek region in Belgium. The goal is to act as a catalyst for regional digital development and transformation by enabling ultra-reliable low-latency communication (uRLLC), Internet of Things (IoT) sensor integration, and sufficient bandwidth for data, voice, and video communications. It focuses on improving healthcare and emergency services and increasing inclusion and educational opportunities for children with long-term illnesses.
Primary Actors	e-BO Enterprises (Mobile Network Operator and lead), Jan Yperman Hospital, Provincial Development Agency of West Flanders, local emergency services, educational institutions.
Goal in Context	To provide stable and reliable 5G connectivity in a low-density rural area where traditional telecom infrastructure is insufficient for critical services, enabling improved healthcare delivery, emergency response, and education access in the Westhoek region.
Scope / Level	Deployment and operation of a private 5G network in rural Westhoek, designed to complement existing commercial mobile networks and cover under-served or uncovered areas, thereby supporting mission-critical applications and community digital inclusion.

Section	Content
Stakeholders	Local hospitals, emergency services, regional development agencies, telecom operators, educational bodies, regional government, citizens.
Preconditions	Regulatory approval for private 5G deployment, availability of suitable spectrum, infrastructure installation capabilities, cooperation with healthcare and emergency organizations, IoT device integration readiness, existing inadequate telecom coverage.
Trigger	Insufficient mobile network coverage for critical public services and growing need for digital inclusion and innovation in the rural Westhoek area.
Main Success Scenario	1. Private 5G mobile network infrastructure installed and operational covering the majority of the Westhoek region. 2. Healthcare providers use 5G services for improved patient monitoring and emergency communications. 3. IoT sensors and connected devices deployed for public safety and health. 4. Children with long-term illnesses access enhanced educational resources via reliable connectivity. 5. Region experiences improved public service quality and broader digital transformation.
Alternative Flows	Gradual infrastructure rollout prioritizing priority areas; temporary use of fallback networks where 5G coverage is limited; iterative integration of IoT applications; complementary use of existing mobile networks.
Communication Requirements	Ultra-reliable low-latency communications (uRLLC) for critical services; sufficient bandwidth for simultaneous data, voice, and video streams; stable and secure private 5G network operation complementing existing telecom infrastructure; IoT communications support.
Data Requirements	Real-time sensor data, patient monitoring data, emergency communication streams, educational data traffic, voice, and video transmissions.

Section	**Content**
KPIs / Metrics	Coverage percentage of rural area; network reliability and latency metrics; healthcare outcome improvements; emergency response effectiveness; adoption rates by institutions and residents; operational sustainability post-subsidy.
Validation Method	Field measurements of network performance; case studies of healthcare and emergency service improvements; feedback from educational and social inclusion stakeholders; demonstration projects; continuous monitoring by project coordinators and EU evaluators.
System Architecture	Private 5G network infrastructure with base stations and related network equipment deployed to maximize rural coverage; secure data transmission; integration with healthcare and emergency services IT systems; IoT device and sensor platform management; network operated by e-BO Enterprises with service coordination by regional partners.
Communication Impact Analysis	The project bridges critical connectivity gaps in rural Westhoek enabling advanced healthcare, emergency, and educational services through robust 5G connectivity; fosters regional digital innovation and inclusion; presents a replicable model for rural 5G integration in Europe with socio-economic benefits.
References / Standards	EU Connecting Europe Facility (CEF) Digital programme; Belgian regulatory frameworks; ETSI 5G standards; regional development agency data; e-BO Enterprises project documentation; health and emergency service reports.

4.20 5G WAT ERR 5G for Water Supply Management and Emergency Response in Ilirska Bistrica

Section	**Description**
Title	5G for Water Supply Management and Emergency Response in Ilirska Bistrica
Describes the goal or scenario	Enable real-time, resilient management of municipal water resources and fast emergency response via 5G
Primary Actor(s)	Municipal authorities, water utility operators, emergency responders, citizens
Goal in Context	Reliable communications for water status monitoring and incident response in a smart CCAM environment
Scope and Level	System-level deployment across the municipality, covering water supply infrastructure and disaster response
Stakeholders & Interests	- City government: Public safety and efficient water management. - Operators: Reliable data & alerts. - Citizens: Fast, secure, and transparent emergency handling.
Preconditions	5G network coverage; Sensor- and IoT-enabled water management infrastructures established
Trigger	Event such as water supply disruption, infrastructure failure, or emergency detected

Section	Description
Main Success Scenario (Basic Flow)	1. Incident detected via sensors. 2. Systems send real-time alerts over 5G. 3. Operators coordinate and respond, using live data feeds. 4. Emergency services dispatched and situation resolved efficiently .
Extensions / Alternative Flows	Communication fallback to legacy networks; Alert delays; Sensor or connectivity failures; Manual notification
Metrics & KPIs	- Incident detection/response time. - Network uptime & latency. - Number of resolved incidents. - Citizen notification reach .
Data Requirements	Sensor data stream (pressure, flow, leak detection), emergency alerts/messages, geolocation, performance logs
Validation Methods	Field testing in live scenarios; KPI tracking & analysis; Stakeholder feedback collection and review
Communication Impact Analysis	Assesses how 5G networks enhance reliability, speed, and coordination during emergencies, minimizing loss and disruption .

4.21 5G Healthcare in Northern Portugal

Section	Description
Title	5G Healthcare in Northern Portugal
Describes the goal or scenario	Deploy 5G to revolutionize healthcare delivery by enabling advanced emergency communications, remote diagnostics, and immersive training .
Primary Actor(s)	Hospital staff, emergency medical teams (ambulances, helicopters), patients, technical solution providers
Goal in Context	Facilitate real-time medical support and remote diagnosis, improve training, and enhance patient recovery via 5G-enabled connected healthcare .
Scope and Level	System-level across hospitals, emergency vehicles, and training environments
Stakeholders & Interests	- Hospital management: Improved efficiency and safety. - Medical teams: Real-time data and support. - Patients: Faster, higher-quality care. - Technology providers: Innovative solutions and validation .
Preconditions	Available 5G SA network in hospitals and emergency vehicles; Trained personnel; Integrated compatible devices
Trigger	Medical emergencies, patient admission, need for remote training or diagnostics
Main Success Scenario (Basic Flow)	1. Emergency detected. 2. Data and video streamed in real-time from ambulance/helicopter to hospital. 3. Remote doctor guides diagnosis or

Section	Description
	procedure. 4. Training uses live video feed. 5. Patient monitored via IoT/AR tools .
Extensions / Alternative Flows	Network fallback to 4G; Manual communication methods; Service disruption; Extended remote support protocols
Metrics & KPIs	- Ambulance/hospital data transfer latency. - Diagnosis/response time. - Training sessions conducted. - Patient recovery rates. - Number of remote consults .
Data Requirements	Medical imaging, live video, patient records, IoT sensor data, training video feeds
Validation Methods	Pilot deployments, KPI tracking, participant feedback, medical outcome analysis, live scenario testing
Communication Impact Analysis	Measures improvement in emergency care speed, diagnostic precision, training quality, and service coverage

4.22 5G SMILE: Smart Mobility and Inclusive Living Environments

Section	Description
Title	5G SMILE: Smart Mobility and Inclusive Living Environments
Describes the goal or scenario	Enable smart public services, advanced mobility, and inclusive living using 5G infrastructure .
Primary Actor(s)	Municipal authorities, citizens (including vulnerable groups), mobility providers, technology vendors
Goal in Context	Foster accessible, safe, and efficient urban environments using 5G for communication, remote services, and data-driven mobility .
Scope and Level	System-level across municipal networks linking public services, transport, and community facilities
Stakeholders & Interests	- Municipal government: Improved inclusion and public service. - Service providers: Optimized delivery. - Citizens: Equal access and quality of life. - Technology vendors: Market validation and innovation .
Preconditions	Urban area equipped with 5G infrastructure; compatible devices; engagement with user representatives
Trigger	Need for community inclusion, innovative mobility, or smart service deployment
Main Success Scenario (Basic Flow)	1. User requests service via device. 2. Service provider receives real-time data. 3. Mobility or living assistance deployed. 4. Status and data monitored live. 5. Feedback collected to improve experience .

Section	Description
Extensions / Alternative Flows	Service interruption due to network failure; fallback to legacy networks; manual operation; delayed assistance
Metrics & KPIs	- Response time to citizen queries. - Service uptime. - Number of assisted citizens. - Inclusion metrics. - User satisfaction rates .
Data Requirements	Mobility usage data, service requests, sensor outputs, social inclusion feedback, real-time device connectivity
Validation Methods	Field pilots; KPI analysis; direct user feedback; impact evaluation; comparative trials of legacy vs. 5G-enabled services
Communication Impact Analysis	Measures how 5G improves inclusion, accessibility, real-time response, and community engagement

4.23 Hi5: High Connectivity via 5G in Toulouse Metropolitan Area

Section	Description
Title	Hi5: High Connectivity via 5G in Toulouse Metropolitan Area
Describes the goal or scenario	Roll out 5G infrastructure in Toulouse by 2025 to deliver advanced, reliable communication for key public and private services .
Primary Actor(s)	Toulouse city authorities, public service providers, local businesses, residents, technology partners
Goal in Context	Enable high-speed, low-latency connectivity for smart mobility, public safety, e-health services, and city administration .
Scope and Level	System-level deployment covering the Toulouse metropolitan area's strategic sectors (mobility, e-health, public services) .
Stakeholders & Interests	- City government: Urban innovation and competitiveness. - Public service providers: Improved service delivery. - Businesses: Economic growth and digital transformation. - Residents: Better access to digital and municipal services .
Preconditions	Commitment from local government and technology partners; 5G infrastructure buildout permission and funding
Trigger	Initiation of smart urban initiatives or demand for innovative public and business services

Section	Description
Main Success Scenario (Basic Flow)	1. Public/private partner deploys 5G. 2. Services (e.g. mobility, healthcare, e-administration) leverage new network. 3. Stakeholders access faster, more reliable and efficient services. 4. Continuous monitoring and feedback to improve operations .
Extensions / Alternative Flows	Delays in network deployment; fallback to legacy networks; partial service enablement; local opposition; technical disruptions
Metrics & KPIs	- 5G coverage and adoption rates. - Service availability and uptime. - User satisfaction. - Economic and social impact indicators. - Number and diversity of 5G-enabled services deployed .
Data Requirements	Connectivity data, mobility/traffic information, e-health records (where relevant/allowed), service usage logs, feedback datasets
Validation Methods	Pilot and beta service launches; KPI monitoring; stakeholder/user surveys; benchmarking legacy vs. 5G outcomes
Communication Impact Analysis	Measures enhancement in efficiency, availability, inclusiveness, and effectiveness of urban and public services powered by resilient 5G connectivity

4.24 Eugenia: 5G Connectivity for Emergency Services in Madrid

Section	Description
Title	Eugenia: 5G Connectivity for Emergency Services in Madrid
Describes the goal or scenario	Equip Madrid's emergency medical services (SAMUR) with 5G connectivity in the tunnels of the M-30 ring road, enabling real-time communications and data transfer during emergency responses .
Primary Actor(s)	SAMUR (Madrid's municipal emergency medical service), city traffic control, emergency responders, technical infrastructure providers
Goal in Context	Ensure resilient, reliable, and high-speed data and communications for emergency teams operating in challenging environments like city tunnels .
Scope and Level	System-level deployment in urban emergency infrastructure, focused on Madrid's M-30 tunnel network
Stakeholders & Interests	- City of Madrid: Public safety and operational efficiency. - SAMUR: Reliable communications and access to medical data. - Citizens: Rapid and effective emergency response. - Technology providers: Solution validation .
Preconditions	5G network coverage in tunnels; compatible devices integrated in emergency vehicles; protocols for data/talk handoff
Trigger	Dispatch of an emergency medical team into a tunnel or area with poor legacy network coverage
Main Success Scenario (Basic Flow)	1. Emergency detected and SAMUR dispatched. 2. Entering tunnel, devices transition to 5G. 3. Data and voice remain connected throughout operation.

Section	Description
	4. Patient info and location continuously updated to control center. 5. Team leaves tunnel, switches back if needed .
Extensions / Alternative Flows	5G signal degradation or failure; fallback to 4G or other legacy networks; possible loss or delay of data transfer; manual data recording
Metrics & KPIs	- Network uptime in tunnels. - Number of incidents covered with uninterrupted communication. - Data transfer rates. - Response time improvements. - User (SAMUR) satisfaction .
Data Requirements	Real-time patient data, location tracking, incident video/audio, operational communications logs
Validation Methods	Live operational trials, feedback from emergency teams, KPI tracking, technical audits
Communication Impact Analysis	Assesses improvements in life-saving response times and efficiency from continuous, high-speed 5G communications in critical urban environments .

4.25 5G Valenciaport: Private 5G Standalone Network for Smart Port Operations

Section	Description
Title	5G Valenciaport: Private 5G Standalone Network for Smart Port Operations
Describes the goal or scenario	Deployment of a private 5G Standalone network in the Port of Valencia to enable digital transformation, advanced connectivity, and operational efficiency for over 25,000 connected devices .
Primary Actor(s)	Port Authority of Valencia, Fundación Valenciaport, port employees, security forces, logistics providers, technology vendors
Goal in Context	Provide secure, reliable, and high-performance network connectivity supporting port police surveillance, remote maintenance, environmental monitoring, and logistics optimization in a port smart ecosystem .
Scope and Level	System-level covering the entire Port of Valencia infrastructure including terminals, vehicles, cameras, sensors, and operational centers
Stakeholders & Interests	- Port Authority: improved safety, efficiency, and sustainability. - Logistics operators: smooth cargo operations. - Security personnel: real-time surveillance. - Technology providers: innovation showcase. - Environment agencies: pollution monitoring .
Preconditions	Spectrum allocation (n40 band), approval and coordination among port and telecom authorities, device readiness
Trigger	Need to enhance port operations with real-time monitoring, automated systems, and secure communications

Section	Description
Main Success Scenario (Basic Flow)	1. 5G network established covering port area. 2. Devices connect (vehicles, cameras, sensors). 3. Real-time data flows for surveillance, maintenance, and logistics. 4. Network supports high throughput, low latency tasks. 5. Operations are optimized and secured .
Extensions / Alternative Flows	Network fallback modes; partial coverage; cybersecurity incidents; communication delays; manual overrides
Metrics & KPIs	- Number of connected devices (>25,000). - Network throughput (up to 10 Gbps). - Latency and uptime. - Incident response times. - Environmental impact measures .
Data Requirements	Surveillance video, sensor data (environmental, mechanical), vehicle tracking, maintenance records
Validation Methods	Pilot tests on police surveillance and remote maintenance use cases; KPI monitoring; stakeholder feedback
Communication Impact Analysis	Significant improvements in operational safety, efficiency, and port sustainability via private 5G network independence and customized security .

4.26 5G SESAMO: Secure, Smart Applications and Services at the Mobile Edge

Section	Description
Title	5G SESAMO: Secure, Smart Applications and Services at the Mobile Edge
Describes the goal or scenario	SESAMO targets innovations around placing network intelligence and applications at the network edge to enable secure, efficient, and flexible 5G services with enhanced performance and reduced latency .
Primary Actor(s)	Network operators, application/service providers, end-users, edge computing resource managers
Goal in Context	Enable deployment of secure and agile 5G applications at the edge of the network to improve user experience, security, and operational efficiency in CCAM and other verticals .
Scope and Level	System and sub-system level focusing on 5G network edge architecture, including security and orchestration mechanisms
Stakeholders & Interests	- Operators: optimized network resource utilization. - Providers: rapid application deployment. - Users: improved service quality and security. - Regulators: compliance and data protection .
Preconditions	Existing 5G infrastructure with edge computing capabilities; secure orchestration frameworks in place
Trigger	Demand for edge-hosted 5G applications and services requiring low latency, security, or customized network behavior

Section	Description
Main Success Scenario (Basic Flow)	1. Application/service deployed at network edge. 2. Orchestrator manages resources securely. 3. User accesses service with minimal latency. 4. Security policies enforced dynamically. 5. Continuous monitoring and adaptation optimize performance .
Extensions / Alternative Flows	Security breach mitigation; edge resource failure and failover to cloud; application migration; orchestration delays
Metrics & KPIs	- Latency reductions. - Security incident rate. - Resource utilization efficiency. - Service availability and QoS compliance .
Data Requirements	Network telemetry, security logs, user data streams, orchestration commands and status reports
Validation Methods	Lab emulations; live field trials; security audits; performance benchmarking
Communication Impact Analysis	Enhances the reliability, security, and responsiveness of 5G applications at the edge, supporting critical CCAM functions and digital transformation .

4.27 5G Rural: Expanding 5G Connectivity to Spain's Rural Areas

Section	Description
Title	5G Rural: Expanding 5G Connectivity to Spain's Rural Areas
Describes the goal or scenario	Deliver standalone 5G networks in rural towns with fewer than 10,000 inhabitants to bridge the digital divide and enable new economic and social opportunities through advanced connectivity.
Primary Actor(s)	Ministry of Economic Affairs and Digital Transformation (MINECO), regional/local governments, telecom operators, rural communities, farmers, public services
Goal in Context	Ensure equitable access to 5G for rural residents and businesses to boost rural economy, digital services, healthcare, agriculture, and public administration.
Scope and Level	System-level deployment covering entire rural municipalities and smaller population centers across Spain
Stakeholders & Interests	- Government: digital cohesion and economic development. - Telecom providers: infrastructure deployment. - Rural communities: access to services and job opportunities. - Agriculture and public sectors: improved operational efficiency.
Preconditions	Allocation of public funding (€544 million+), frequency rights assigned, commitment from operators, baseline infrastructure in place
Trigger	Funding calls and tenders initiated by government to incentivize rural 5G rollout

Section	Description
Main Success Scenario (Basic Flow)	1. Operators deploy 5G standalone sites in targeted rural towns. 2. Devices connect enabling IoT, AR/VR, AI applications. 3. Public sectors implement 5G-enhanced services like healthcare, emergency, waste collection. 4. Economic and social activities improve driven by 5G technology.
Extensions / Alternative Flows	Delays in deployment, technology fallback to 4G, limited device availability, partial geographic coverage
Metrics & KPIs	- Rural population coverage (% reached). - Number of new 5G sites deployed. - Service uptake rates. - Latency and throughput metrics. - Socioeconomic impact indicators.
Data Requirements	Coverage maps, network performance data, application usage metrics, economic impact reports
Validation Methods	Government audits, operator progress reports, field testing of network KPIs, feedback from rural communities
Communication Impact Analysis	Measures improvement in rural connectivity, digital inclusion, and enabled smart services contributing to socioeconomic resilience of rural Spain.

4.28 5G-PHINGE: Flexible and Programmable 5G Network Infrastructure for Industry and Verticals

Section	Description
Title	5G-PHINGE: Flexible and Programmable 5G Network Infrastructure for Industry and Verticals
Describes the goal or scenario	To develop a programmable, dynamic 5G network infrastructure enabling vertical industries to deploy customized network slices and services addressing their specific needs with high flexibility and performance .
Primary Actor(s)	Network operators, vertical industry users (factories, smart cities, smart energy), service developers
Goal in Context	Provide a flexible 5G infrastructure supporting rapid service creation, customization, and orchestration benefiting industries such as manufacturing, energy, and smart urban environments .
Scope and Level	System and subsystem level focusing on network architecture, slicing, and orchestration across 5G infrastructure elements
Stakeholders & Interests	- Operators: efficient network resource use and new revenue sources. - Industry verticals: tailor-made network functionality. - Developers: rapid deployment environment. - End-users: enhanced service quality and performance .
Preconditions	5G infrastructure implemented with support for virtualization and slicing; orchestration tools deployed
Trigger	Demand from vertical sectors for customized, agile, and programmable 5G connectivity and services
Main Success Scenario (Basic Flow)	1. Vertical submits service requirements. 2. Orchestration platform allocates and configures network slices. 3. Service deployed with required QoS and security. 4. Dynamic adjustment responds to changing demands. 5. Continuous monitoring ensures SLA compliance .
Extensions / Alternative Flows	Resource contention; slice reconfiguration; network faults; fallback to common slices or traditional networks
Metrics & KPIs	- Slice creation time. - Resource utilization. - Service latency and throughput. - SLA compliance rate. - Orchestration efficiency .
Data Requirements	Network configuration data, slice usage statistics, service performance logs, QoS parameters
Validation Methods	Simulation and emulation; testbed deployment with vertical partners; KPI monitoring; user feedback

Section	Description
Communication Impact Analysis	Improves 5G service agility and customization critical for industrial verticals, fostering innovation and efficient resource use .

4.29 5G Connect Danube Delta (5G-CDD)

Section	Description
Title	5G Connect Danube Delta (5G-CDD)
Describes the goal or scenario	Establish a 5G Standalone and Edge Cloud communication network across remote and underserved communities in the Danube Delta to improve quality of life, healthcare, education, tourism, and environmental monitoring .
Primary Actor(s)	Local residents, tourists, public authorities, healthcare providers, NGOs, digital infrastructure providers
Goal in Context	Provide high-speed, reliable 5G connectivity enabling advanced telemedicine, digital education, environmental monitoring, and support for local economic and social development .
Scope and Level	System-level deployment in at least 19 localities in the Danube Delta region covering multiple use cases
Stakeholders & Interests	- European Commission and funding bodies: digital inclusion. - Local governments and authorities: improved services. - Residents and tourists: better connectivity and services. - NGOs and environment agencies: enhanced monitoring. - Technology providers: showcase and testbed for rural 5G .
Preconditions	Funding secured, 5G SA network and edge cloud infrastructure prepared, local collaboration established
Trigger	Project launch following funding availability and planning
Main Success Scenario (Basic Flow)	1. 5G infrastructure deployed. 2. Medical devices and educational tools connected to 5G-enabled devices. 3. Telemedicine applications (e.g., Telios Care) operate remotely. 4. Environmental sensors monitor protected areas. 5. Public services and tourism benefit from improved connectivity .
Extensions / Alternative Flows	Infrastructure deployment delays; limited device availability; fallback to 4G technologies; partial area coverage
Metrics & KPIs	- Number of connected users (residents, tourists). - Latency and throughput performance. - Number of telemedicine consultations. - Environmental data volume collected. - Community satisfaction and economic indicators .
Data Requirements	Medical device telemetry, educational content, environmental sensor data, usage logs
Validation Methods	Pilot testing and monitoring, KPI analysis, user and stakeholder feedback

Section	Description
Communication Impact Analysis	Enables digital inclusion and socio-economic uplift through comprehensive 5G coverage and targeted applications in a rural and environmentally sensitive region .

5 Reference List

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