

Comunicações Móveis Ferroviárias: Presente e Futuro

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Agenda

Railways Services Systems	01
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Current Radio Solutions for Railways Transport	05
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Performance & Reliability

Continuity of service

Optimised Infrastructure

Cost efficiency

Safe & Seamless Deployment

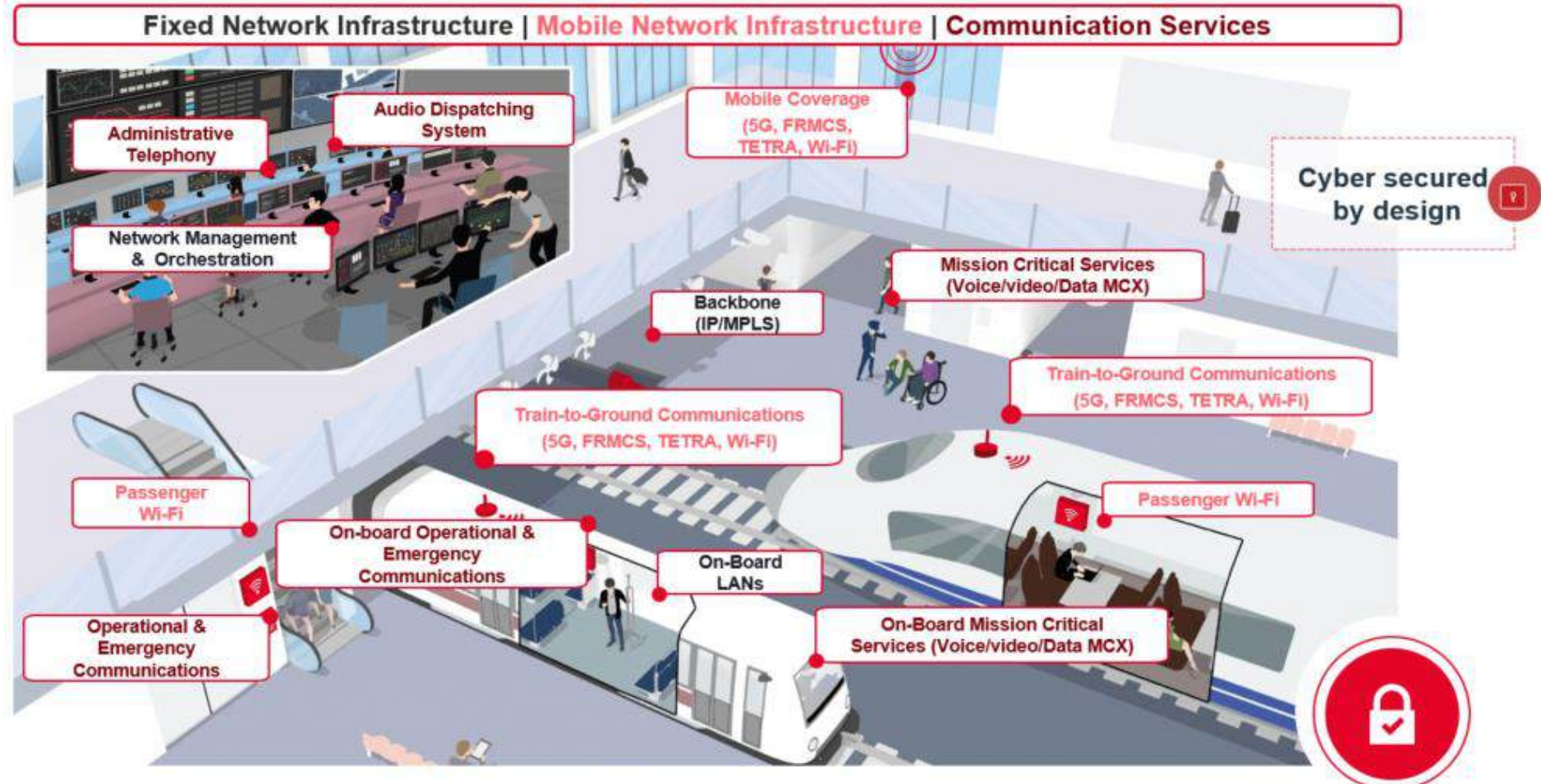
Extensive operational experience

End-to-end Cybersecurity

By design



Design, qualification and implementation of end-to-end telecommunications solutions for railway operations.



Onboard Railways Services Systems

Passenger Information System, Public Address System



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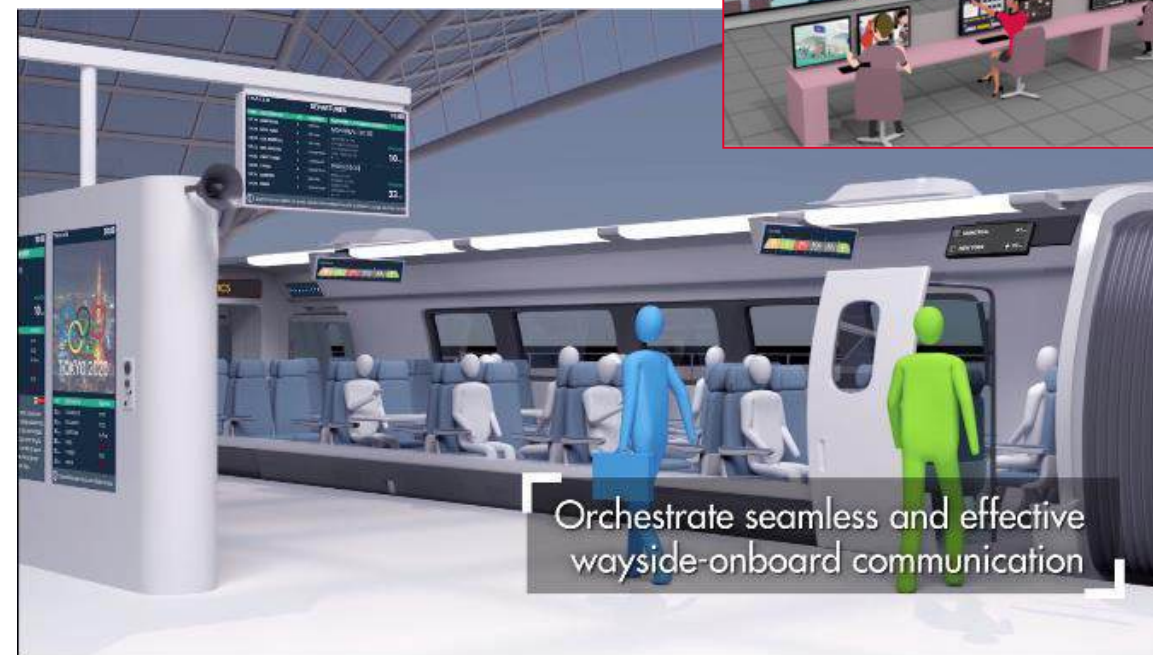
Station and Onboard **PIS (visual)** can provide:

- train schedule,
- general operation information to the Passengers and
- Generic infotainment



Station and Onboard **PAS (audio)** can provide:

- train schedule, and
- general operation information to the Passengers



Onboard Railways Services Systems – Passenger Information



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Onboard Railways Services Systems – Passenger Information



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☀ 25°C Wen 08 May 20:15

DIRECTION MINUTES

Al Wakra	10
Hamad Airport	15
Al Wakra	20

Passengers are reminded not to leave their belongings unattended

Infraestruturas de Portugal 15:09

PARTIDAS - DEPARTURES

HORA	DESTINO	LN	COMBOIO	OBSERVAÇÕES
15:15	CAÍDE	1	REGI 4007	LIGAÇÃO AO PINHÃO
15:16	PORTO-SÃO BENTO	4	SUBU 15824	
15:21	PORTO-SÃO BENTO	5	SUBU 15632	
15:35	CAÍDE	1	SUBU 15533	
15:45	PORTO-SÃO BENTO	2	SUBU 15232	
15:50	BRAGA	1	SUBU 15228	
15:55	OVAR	4	SUBU 15830	
15:56	PORTO-SÃO BENTO	2	SUBU 15420	
16:05	PENAFIEL	1	SUBU 15415	

Mensagem

☀ 25°C Wen 18 May 18:30

This station is **Msheireb**

Change here for

Passengers are reminded not to leave their belongings unattended

☀ 25°C Wen 08 May 20:15

This train is for Lusail

The next station is **Al Bidda**

Passengers are reminded not to leave their belongings unattended

Infraestruturas de Portugal 15:07

CHEGADAS - ARRIVALS

HORA	ORIGEM	LN	COMBOIO	OBSERVAÇÕES
15:11	OVAR	4	SUBU 15824	
15:14	PORTO-SÃO BENTO	1	REGI 4007	LIGAÇÃO AO PINHÃO
15:16	AVEIRO	5	SUBU 15632	
15:31	OVAR	4	SUBU 15827	
15:34	PORTO-SÃO BENTO	1	SUBU 15533	
15:44	BRAGA	2	SUBU 15232	
15:49	PORTO-SÃO BENTO	1	SUBU 15229	
15:55	PENAFIEL	2	SUBU 15420	
16:00	PORTO-SÃO BENTO	7	SUBU 15738	

Mensagem

☀ 25°C Wen 18 May 18:30

This station is **Hamad Airport**

Passengers are reminded not to leave their belongings unattended



To Greenwich
S01

2 min

Train Crowding

Subsequent Train: 4 min

BUS INFORMATION

Bus number 1	10 mins
Bus number 2	3 mins
Bus number 3	1 min
Bus number 4	Arrived
Bus number 5	2 mins

NEXT TRAINS

G08 Line 1 to G08
Next Train 12 mins

B06 Line 1 to GB06
Next Train 34 mins

23:59:59 18° Taipei, Taiwan Lorem ipsum dolor sit amet, consectetur adipiscing elit. Pellentesque tellus purus

Onboard Railways Services Systems – CCTV



CCTV Onboard Cameras



Video analytics can be used to detect violent events



CCTV Onboard Screens



Onboard Railways Services Systems – Internet Access & Passenger Advertisement



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Internet Access



Onboard Passenger Information and Advertisement



Onboard Information and Advertisement



ECS Emergency Call System



Cab Radio



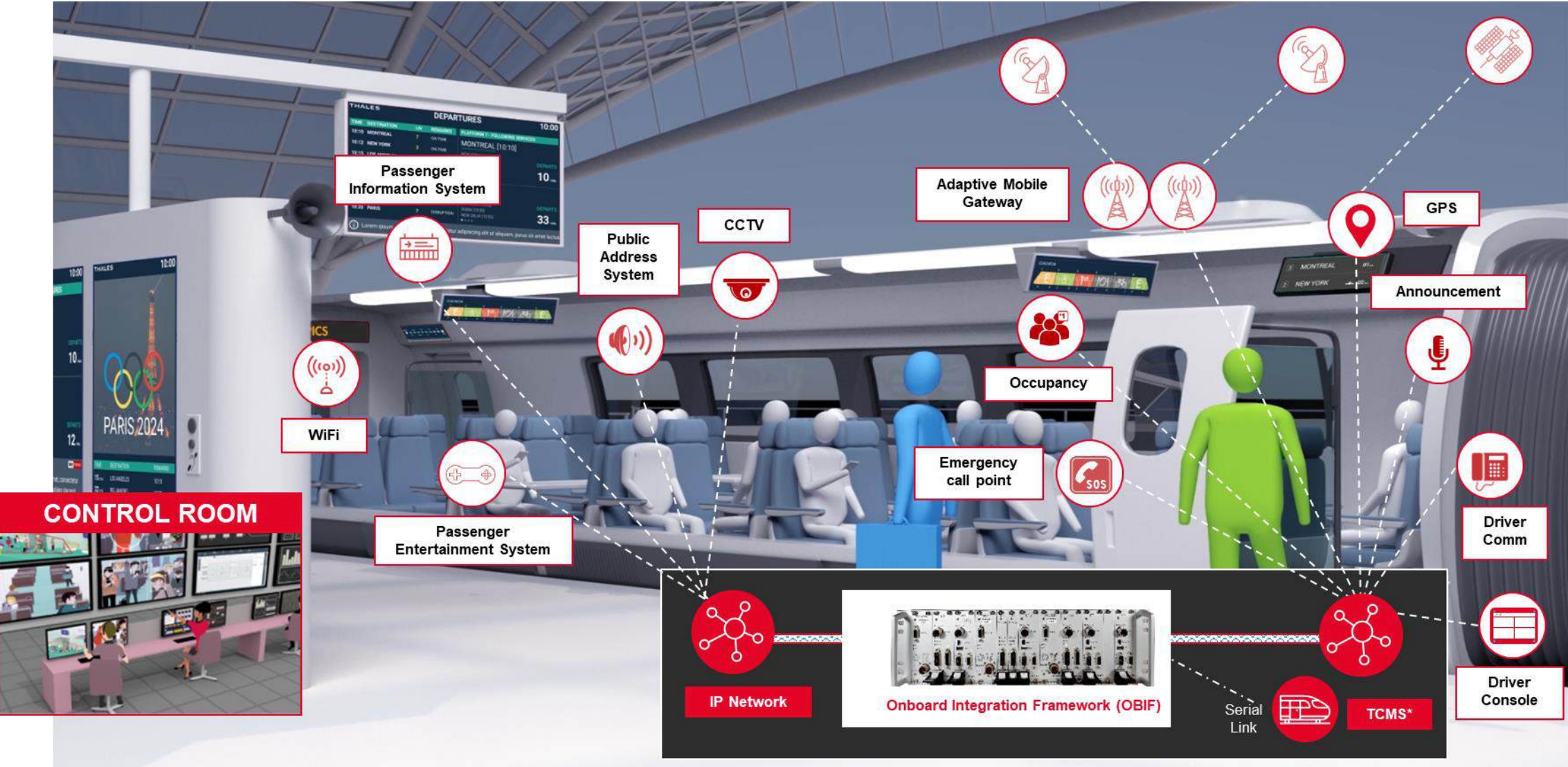
Tetra Radio



Onboard Railways Services Systems – Public Address System



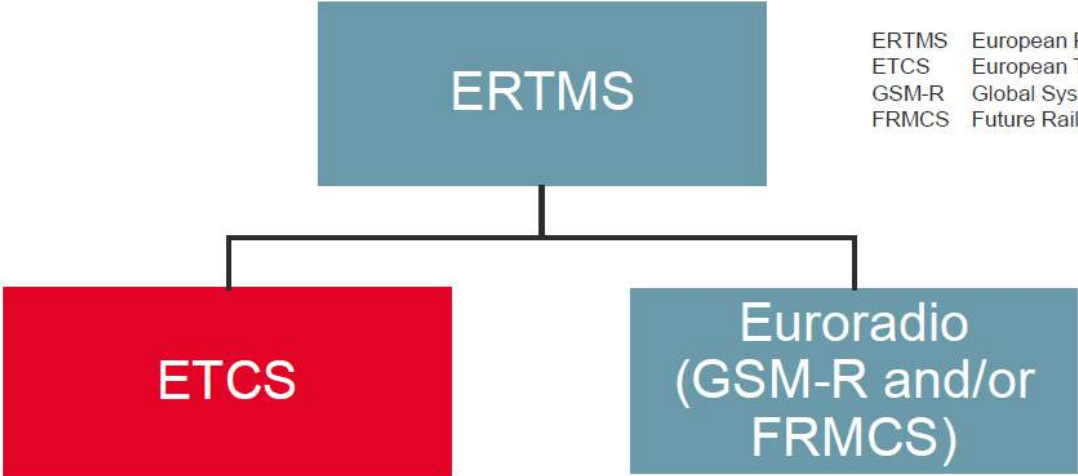
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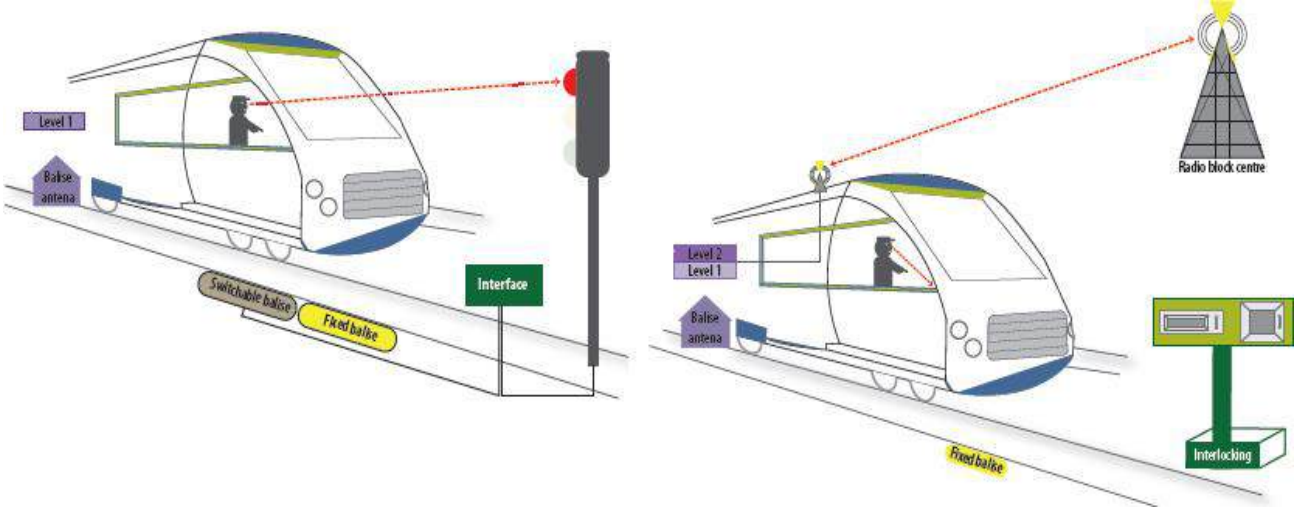
Onboard Railways Services Systems – ERTMS GSM-R



ETCS is a part of ERTMS.



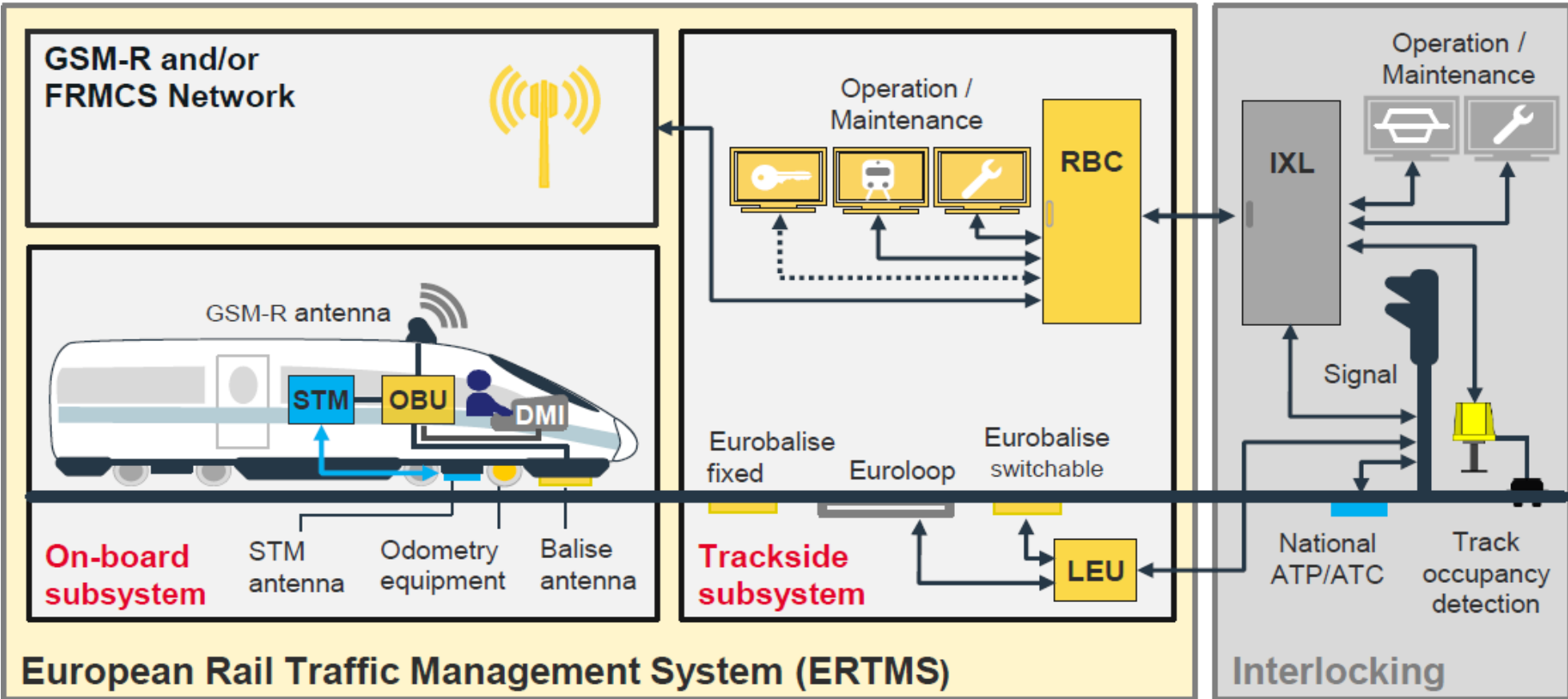
- ERTMS European Rail Traffic Management System
- ETCS European Train Control System
- GSM-R Global System for Mobile for Railways
- FRMCS Future Railway Mobile Communication System



Onboard Railways Services Systems – GSM-R



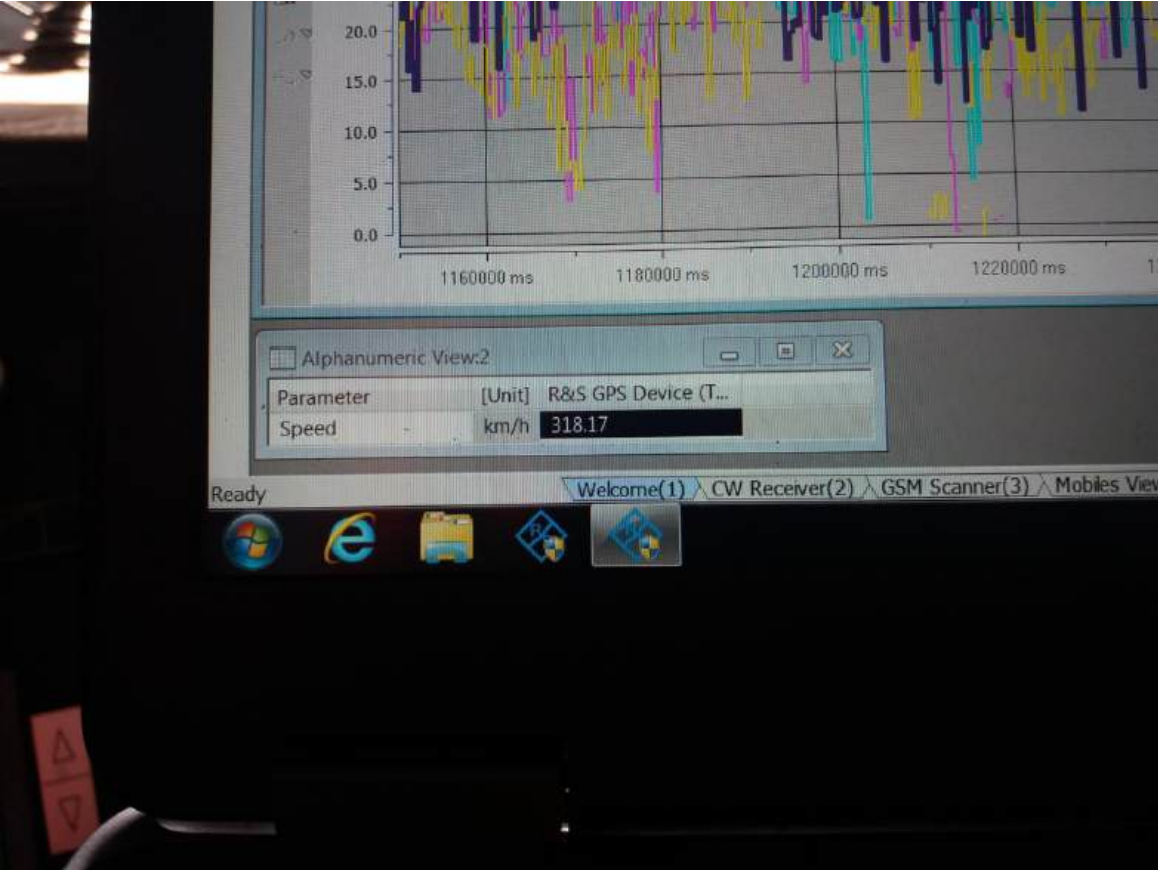
ETCS consists of trackside and on-board subsystems.



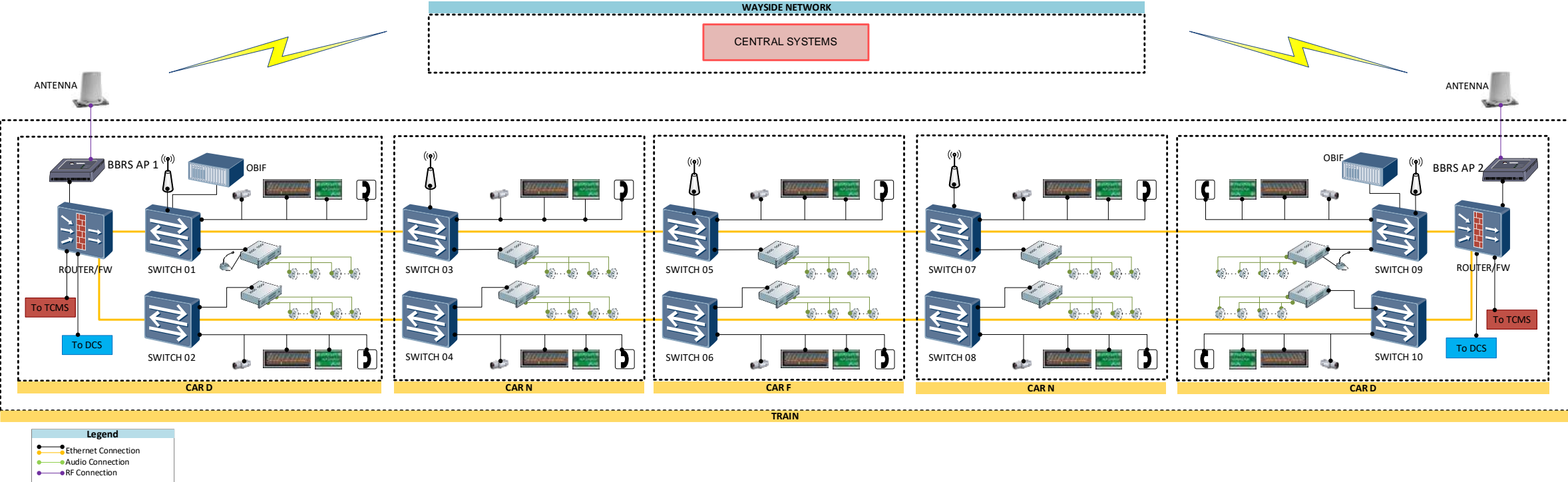
- DMI Driver Machine Interface
- IXL Interlocking (e.g. ESTW L90)
- LEU Lineside Electronic Unit
- OBU On-Board Unit
- RBC Radio Block Centre
- STM Specific Transmission Module

Onboard Railways Services Systems – GSM-R DMI – Driver Machine Interface





Onboard Railways – Conceptual Design



OCC – Operational Control Centers



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CCO do Porto



CCO de Lisboa



OCC Copenhagen

OCC – Operational Control Centers



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These services can be classified into three main categories:

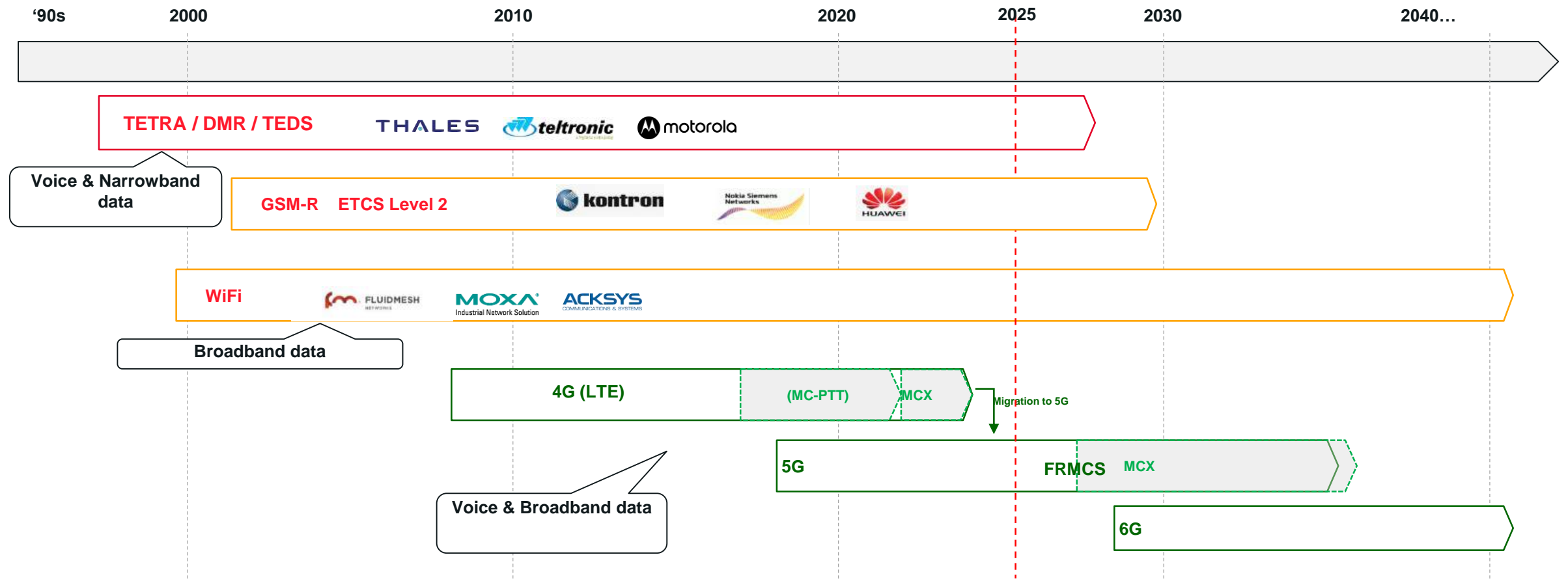
- **Safety-critical services:** signaling traffic, operational voice.
- **Operational non-safety services:** Passenger information, CCTV.
- **Non-critical applications for infotainment:** Internet access for passenger, advertisement, passenger entertainment...

These services have different Quality of Service (QoS) requirements

Example - Safety-critical services QoS requirements – signaling system:

- Low throughput (up to 100 kbps)
- Strong requirements in terms of security and reliability
- Availability (at least) 99,999%
- Packet loss rate lower than 10^{-3}
- Delay lower than 500-800 ms
- Example – Onboard CCTV
 - Throughput: 2Mbps/Camera Video Stream (5-10 cameras => 10-20Mbps)
 - No demanding requirements in terms of security and reliability
 - Availability (at least) 97%
 - No demanding Pack Loss
 - Delay ~1,5s

Mobile Communications Systems: Current Status



	GSM-R	TETRA	Wi-Fi	LTE	5G (FRMCS)
Maturity	End by 2030	Mature	Widely adopted in urban areas	Mature but limited use in RailwaysTransport	Available 2027

5G emerges as the new radio technologies fostering rail digitalisation

References (Hitachi)

➤ Global references:

- TETRA/WiFi BBRS

- London Underground
- Denmark
- Manchester
- Dublin LRT
- Metro Saint Domingo
- Metro Panama
- Doha Metro
- Hanoi Metro

➤ Hitachi Portugal references:

- TETRA/WiFi BBRS:

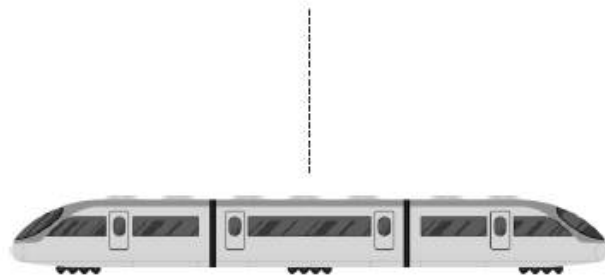
- Bangalore
- Mumbai
- Mecca
- Montreal
- Hyderabad

- GSM-R

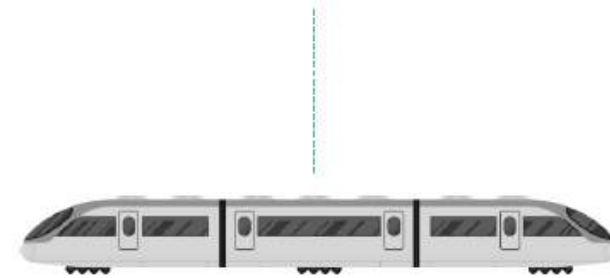
- Saudi Arabia
- Marrocos
- Algeria

Mobile Communications Systems – GSM-R => FRMCS

GSM-R



FRMCS



2G – 900MHz
Circuits based
Voice, Data
Data rate ~ 10Kbit/s
Latency > 500ms

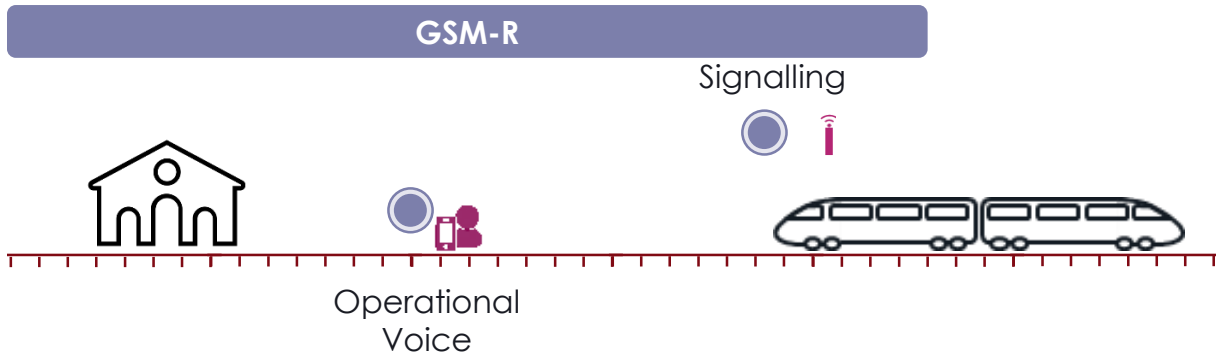
GSM-R End-of-Life announced (2030-35)



5G – 900/1900MHz
IP based
MCX: Voice, Video, Data
Data rate > 1Mbit/s *
Latency < 50ms *
Interoperability under FRMCS standard

**subject to frequency and bandwidth availability*

Mobile Communications Systems – Migration GSM-R => FRMCS

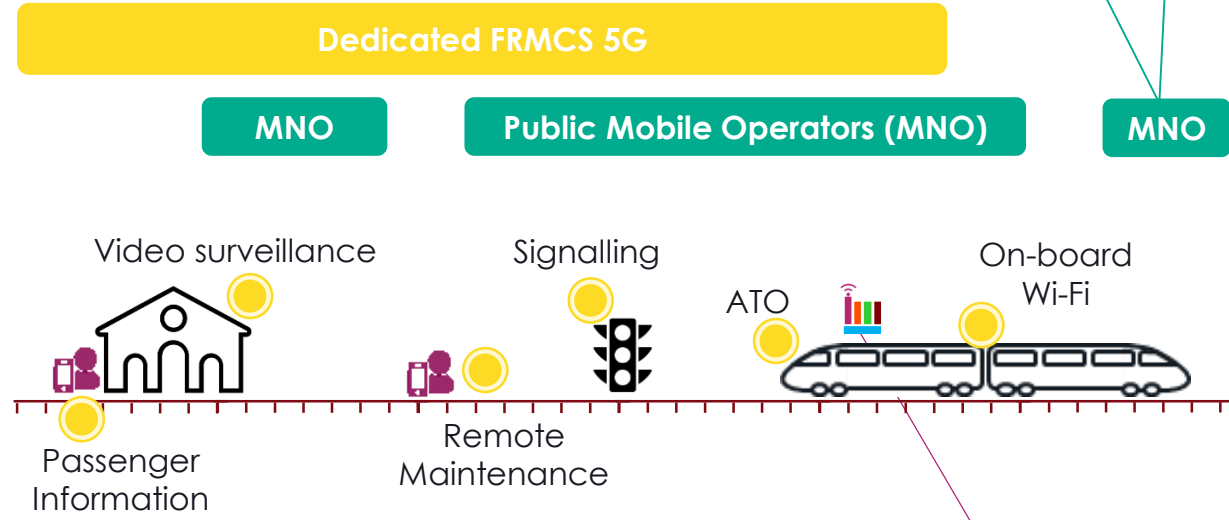


- 150.000 km Track Lines
- 38 Countries

For "Critical & Performance Communication Applications"



For "Performance &/or Business Communication Applications"



FRMCS currently visible in Hitachi Rail opportunities ?

NEOM – Saudi Arabia

Rail Baltica

TELT Lyon-Turin

**Several opportunities
appearing in:**

- Europe**
- Australia**
- North America**
- Asia**

Thank you

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PDA

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