



# Commission view on the future rail radio system

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**Valenciennes, 16/10/2019**



@Transport\_EU

Mobility and  
Transport

**CONNECTING  
EUROPE**

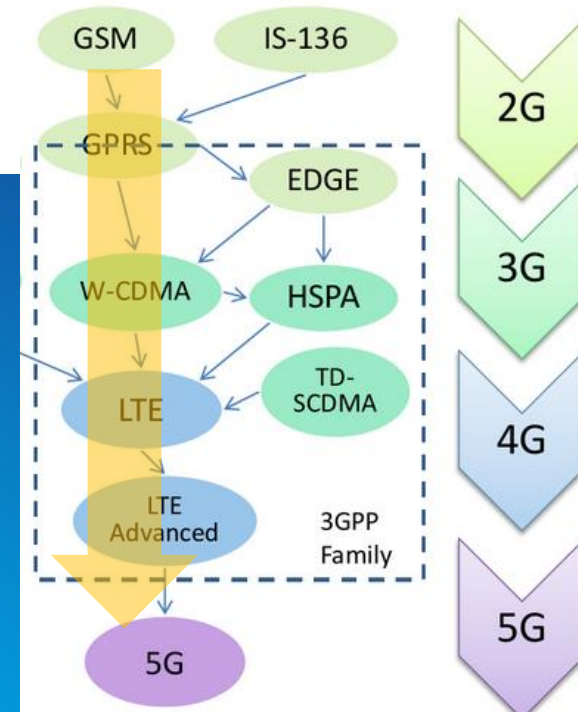


# FRMCS

- **Technology**
- **Governance**
- **Spectrum**
- **Boundary conditions**
- **Roadmap**

# Technology

- Readiness to engage on 5G
- Release 16->...
- New functions being introduced



Service requirements for cyber-physical control applications in vertical domains

Service requirements for Video, Imaging and Audio for Professional Applications (VIAPA)

Mission Critical (MC) services common requirements

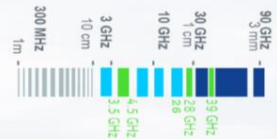
- Spectrum slots **Constraints** (min 5 MHz) vs. **Opportunities** (network slicing with LoS) to be deepened – NB: *Video? GoA 3 / 4 uptake?*



European Commission

# 5G4Rail (Nokia)

## A variety of spectrum bands\*



\* However, European ER GSM band support missing, concepts under evaluation

## Highest Reliability & Availability

- From 99.9% to 99.99999%
- Redundant path
- Stateful virtualization / cloud core concepts

## Multi Access

- 3GPP and non 3GPP simultaneously
- 4G, 5G, WiFi, Satellite
- Smooth migration (4G->5G)



## Mission Critical Communication Application

- Independent on bearer
- 4G and 5G support for QoS
- Application integration

## Distributed flexible architecture

- Centralized and distributed
- Distribute for low latency



## Security & QoS

- Flexible flow based QoS
- Separate critical from non critical data - guaranteed
- Comprehensive security solution end to end

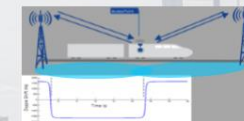
## Slicing

- Slices in dedicated networks
- Sharing with public operator (non mission critical)



## High Speed

- Managing Doppler Effects
- > 500 km/h





# Governance

ECC - Spectrum policy and studies

UIC with the sector:  
FRMCS functional requirements -  
critical and non-critical applications -  
> CCS TSI & radio spectrum)

ETSI -  
Standardisation  
(Tech standards as EIRENE for GSM-R);  
cooperation with 3GPP

European Commission:  
EU Policies: Transport-Rail, Telecom- spectrum and tech (5G Action plan),  
Industrial policy (standards)  
Technical/Regulation: Defines & adopts (CCS) TSIs , Mandates standards,  
reference to harmonised standards

ERA - System Authority  
for ERTMS (ETCS+GSM-R)  
Current and future TSI  
implementation

S2R - TD 2.1 - Adaptable  
train-to-ground  
communications system:  
i.e.: a bearer independent  
On-Board system

## (Radio) Spectrum

- 2 x 5.6 MHz at 900 MHz – used by GSM-R (« white spaces » ? Final target? Else?)
- 10 MHz at 1900 MHz (free)
- Other harmonised solutions?...



## Spectrum - Alternative models

- **DK:** MNOs with SLA -> QoS required? Liabilities?
- **FI:** Critical applications sharing lower band -> priorities? Legal arrangements? Could 5G simplify it?

*These models have **currently** low support from Rail community for essential requirements.*

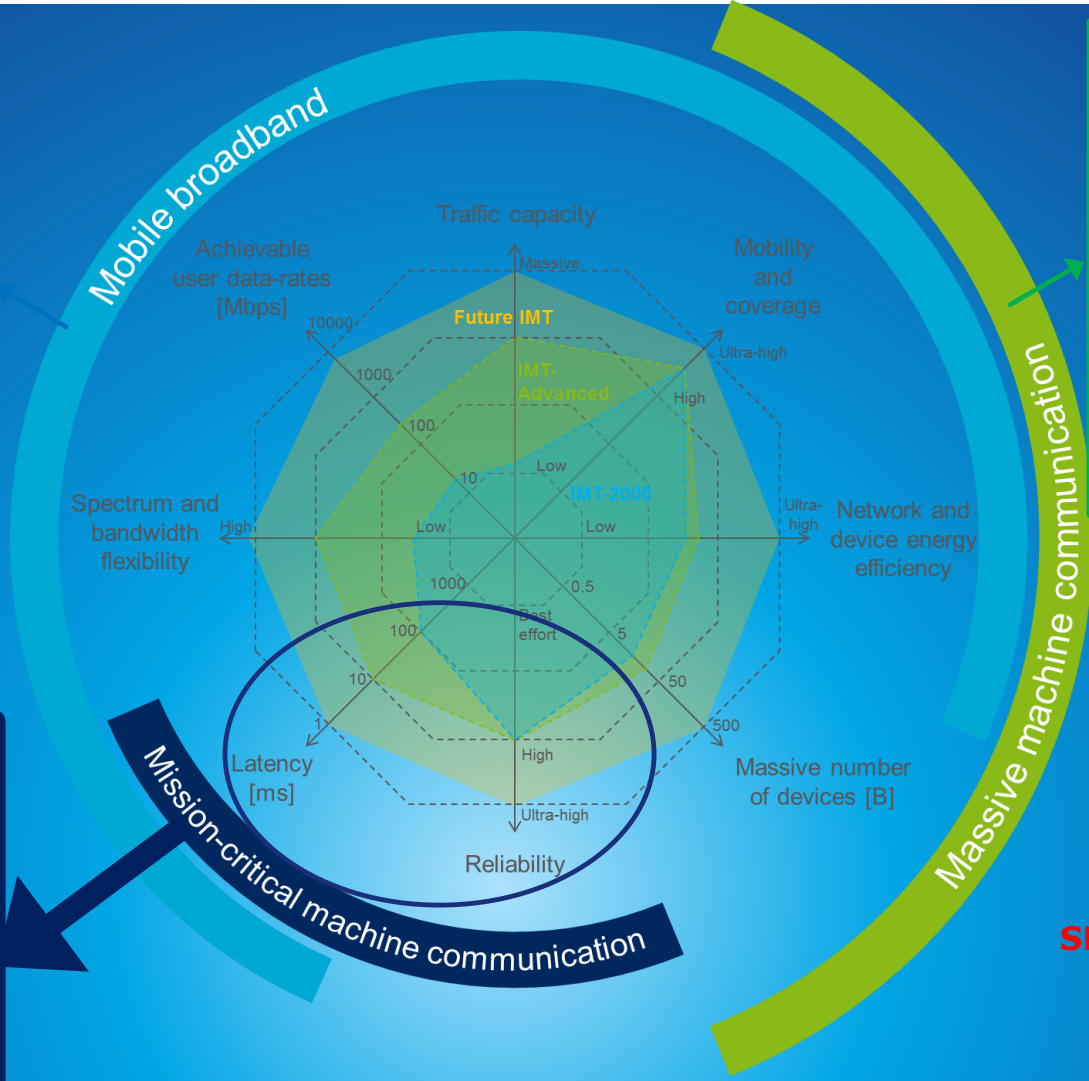
# Spectrum

**Gb/s capacity =  
Technology x  
Spectrum x Re-use**

→ **Beamforming**  
→ **Small cells**  
**! mm-wave bandwidth**  
**! Flexible licensing**

**Mission-critical =  
low latency, ultra-  
high reliability**

→ **mobile edge  
computing**  
**! Sub-1GHz**  
**! Exclusive  
licensing**



**Massive = high  
number/density  
of devices**

**! Mobile &  
dedicated bands**  
**! Narrowband**  
**! Shared  
spectrum use**

**EU LEVEL:  
SPECTRUM MIX  
COVERAGE  
CRITERIA  
PER-SERVICE  
COORDINATION;**





## Boundary conditions

A **massive** investment has taken place for GSM-R, Track Side & On-Board; coverage: 50% (goal: **100%**: +~130.000 km?)

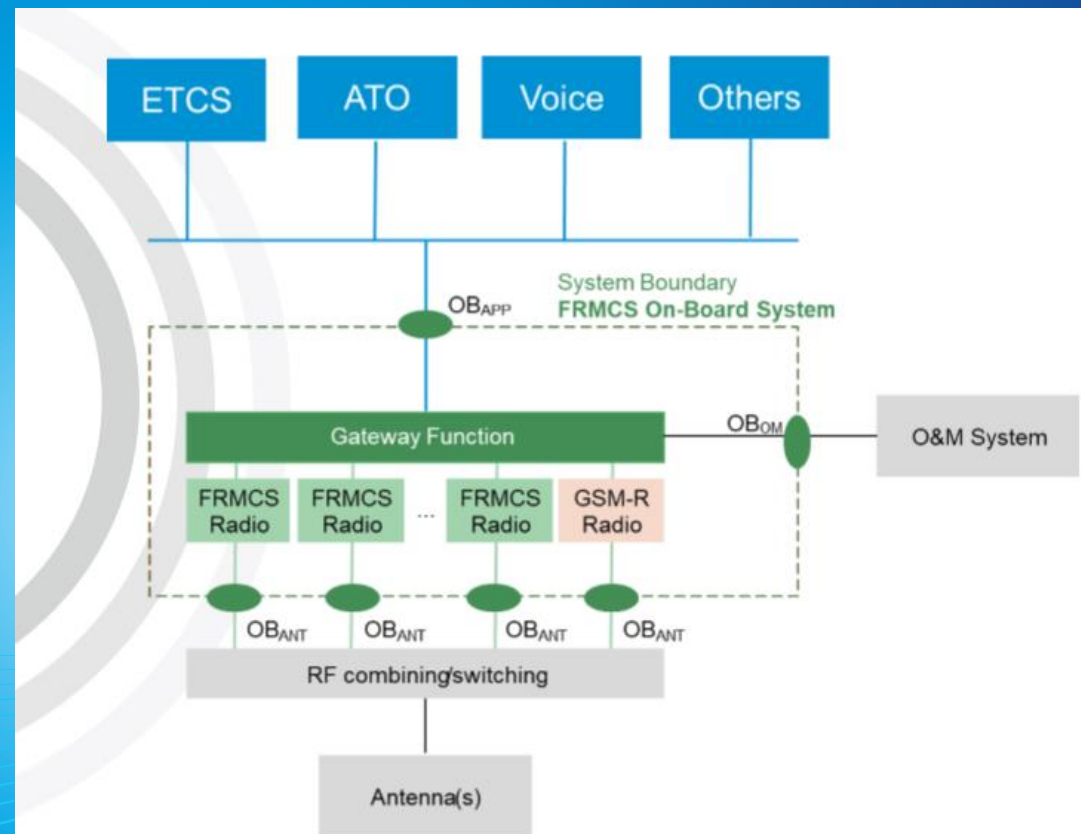
- How to protect **Track-side** investments?
- How to ensure **Baseline 3 OB** will run unimpeded (key EC objective)?
- How to stay as close as possible to standard, COTS solutions (**no** spectrum fragmentation **nor** tailored-made solutions for rail)?

## Boundary conditions

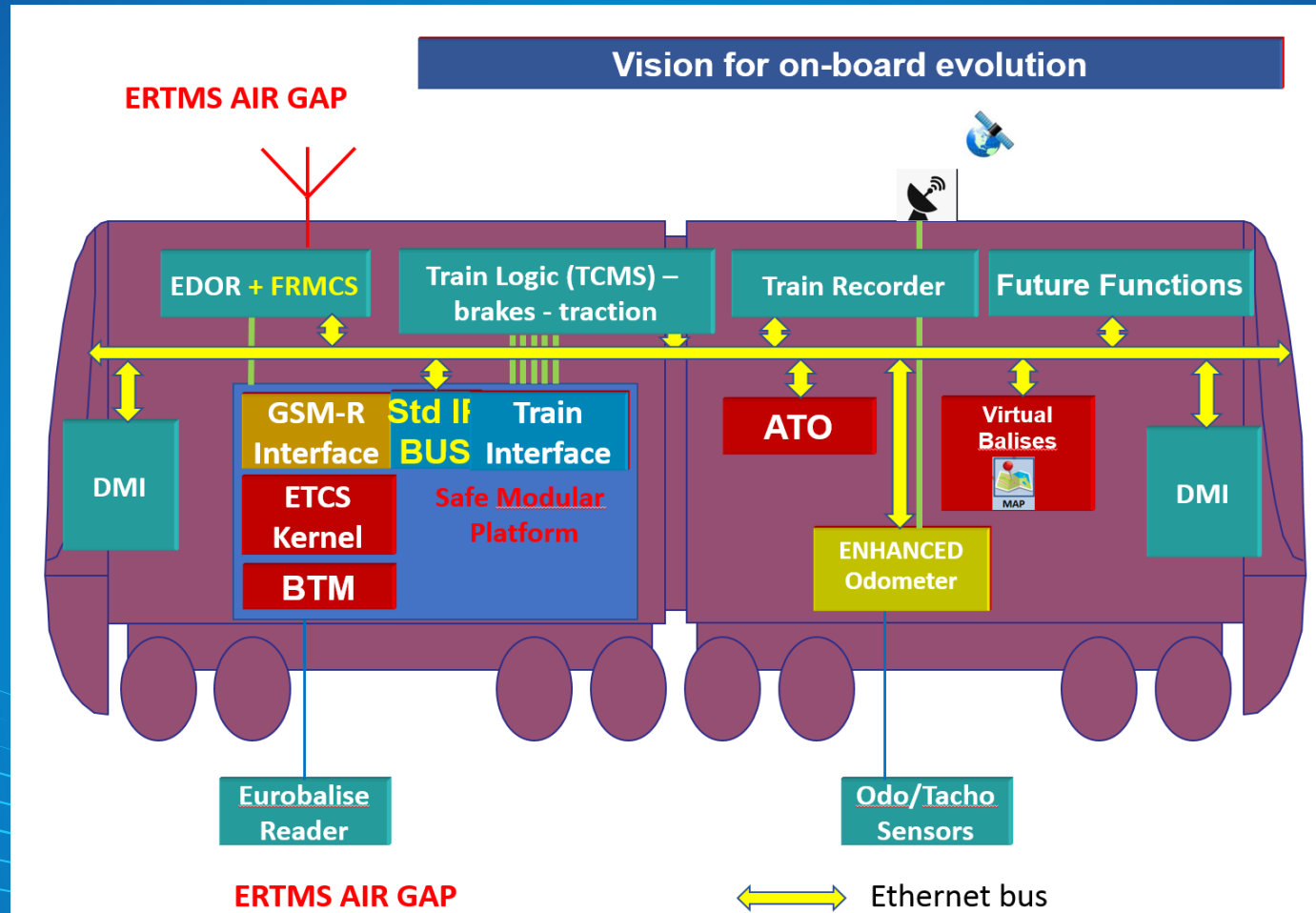
The sector is working on the (Radio) system architecture – TOBA group

- train integrity
- ATO
- ...(game changers) to be encompassed)

ETSI is working on setting a solution  
TR 103 459 OB part

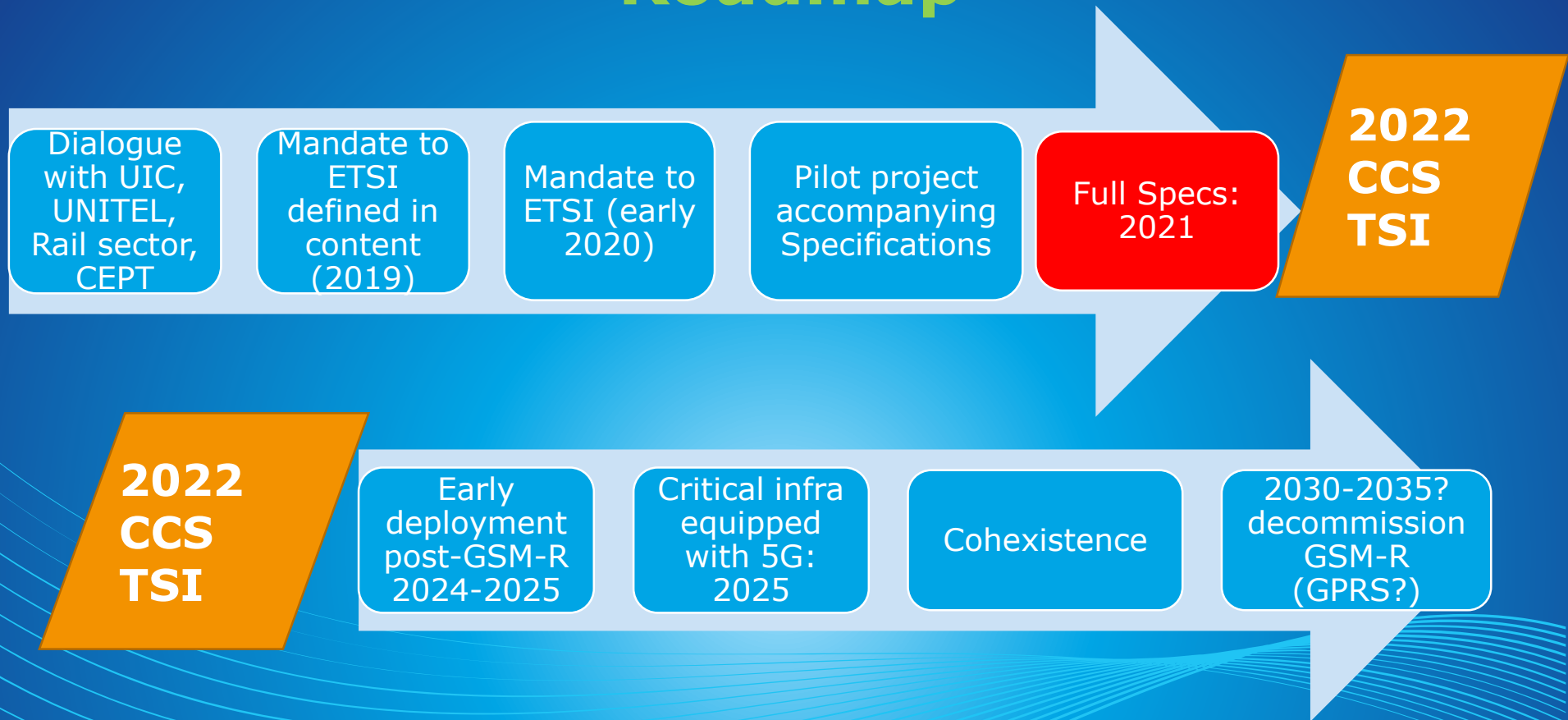


# ...to be fitted into an overall On-board architecture (up to → FFFIS)





# Roadmap





## Roadmap - next steps

- EC & ERA -> standardisation mandate for ETSI
- consultations with RISC, written procedure -> full mandate by 2020
- 2021-2022 outcome
- 2023-2024 development of technological products?
- In parallel: **testing, architecture** (new / retrofit)



**Thanks for your attention**

