Key Concepts
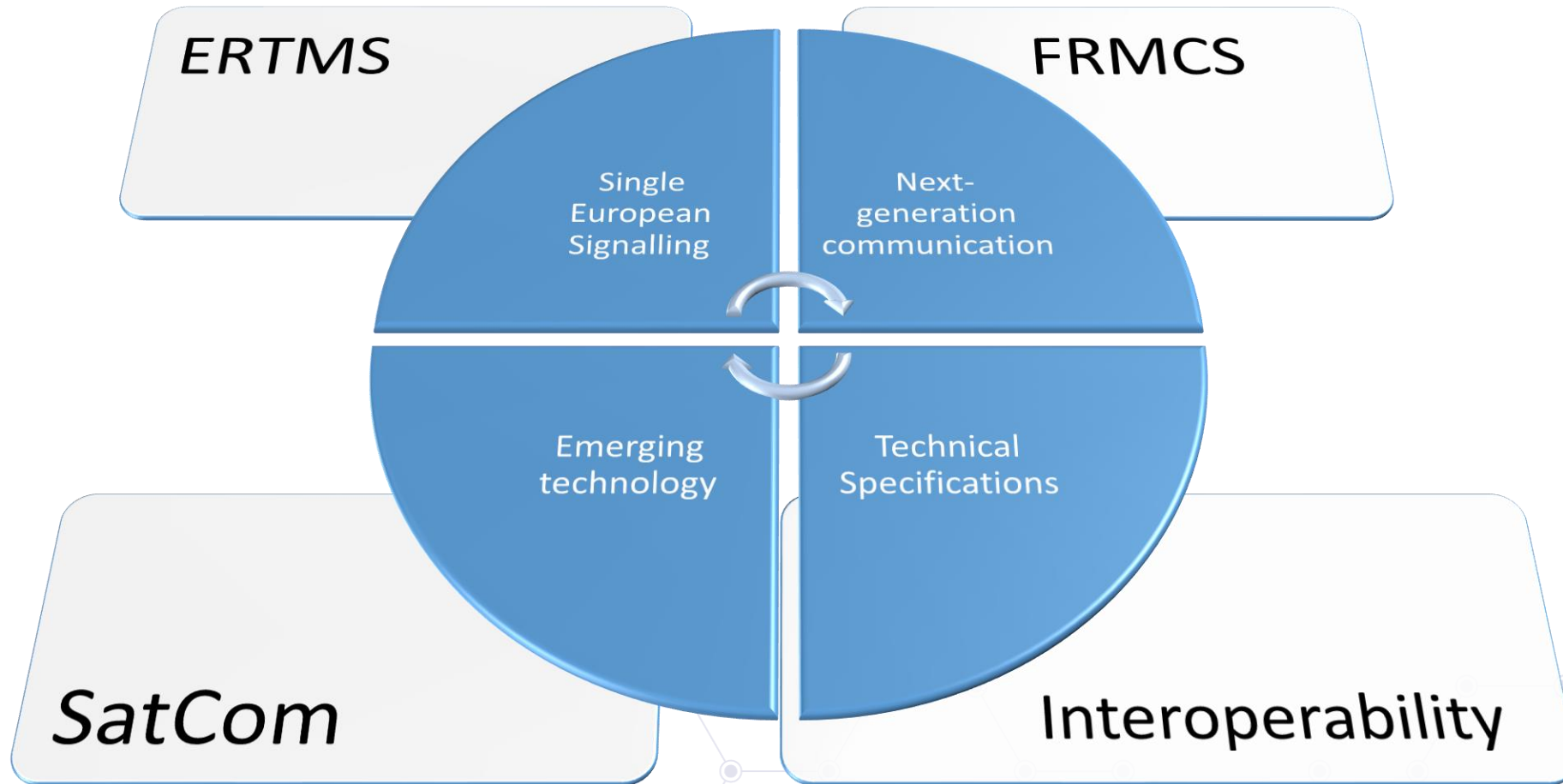
Key concepts of railway modernization, digitalization and interoperability

- ## 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

#EUSpace

Outline

ERTMS

FRMCS

SatCom

Interoperability

Single European Signalling

Next-generation communication

Emerging technology

Technical Specifications

EU SPACE WEEK 2023

#EUSpace

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

#EUSpace

Role of FRMCS in Railway Applications

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
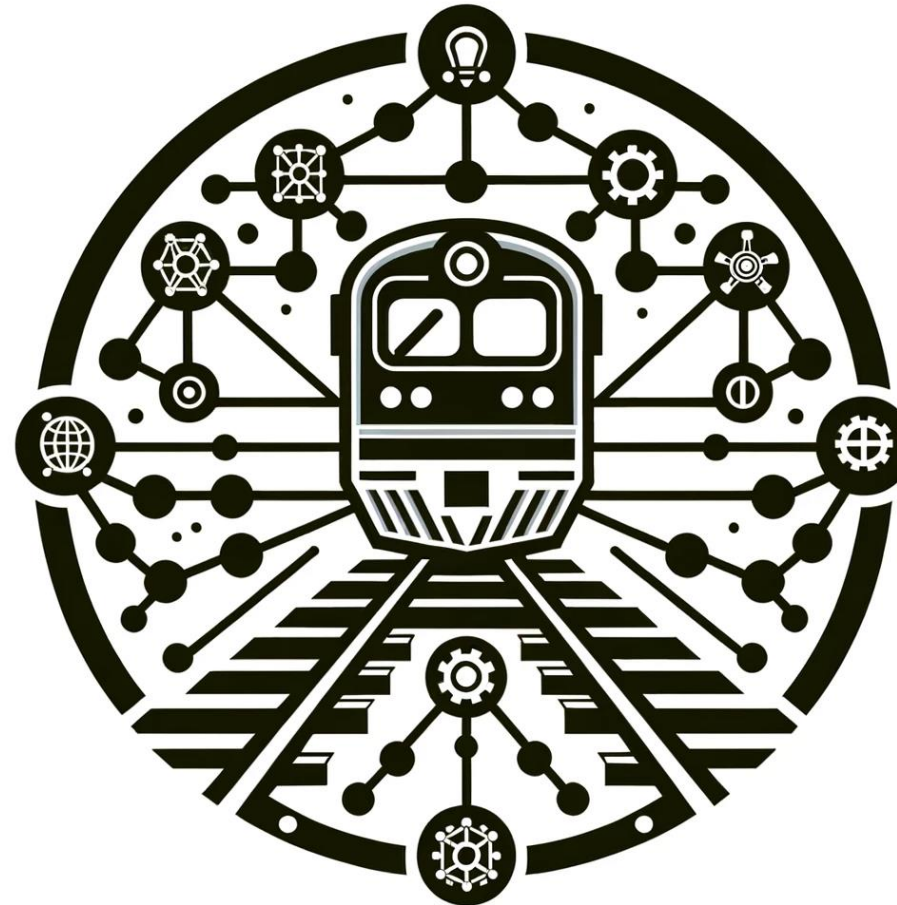
Specification for Interoperability

Key concept: Interoperability

- **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.

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.
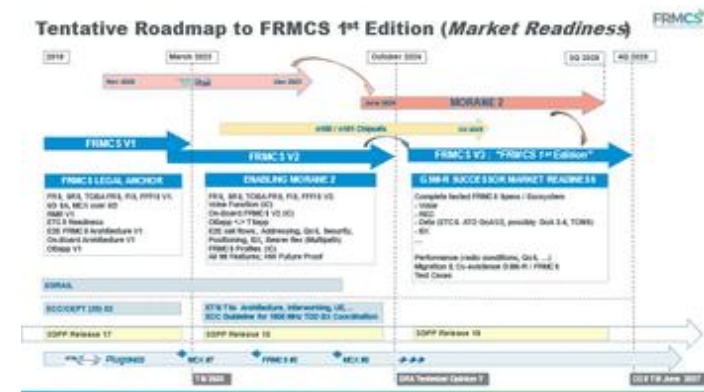
#EUSpace

Is it possible to incorporate SatCom into the FRMCS system?

EU SPACE WEEK 2023

FRMCS: multi-bearer system

- The integration of SatCom into the FRMCS is **technically feasible** as FRMCS <u>is designed to be a multi-bearer system</u>

- **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.

Source: UIC FRMCS Roadmap

- According to the <u>FRMCS roadmap</u>, the potential utilization of **SATCOM** could be considered in FRMCS **Version 4**.

#EUSpace
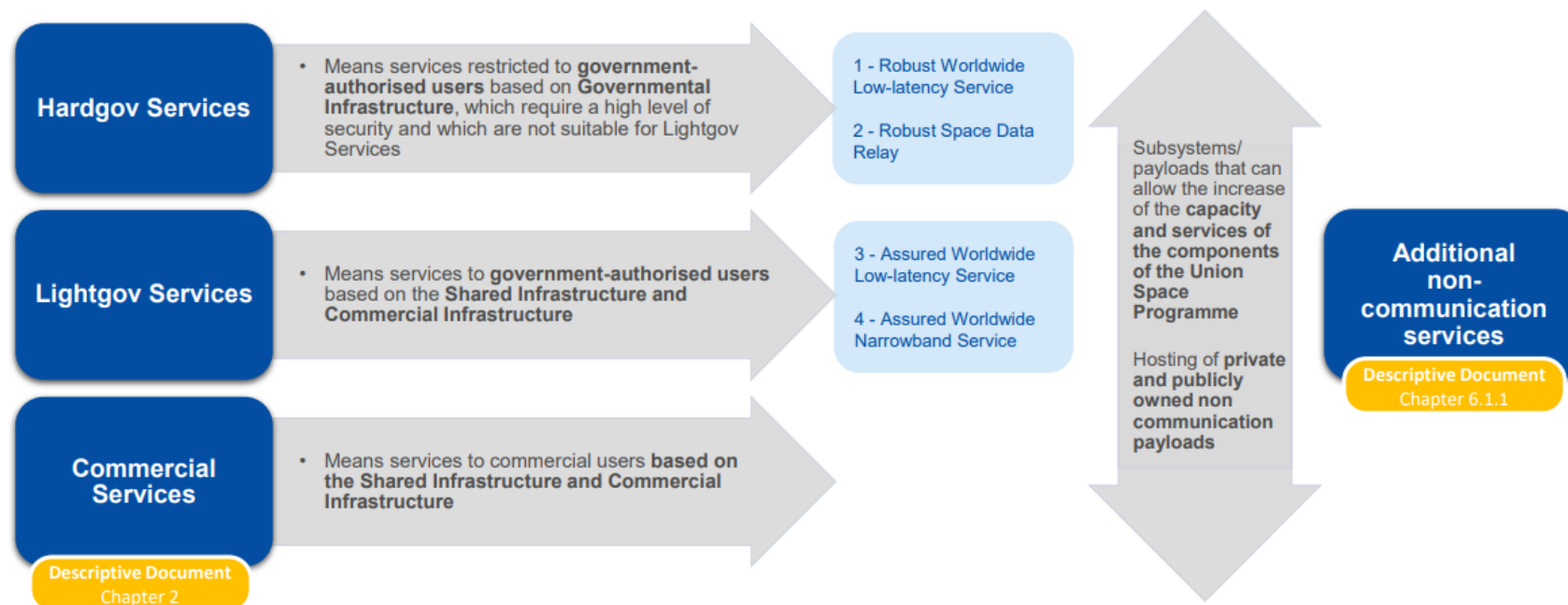
Can IRIS2 be a potential candidate to the FRMCS framework?

Services

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

Source: IRIS2 Industry Information Day (2023)

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

#EUSpace

Imagine...

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.

#EUSpace

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

SATCOM – An option for FRMCS

Ricardo Campo Cascallana

EU SPACE WEEK 2023

#EUSpace

EU SPACE WEEK 2023

www.euspaceweek.eu | #EUSW