



GSM-R

FRMCS
Future Railway Mobile Communication System

KIVI Telecom Mini-seminar Rail Communication

Evolutie van GSM-R naar FRMCS

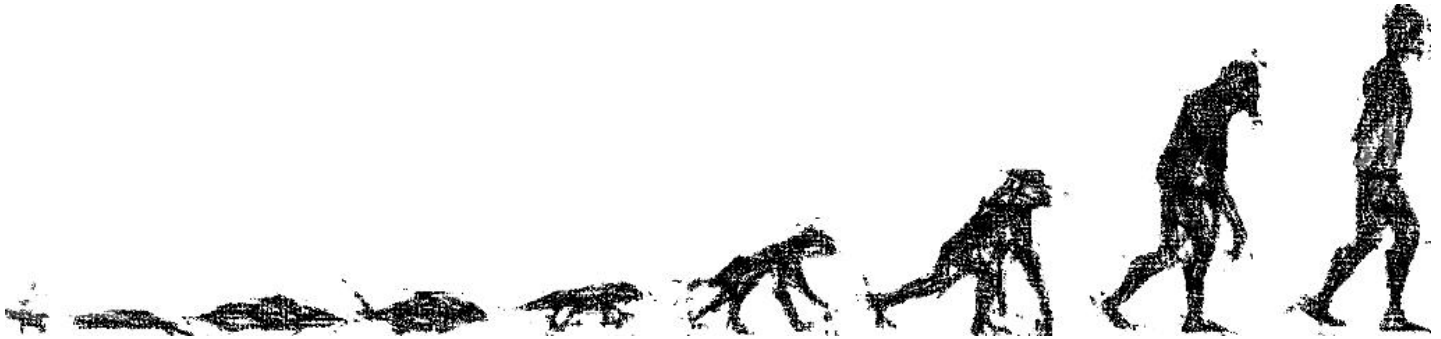
Jos Nooijen, ICT Domeinarchitect, ProRail ICT/.../Mobiële Connectiviteit **11 september 2024**

ProRail

Inhoud

- Evolutie of revolutie (van GSM-R naar FRMCS)
 - FRMCS highlights
 - Standaardisatie (TSI)
 - ETCS en FRMCS; hoe werkt dat samen?
 - Trials EU Rail (FRMCS MORANE 2)
- Wat betekent de migratie naar FRMCS voor een vervoerder?

Evolutie of revolutie?



GSM-R

gsm-r
advanced mobile
communication for railways

5G

FRMCS
Future Railway Mobile Communication System

5G Deployment will improve passenger experience and rail operations

Two key requirement sets defined

Smart Mobility The Gigabit Train

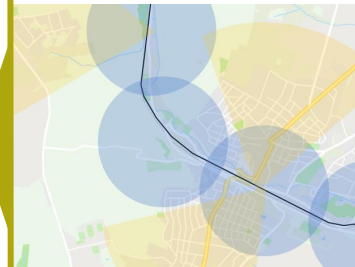


Objectives

Gigabit Train –
Ensuring passenger connectivity like @Home or @Work across borders

Digital rail operations
cross-border including network sharing opportunities

Smart Operations Tracks and Trains



STRATEGIC DEPLOYMENT AGENDA
"5G CONNECTIVITY AND SPECTRUM FOR RAIL"

Update of the SDA of April 20th, 2020, developed by EIM, CER and UIC, with input provided by UNIFE/UNITEL and members of the European Rail industry.

Download SDA 5G Connectivity & Spectrum for Rail (23 August 2024) at <https://eimrail.org/2024/09/03/strategic-deployment-agenda-5g-connectivity-and-spectrum-for-rail/>

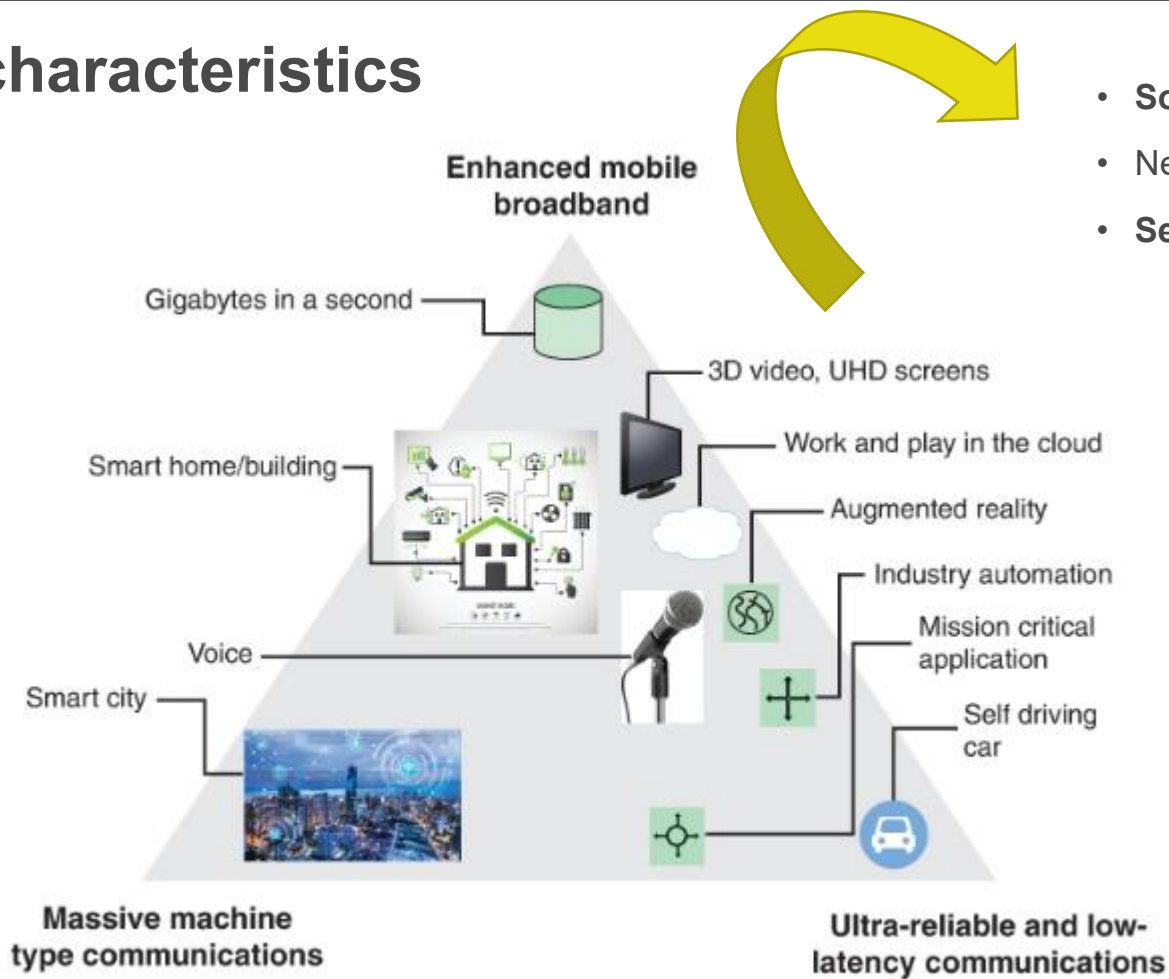
5G en FRMCS

5G functionality



Source: European Commission.

5G characteristics



FRMCS characteristics (1)

- FRMCS is de opvolger van GSM-R voor mission critical mobiele communicatie voor het spoor
- FRMCS is een internationale spoorwegstandaard (TSI 2023 → TSI 2027)
- Verplicht volgens TSI: FRMCS verzorgt connectiviteitsdiensten voor:
 - ETCS (European Train Control System)
 - ATO (Automatic Train Operation)
 - Spraakcommunicatie tussen machinist en treindienstleider
 - REC (Railway Emergency Call)
- Niet verplicht volgens TSI: Overige applicaties (bijvoorbeeld voor telemetrie, monitoring en diensten operationele processen) → meer dan 50 use cases

FRMCS characteristics (2)

- FRMCS is gebaseerd op de 5G standaard (GSM-R = 2G)
- FRMCS heeft spoorwegspecifieke extra's:
 - Mission critical features (MCX framework)
 - Spoor specifieke frequenties: 900 MHz band en 1900 Mhz band (RMR*)
 - Treinen kunnen verbinding maken via RMR *en* publieke mobiele netwerken** (hybride en parallelle operatie)
 - Mogelijkheden voor FRMCS-as-a-service middels virtualisatie in publieke mobiele netwerken (“slicing”)

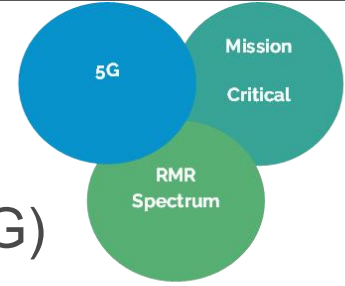


Figure 1: FRMCS 5G High-Level Components
(source UIC)

*RMR= Railway Mobile Radio (= GSM-R + FRMCS)

**Publieke mobiele netwerken: Odido, KPN, Vodafone



- ETSI specifications for Railways (RT group)



3GPP specifications



Trials



UGFA

- Spectrum matters

Functional WG

- User Requirements Specification
- Functional Requirements Specification

Architecture & Technology WG

- System Requirements Specification
- Architecture
- Interfaces

TOBA WG (Train)

- Functional Requirements Specification
- System Requirements Specification



Technical Specifications for Interoperability (TSI)



ERTMS



Spectrum decisions



Railway Undertakings



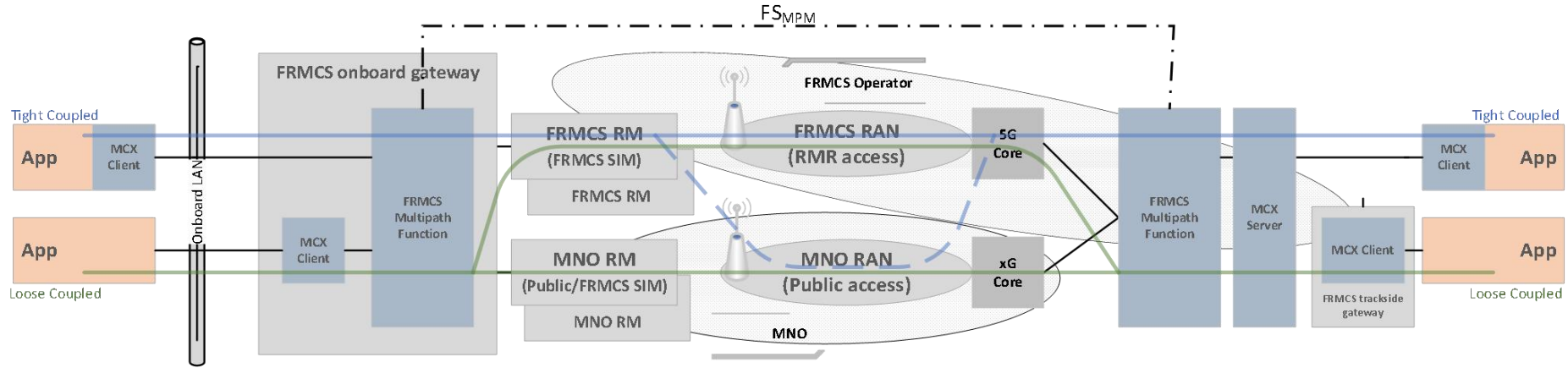
Infra Managers



ETCS en FRMCS

Hoe werkt dat samen?

FRMCS Multipath for ETCS and ATO (example)



FRMCS Multipath technology

- MPTCP and/or MPQuiC (IETF standards)

Data path options:

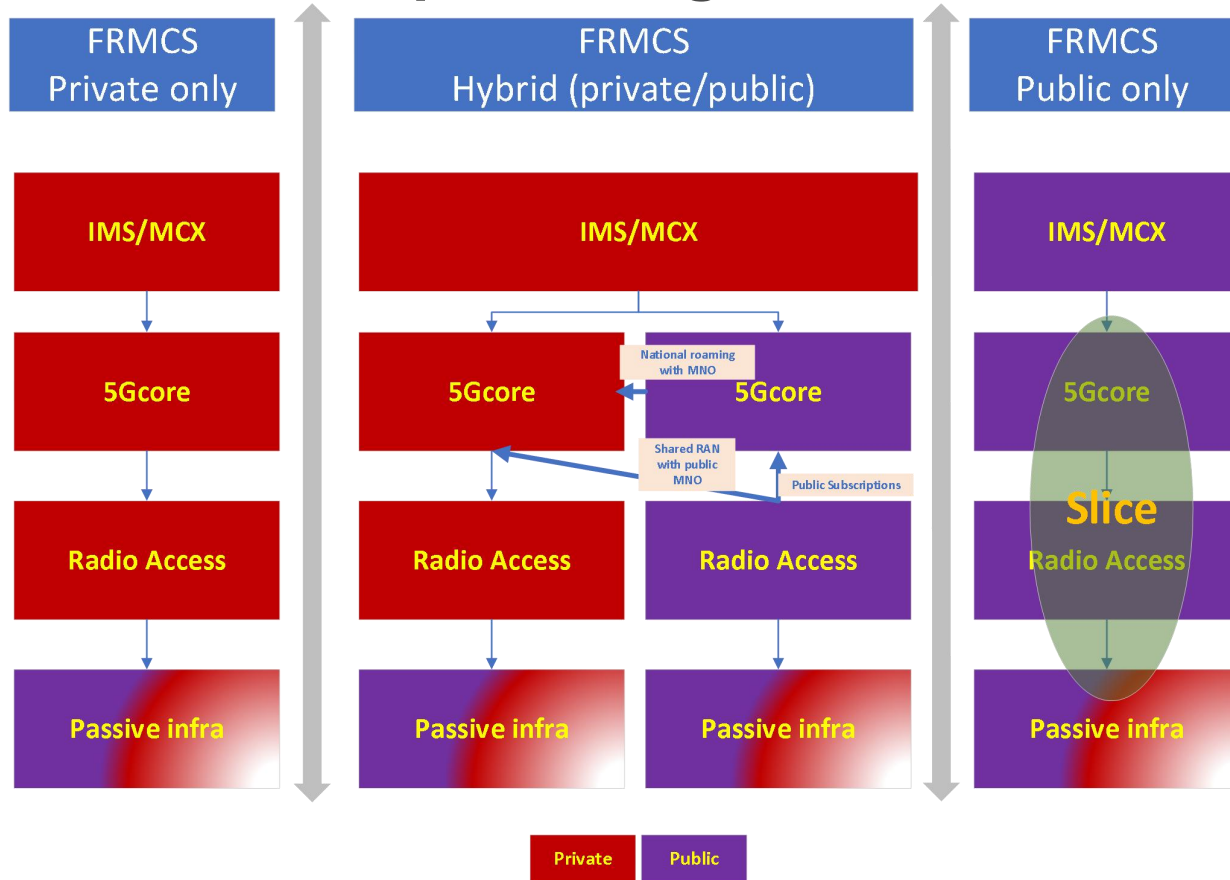
- Data paths via MNO (public subscription)
- MOCN (shared RAN with MNO) or national roaming (RMR and MNO)

Use cases

- Fallback (RMR + MNO)
- Resilience through best path selection (best of RMR and MNO)
- Resilience through packet duplication (RMR and MNO simultaneously)
- Coverage extension
- Application specific path selection
- (Capacity extension)

FRMCS migration models infra

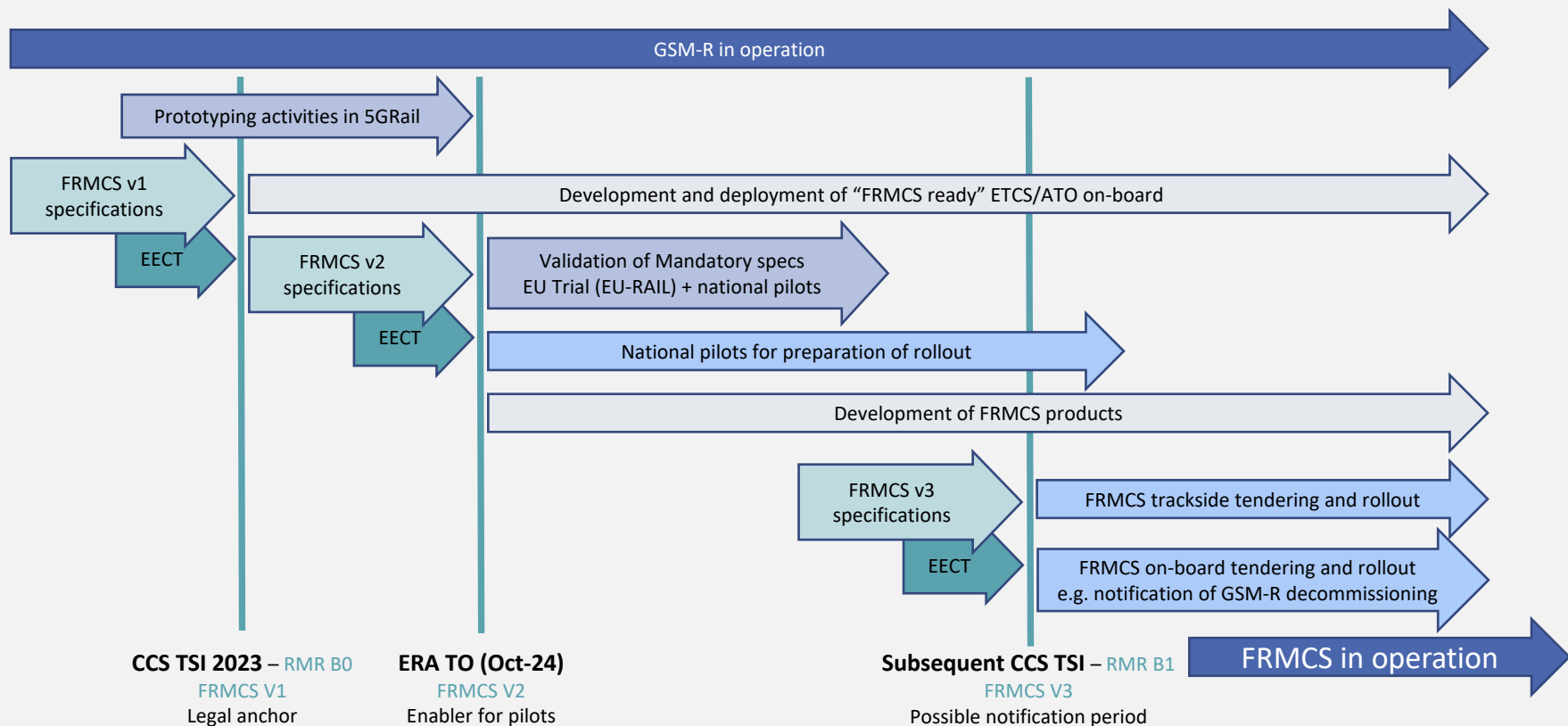
Hybrid model most promising



FRMCS in Nederland (getting started)

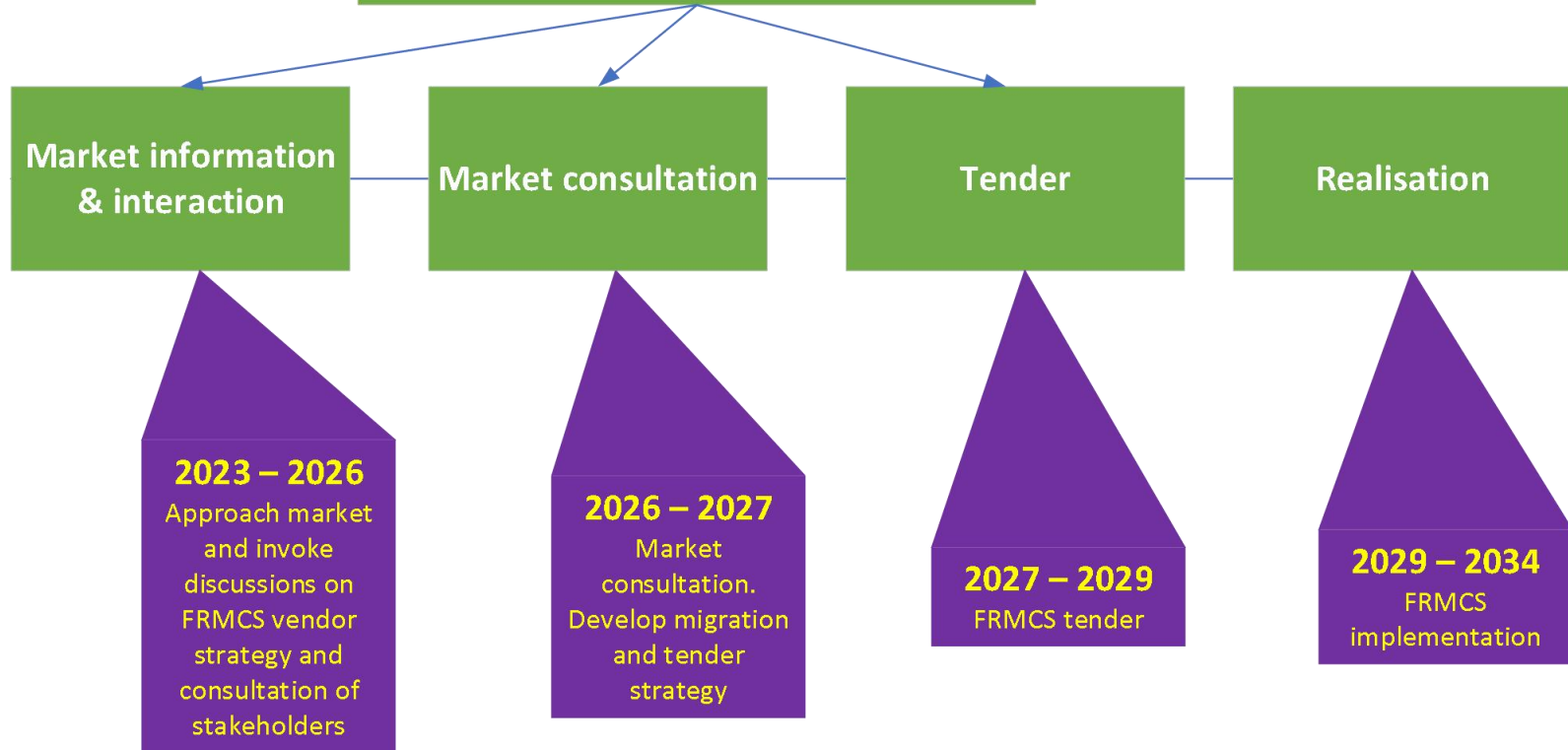
FRMCS planning en migratie

FRMCS v2/3 Timeline



FRMCS planning (ProRail draft proposal)

- 5GiRa (CEF2 digital (FRMCS + Gigabit train))
- FRMCS trial **MORANE 2**
- Hybrid operation (MNO + RMR1900)
- Arnhem - Grens



Forecast

GSM-R end of Life

FRMCS Deployment

Based on Member States
answers @RISC#95 (July 2022)

*EC contacts with suppliers
suggest GSM-R maintenance
dates are unrealistically long!*

