EURAIL – FA6 FutuRe Project
Innovative solutions for G2 regional lines

Donostia

23 October 2024

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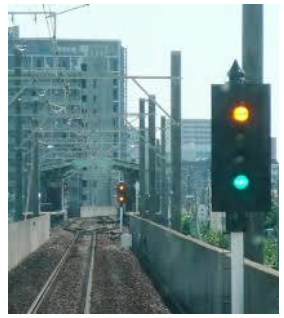
What are G2 lines?

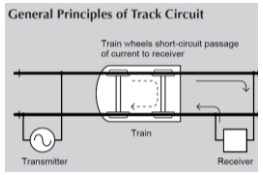
European regional lines are an essential part of the multimodal mobility scheme. Despite their relevance, they are gradually being abandoned due to the increasing total cost of ownership (TCO).

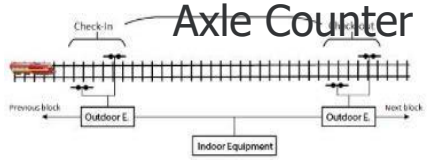
FutuRe FP6 project aims at the development of the **traffic management/control/command and signalling system for low density lines** that are:

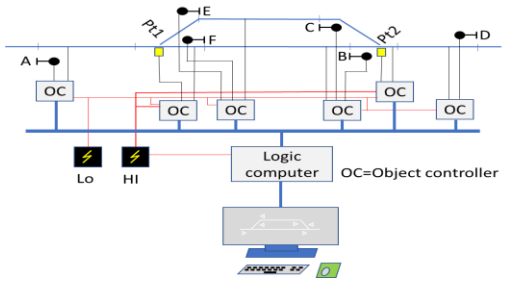
1. **not functionally/operationally fully connected with the mainline** network – so called **Group 2 Lines (G2)**,
2. i.e. operated by passenger and/or freight **services that do not usually enter mainline** infrastructure.

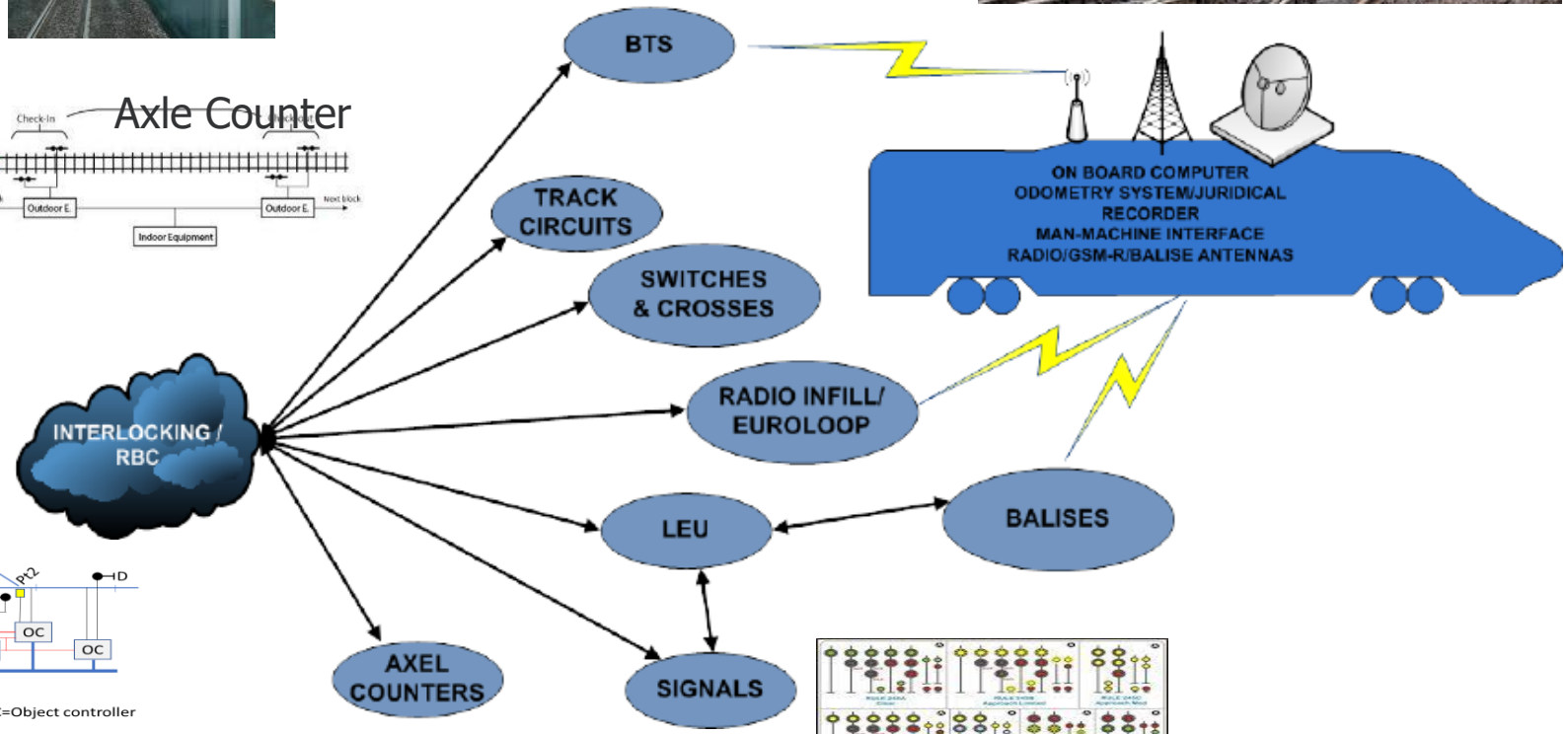
Traditional signaling system – too expensive for low-density lines

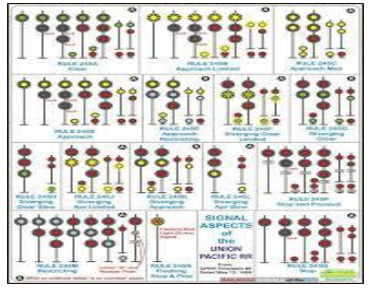






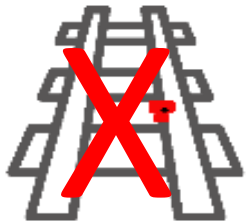




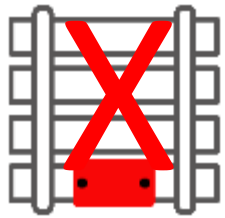


Solution? Significant wayside equipment reduction

Dedicated Radio Network



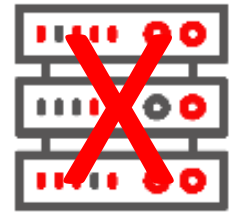
Track circuits/ Axle Counters



Balises/Tags

Signals

Cables



Many Sub-systems

Key cost drivers contributing to regional low-density lines competitiveness

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1. **Significant limitation of wayside installations** deploying more onboard centric solutions by monitoring the train integrity and determining location through communication systems/sensors (Satellite, Radio).
2. Usage of geographical data in **Onboard Track databases**, similar as to CBTCs, in support to train positioning and detection.
3. Moving wholly to **Moving block** techniques allowing the removal of lineside signals.
4. **Moving away from expensive, soon obsolete dedicated radio** network solutions in favour of public networks.
5. **Rationalisation of the Traffic Management & Control Centre.**

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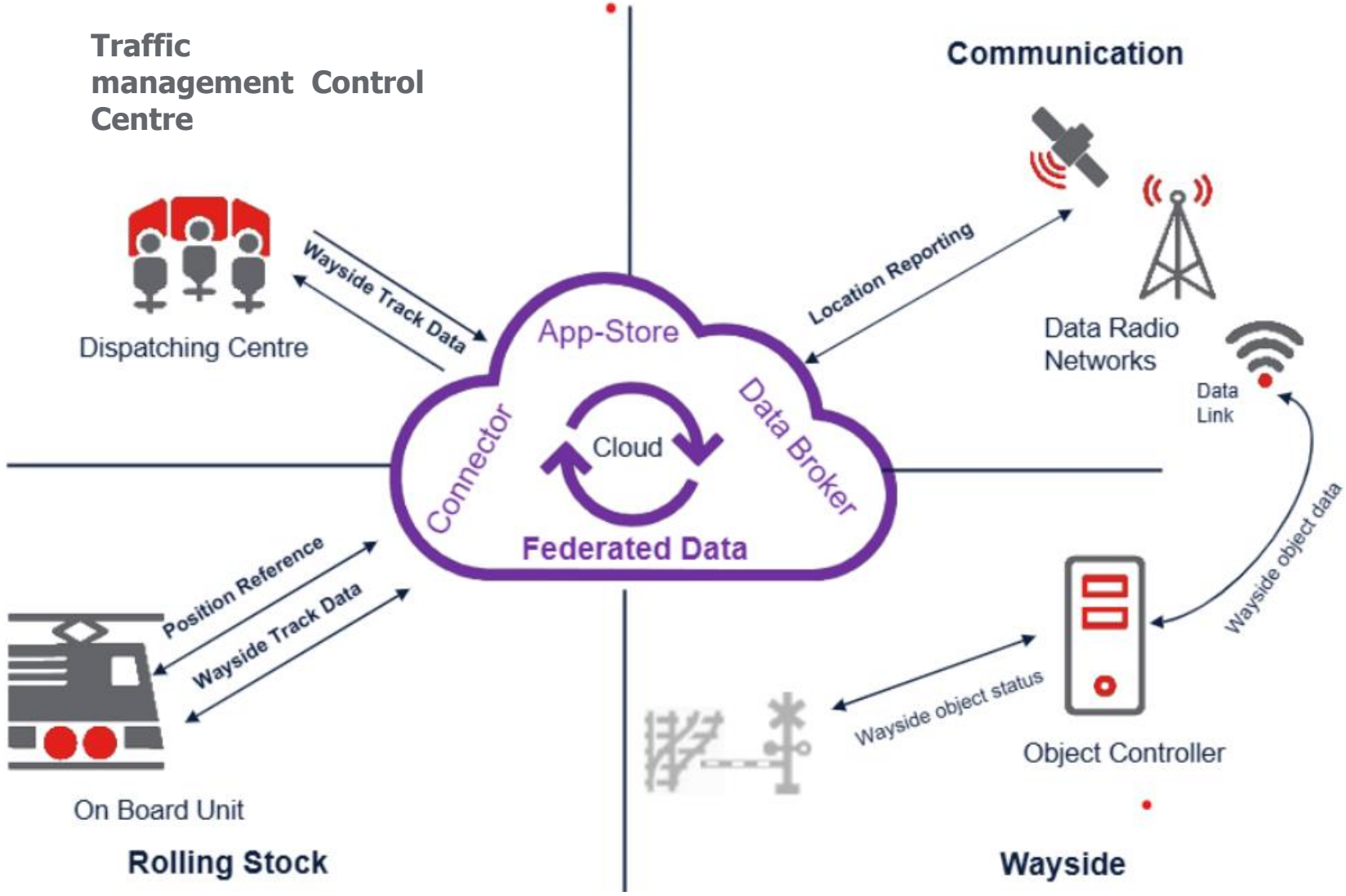
G2 CCS Principles

1. Guaranteeing **high-level of the system safety** for G2 Lines
2. A r**eview of European and national regulations** and proposed amendments to them (when need be) resulting from:
    - A new concept of traffic management/traffic control centre (TMS/CTC) and associated services
    - A novel structure supporting "long term competitiveness of regional railways by decreasing the total cost of ownership (TCO)"
3. **Standard interfaces and standard data protocols** (preferably supporting the use of COTS)
4. **Compatibility among differently equipped trains and different TMS/CTC** that enhances competition and innovation.

G2 CCS Building blocks



Communication network

A **dedicated radio network typically represents around 20% to 30% of the overall CAPEX cost** of new signalling systems, plus significant OPEX costs

Therefore, **it is strategic to use Internet Protocol standards-based messaging**, public networks and routing COTS solutions allowing:

1. Transparent access to **cellular, wi-fi** and **satellite communication** (and future technologies) with an automatic selection of the available and cheapest one for maximum availability and minimised costs
2. **Cloud and Web based application using Federated Data** with certified level of security, utilising advanced encryption and authentication algorithms

==> **A "telecom technology agnostic" architecture**

Onboard Assembly

1. On-board assembly recalls the well-known concept of **Communication Based Train Control (CBTC)** to which train positioning is integrated
2. **Radio and satellites provide** (augmented high precision) **train positioning to the on-board unit**, which does use an onboard track database

==> **removing the need for wayside balises / transponders**

1. **Train detection** resulting from onboard positioning and train integrity monitoring transmitted to the TMS/CTC

==> **removing the need for track circuits / axle countres**

Positioning via Radio

1. Positioning technology is evolving quickly.
2. Today Wabtec owns a railway product for satellite localization with **~3 cm precision**
3. 5G + GNSS will improve radio localization.
4. The key is the **Track Database on-board**
5. And leave positioning technology specifications **OUT of the rail standard**! It will evolve quicker than Railway.

==> **The *positioning module* as well as the *radio communication module* should be separated from the Railway applications (i.e. the ATP and ATO)**

Wayside assemblies

The wayside assemblies are limited to

- the **level crossings** (wirelessly controlled or autonomous)
- **point machines** (including also self-returning type) and **point control**

G2 CCS aims to make them:

- renewable energy operated (combination of batteries and solar panels)
- radio controlled (not requiring any expensive signaling and power cables).

==> **CAPEX: -15% OPEX: -20%**

Integrated Control Room / Centralised Traffic Control & Traffic Management System

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Low-density lines need a fast and easy configurable cloud based **low-cost Integrated Control Room** - one HW unit can manage all functions needed:

- Traffic Management System (TMS) - non-vital
- Centralised traffic Control (CTC) & Interlocking - SIL4;
- Radio Block Centre (RBC).

A **single database** will ease the configuration and testing, reduce expensive engineering hours and software maintenance.

==> **Integrated Control Room will increase punctuality, reduce travel time and allow on-demand passenger services**

==> **Cloud-based services provided by third parties can reduce the cost allowing web-based access for remote parties**

==> **CAPEX: -15% OPEX: -20%**

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Summary: The modern signalling principles (not G2 only)

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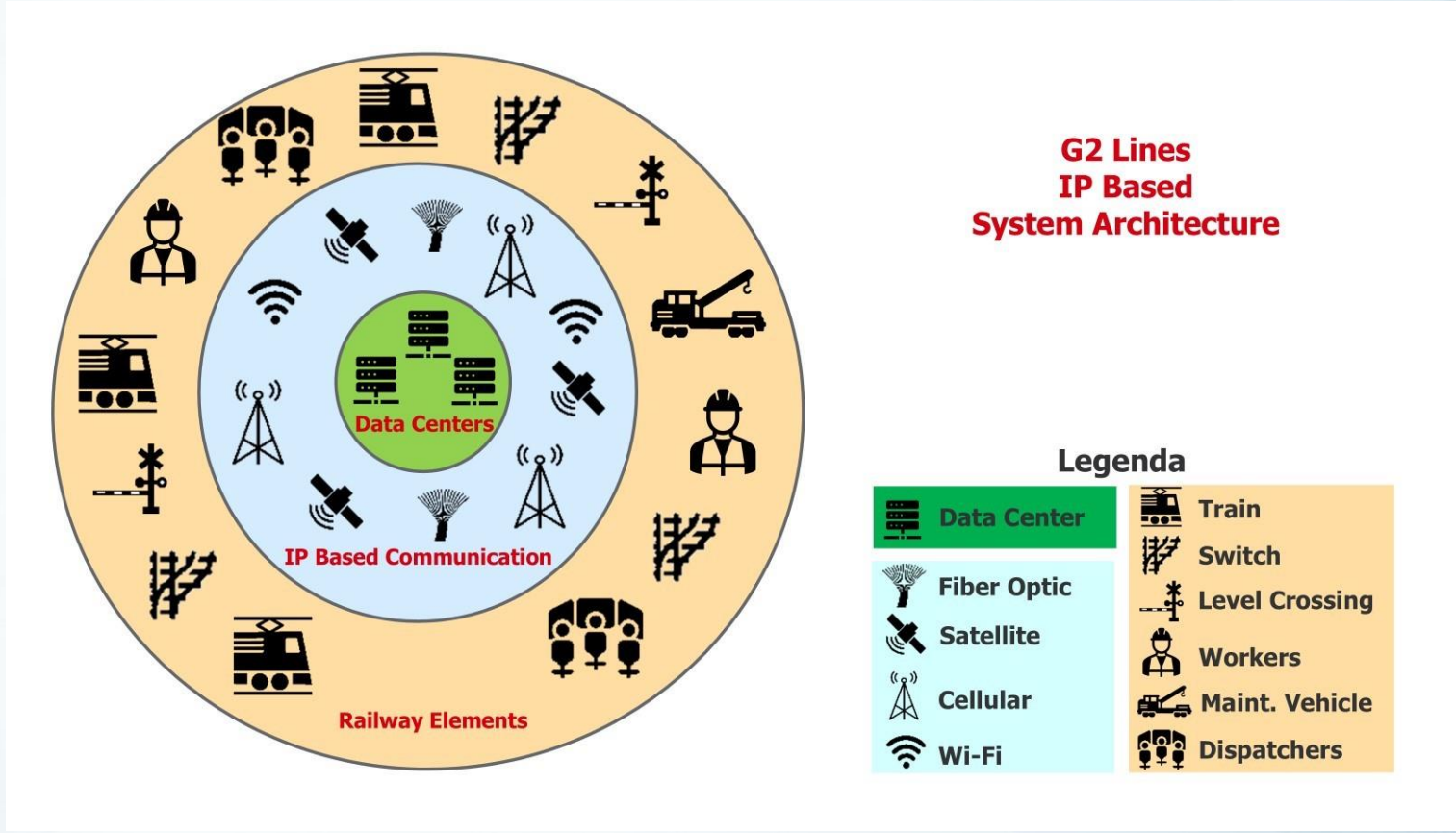
- **Train onboard:** precise satellite positioning / simple ATO for energy saving and remote control / radio based moving block ATP
- **Wayside:** self-energized (solar panels) point machines and level crossings remotely controlled via radio
- **Control room:** cloud / data center based integrated dispatching center
- **Communication:** open interoperability specifications and IP based data radio protocols, applicable on different types of data radio networks.

Public networks: ~**20-30% CAPEX reduction** compared with dedicated radio network.

Zero signals, track circuits, axle counters, eurobalises. **CAPEX: -15% OPEX: -20%**

Zero eurobalises → 100% radio based solution.



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Final Key message:

Railway technology evolves slower than ITC (for many good reasons…) and growing competition does not allow Railways to work on dedicated solutions on ITC

We need solutions that makes the railway systems independent of ITC evolution and obsolescence

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