

EU SPACE WEEK 2023

7 - 9 November - Sevilla, Spain

SATCOM – An option for FRMCS

User Consultation Platform: Rail

Ricardo Campo Cascallana



Key Concepts

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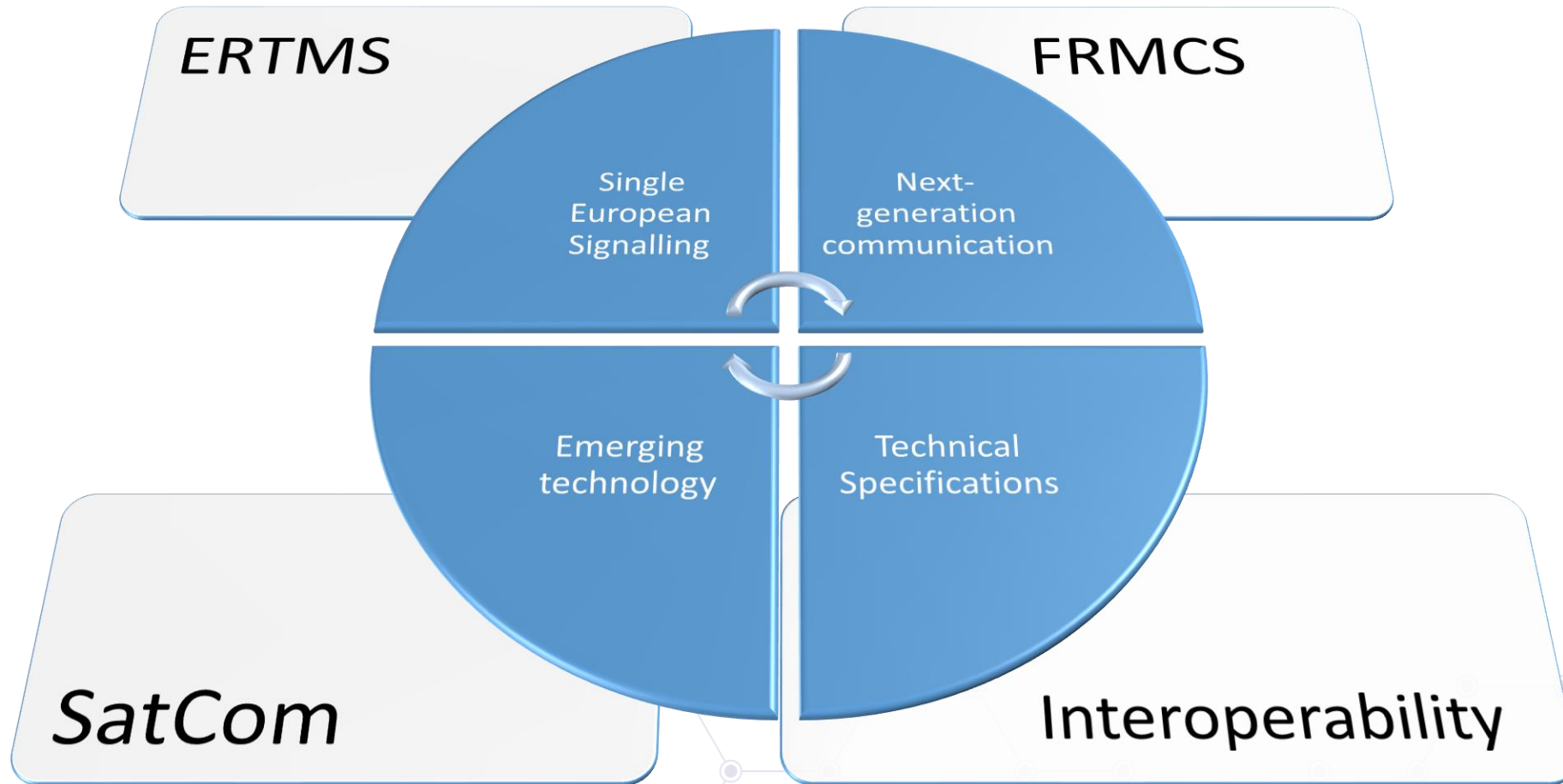
Key concepts of railway modernization, digitalization and interoperability

- **ERTMS:** standardized control, command, and signalling framework
 - ERTMS (European Rail Traffic Management System) is a standard for train signalling and control, enhancing **interoperability** and safety across European railways.
 - ERTMS is set to replace the National Train signalling systems.
- **FRCMS:** modernizing and digitalizing railway communications and operations.
 - FRMCS (Future Railway Mobile Communication System) is the next-generation communication system for railways, ensuring **interoperable**, secure, and high-capacity communication.
 - FRMCS is set to replace the current GSM-R

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Outline

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Why is radio communication crucial for ERTMS Level 2/3?

ERTMS Levels:

- **Level 1:** Uses Eurobalises (trackside beacons) to send spot transmission from track to train.
- **Level 2:** based on **Euroradio** for track to train communication and on Eurobalises as spot transmission devices mainly for location referencing.
 - Train detection and train integrity supervision are performed by the trackside equipment of the underlying signalling system (IXL).
- **Level 3:** based on **Euroradio** for track to train communication and on Eurobalises as spot transmission devices mainly for location referencing.
 - Train location position and train integrity supervision are performed by the trackside radio block centre in co-operation with the train
- **Hybrid Level 3:** based on **Euroradio** for track to train communication and on Eurobalises as spot transmission devices mainly for location referencing.
 - Train detection and train integrity supervision are performed by the trackside equipment of the underlying signalling system (IXL).
 - Supported by train location position and train integrity supervision are performed by the trackside radio block centre in co-operation with the train to increase the capacity of the line.



Why is FRMCS relevant for ERTMS?

FRMCS:

- **GSM-R** standard will reach the end of its life around 2030.
 - i.e. until the migration to the FRMCS has been successfully finalised
- **ERTMS** is a safety critical application
- **ERTMS-Enabled Technologies** demands higher data capacities than GSM-R :
 - ATO: Automatic Train Operation
 - KMS
 - GNSS-based odometry systems
 - Digital Map
 - Digital Twin



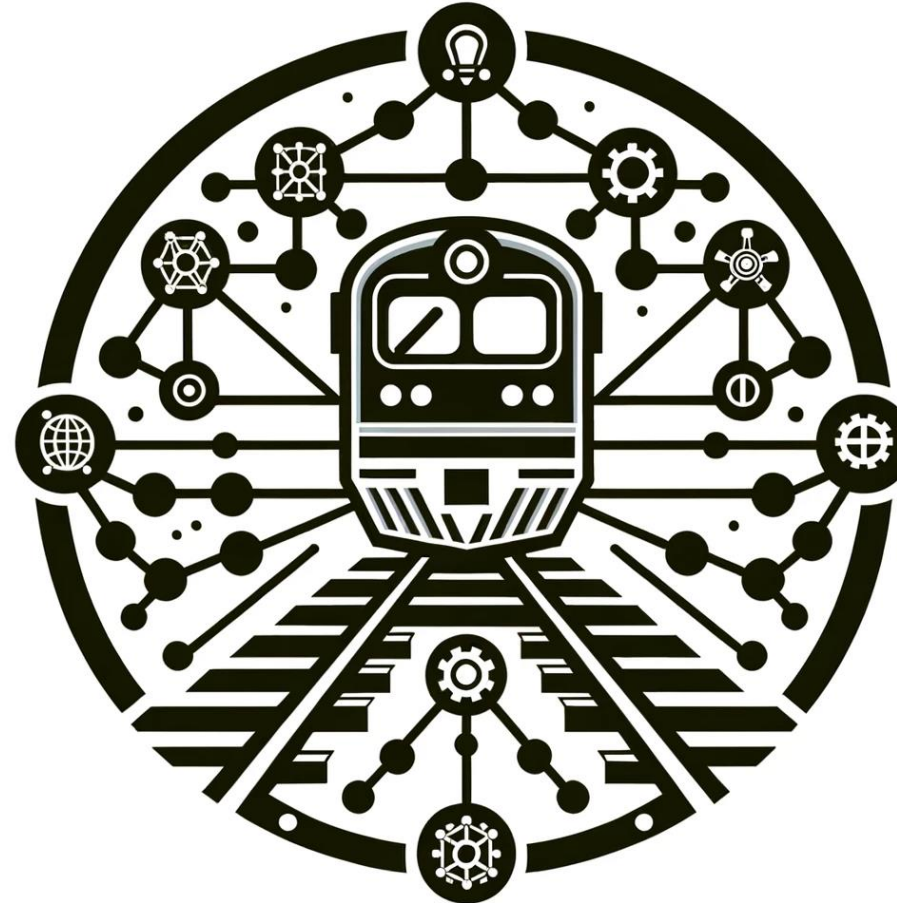
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Role of FRMCS in Railway Applications

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Use cases: safety and non-safety

- Passenger information systems
- Freight Operations
 - Logistics Integration
 - Cargo Monitoring
- Smart Rail Infrastructure
 - Capacity Management
 - Energy Management
 - Maintenance
- Voice communication
- EGNOS –EDAS for Train localization
- Earth Observation and GIS
- Remote Controls & Monitoring
- Emergency communications



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Specification for Interoperability

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Key concept: Interoperability

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- **Interoperability** in the railways refers to the ability of rail systems to work seamlessly across different infrastructure, operations, and rolling stock.
- **Unified** set of Technical Specifications for Interoperability (TSIs) under the **European Railway Agency (ERA)** as European authority.



Technical Specifications for Interoperability
Directive (EU) 2016/797 of the European Parliament and of the Council of 11 May 2016 on the interoperability of the rail system within the European Union

Energy TSI	Infrastructure TSI
Rolling Stock - Locomotives and Passengers TSI	Noise TSI
Rolling Stock - Freight Wagons TSI	Safety in Railway Tunnels TSI
Control Command and Signalling TSI	Persons with Disabilities and with Reduced Mobility TSI
Operation and Traffic Management TSI	Telematics Applications for Passenger service TSI
Telematics Applications for Freight service TSI	

Source: ERA TSIs webpage



- **CCS TSI:**
 - ERTMS will constitute the backbone for a digital, connected Single European Rail Area.
 - FRMCS will establish the infrastructure for a digital, connected rail network as a global data transmission standard.

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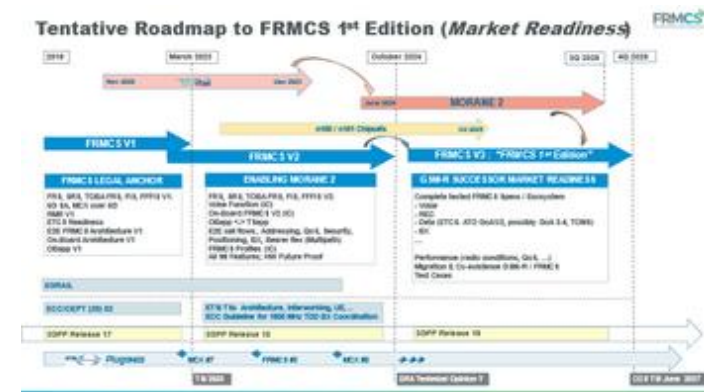
Is it possible to incorporate SatCom into the FRMCS system?

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FRMCS: multi-bearer system

- The integration of SatCom into the FRMCS is **technically feasible** as FRMCS is designed to be a multi-bearer system
- Current expectations within the rail sector:
 - Key stakeholders in the railway industry have a clear preference for utilizing 5G technology in FRMCS up to version 3. 5G's capability to fully address the mission-critical communication needs essential for rail operations to replace GSM-R.
 - **5G MNOs** (Mobile Network Operator) are considered in FRMCS version 3.
- According to the FRMCS roadmap, the potential utilization of **SATCOM** could be considered in **FRMCS Version 4**.

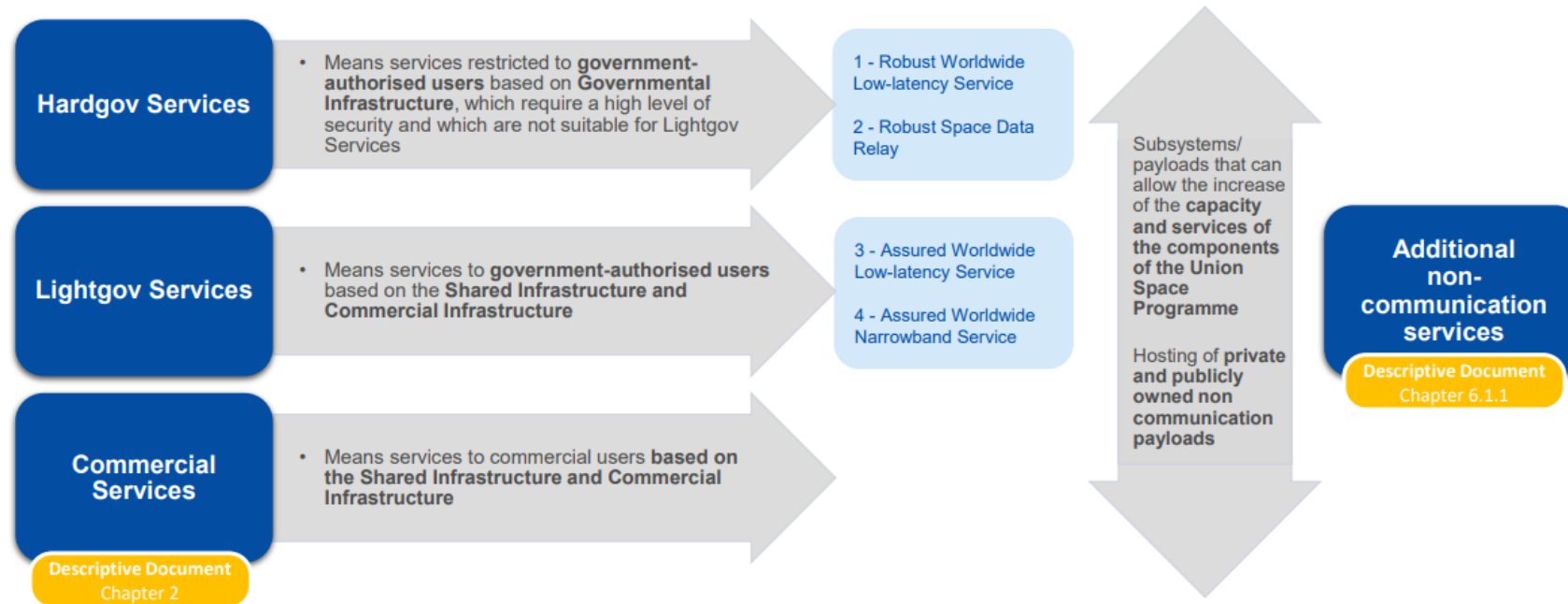


Source: UIC FRMCS Roadmap

Can IRIS2 be a potential candidate to the FRMCS framework?

Services

- The **IRIS²** program, via the provision of Hardgov Services and Lightgov Services, will address the safety-critical mission requirements inherent to railway operations.



Source: IRIS2 Industry Information Day (2023)

- IRIS² is scalable, secure, and can be integrated with the existing FRMCS system.

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Imagine...

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Imagine you are an Infrastructure Manager with the ability to use interoperable MNOs and SatCom within the FRMCS framework.

Accelerating Railway Network Modernization

- **Regional lines:**

- **Cost Savings:** Achieve lower capital expenditures (CAPEX) and operational expenses (OPEX) compared to proprietary FRMCS lines.
- **Rapid Deployment:** Bypass the complexity of setting up proprietary FRMCS networks for a faster start-up time.
- **Reliable Continuity:** Provide robust backup and redundancy for **FRMCS 5G MNOs** (Mobile Network Operators).

- **Future-Ready Scalability:** Enhance current ERTMS with GSM-R systems to support future advancements like ATO, Digital Map, and TCMS.

- **Strategic Key Centralization:** Implement Key Management Centre (KMC) at the national or European level to streamline operations.

Conclusions

- The **railway industry's** robust **support** is essential for integrating SatCom into the FRMCS framework.
- **IRIS²** could potentially be selected as the SatCom technology for the **FRMCS**.
- The integration of SatCom and MNOs in the **FRMCS framework** will enhance modernization and digitalization in railways by capitalizing on the strengths of both systems in the following areas:
 - ERTMS in Regional lines
 - ERTMS-Enabled technologies
 - New safety critical and not safety critical FRMCS applications
- **Safety improvements** in comparison to national signaling systems.



Q&A




Thank you for your attention

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