



International Timing & Sync Forum 2022

#ITSF2022



5G Technology and Sync in Railways

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Who we are

#ITSF2022



Ferrocarrils de la Generalitat de Catalunya was founded in 1979

As a public company associated to the **Ministry of Territory** of the Generalitat de Catalunya (Catalan Government), its functions are as follows:

- Operate railway services and manage the infrastructures.
- Manage tourist trains and mountain resorts.

More than 40 years at the service of citizens

... committed to **territorial balance**, sustainable mobility and combating climate change,

... benchmark in **efficiency, competitiveness, leadership** and excellence,

... leader in **punctuality, reliability and availability of trains** during peak hours.



FGC Territorial presence in Catalonia

Current services

- 19 Railway lines
- 2 Rack railways
- 6 Mountain resorts
- 4 Funicular railways
- 57 Lifts
- 1 Cable car
- 1 Cable railway
- 16 Chairlifts
- 7 Tourist trains
- 3 Freight lines
- 2 Hotels
- 1 Astronomic park

Future services

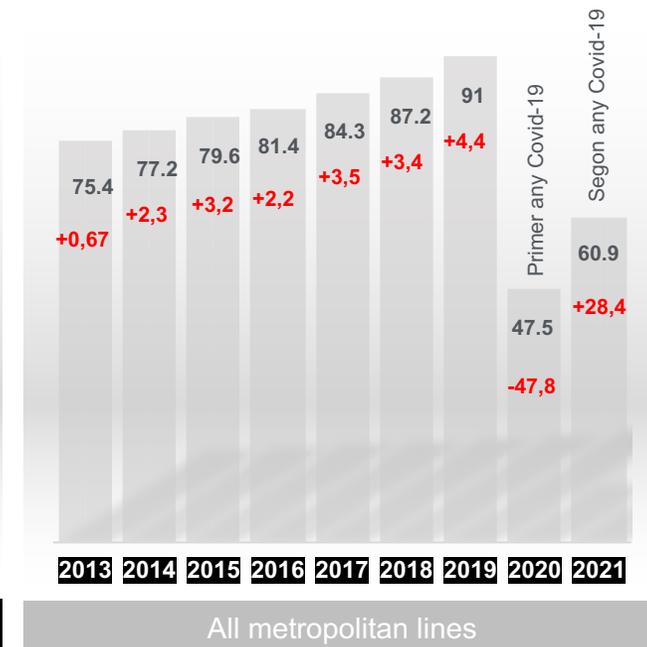
- 2 Regional lines (*Lleida-Cervera; Cervera-Manresa*)
- 1 Fast connection with Barcelona airport
- 1 Trolley car (*Camp de Tarragona trolley car*)
- 1 New network interconnection (*connecting the Vallès and Llobregat lines*)



Passengers on the Metropolitan Lines

- **32 trains** at peak hour/direction
- Vallvidrera Funicular: 196 trips a day

- **15 trains** at peak hour/direction



In 2019 the Metropolitan Lines reached 91 million trips: 66,3 million in the B-V and 24,7 million in the L-A

Time and Railways

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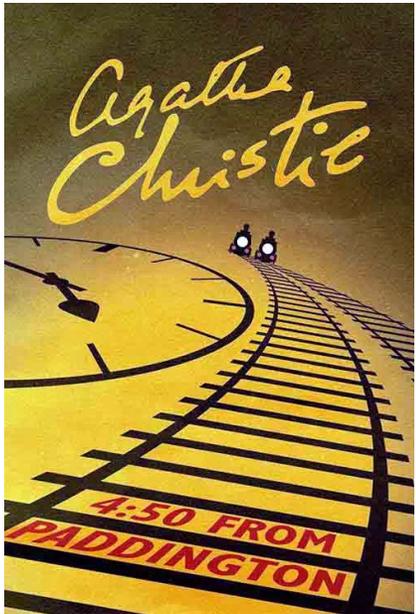


Time and railways have a close relationship ...

... in books ...

... movies ...

... and, of course, in real world



The Golden Rule

A train should not be late ...

... but, above all, it should never leave before the scheduled time

The Context

The railway appears to be a system, but in reality it is a set of interrelated subsystems, which often do not speak the same language ...

... and that each of them has its own clock

Safety is a basic element in railways ...

... which means that subsystems are not always willing to explain what language they speak

Of all the variables used by each of the subsystems, the only one that can be common to all is time ...

... and therefore time is essential to be able to relate them, as long as there is synchronism

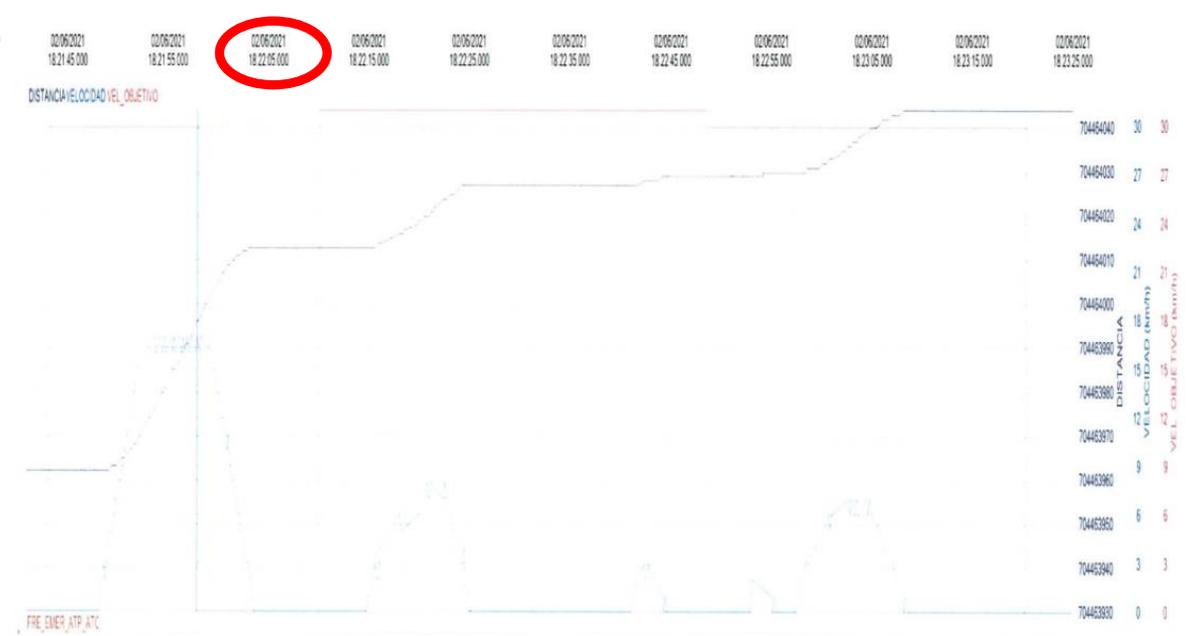
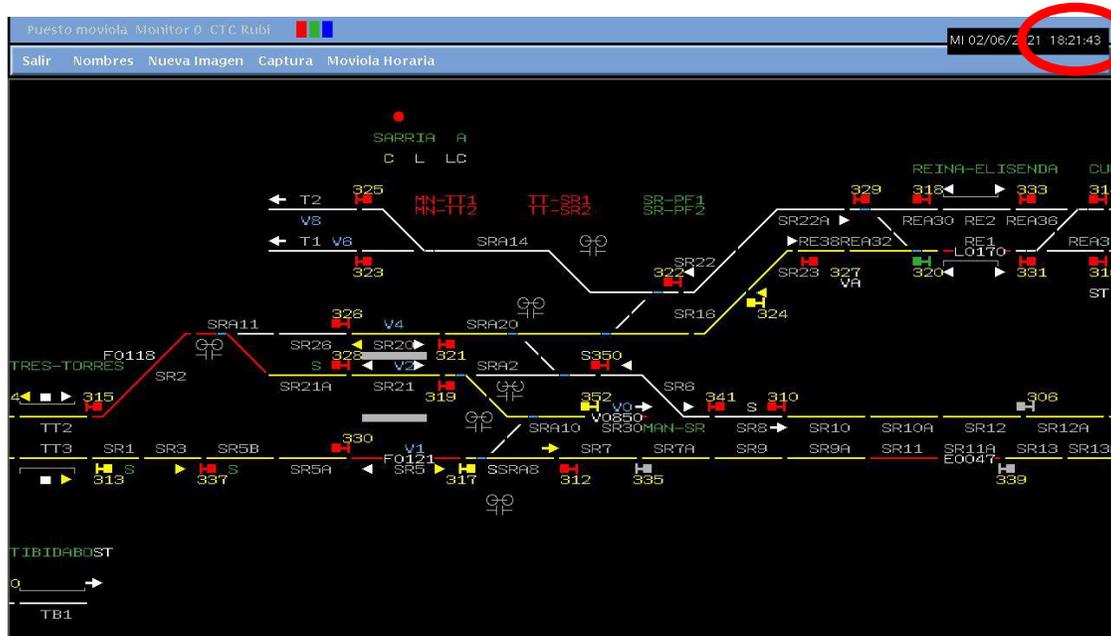
Fortune solutions



Added difficulties

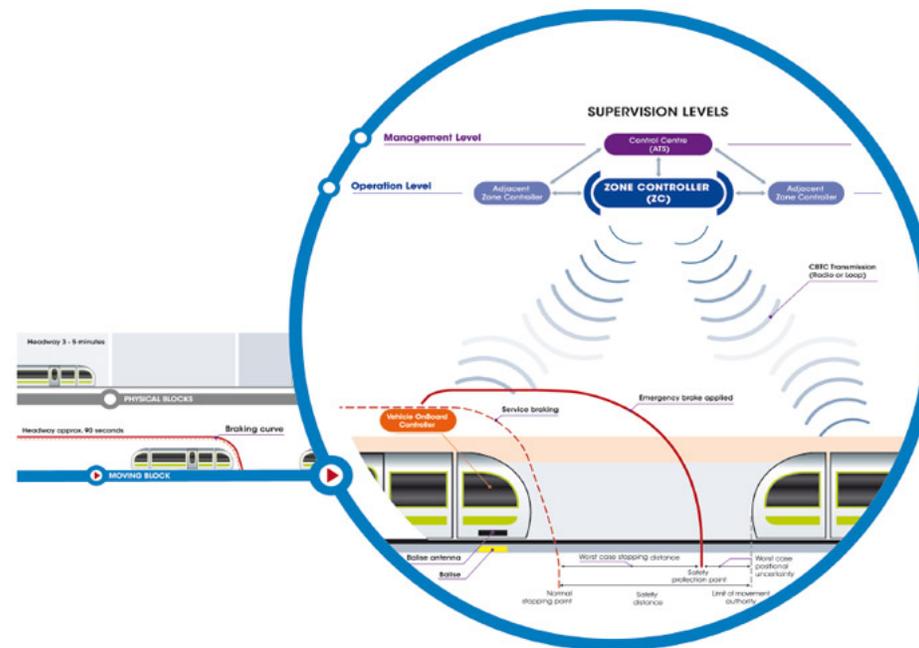
It is relatively simple, despite the previous conditions, to synchronize fixed equipment. The difficulty lies, above all, in synchronizing the internal clocks of the trains

Beyond operational aspects, this synchronization is basic in the investigation of incidents or accidents



Signalling systems

In advanced railway signaling systems, such as the CBTC, safety is guaranteed because at all times the control system knows the position of the trains in circulation, establishing the safety distance. However, you must ensure that the information is synchronized



And the answer is ...

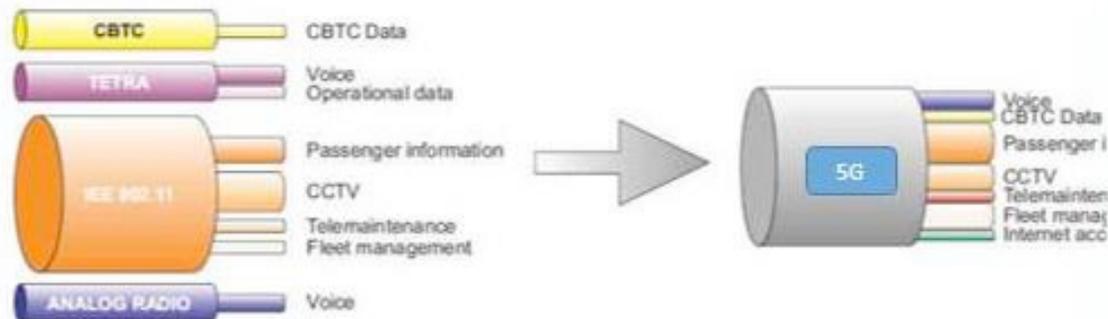
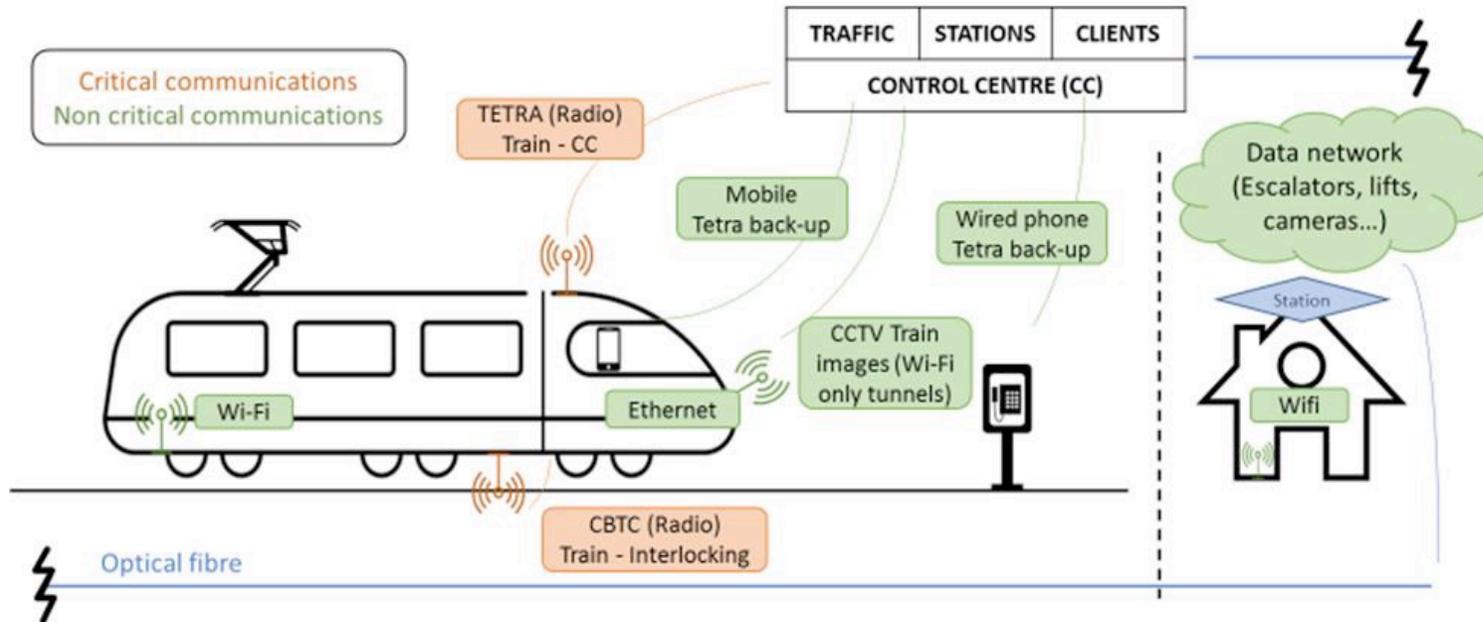
5G: A single infrastructure for multiple purposes

Rail operation critical support services: this group of services cover all the aspects needed for the proper operation of the rail transport service. Basically, they are mission-critical and safety related. It may be possible that the information generated by these applications must be shared by different stakeholders (example: one infrastructure operator and several railway operators). This group of systems requires the maximum Safety Integrity Level (i.e., SIL 4) to minimize the risk associated to the equipment failure.

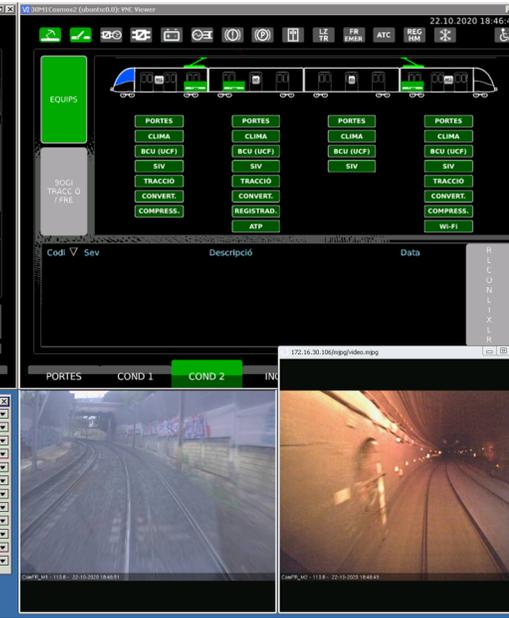
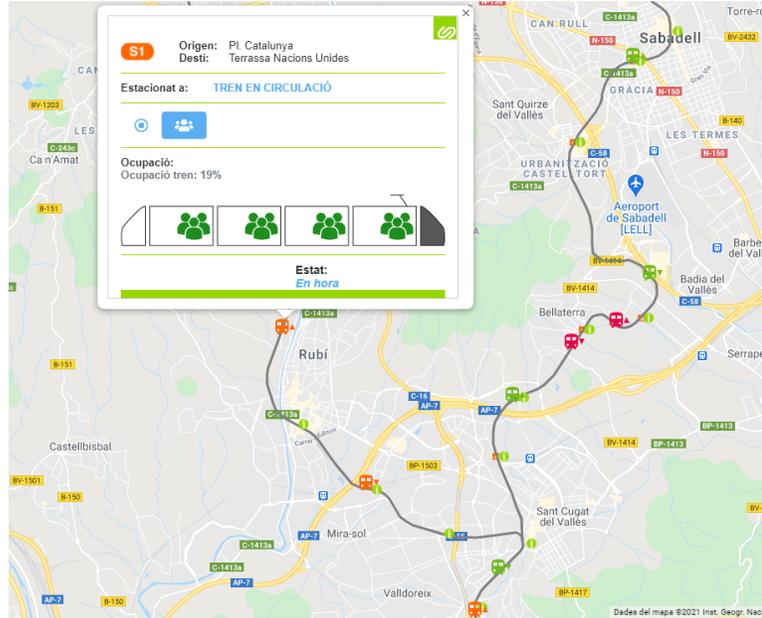
Rail operation non-critical support services: it includes the rest of services related to rail transport service. They can be sub-grouped into four categories: passenger information services, location operation services, security services and maintenance infrastructure services. SIL 2 compliance is required by this group.

Enhanced passenger experience: telecommunications services only focused on passengers, with no safety consequences. Typically, they will be provided by telecommunication operators.

5G: A single infrastructure for multiple purposes



Information is much more than timetables !



Generalitat de Catalunya

FGC Ferrocarrils de la Generalitat de Catalunya

Xarxa FGC Atenció al client Sobre FGC Espai segur Portal del personal CA Inicia sessió

Consulta les places lliures d'aparcament en temps real

Dades actualitzades de forma automàtica

Estacions	Places Totals	Places Lliures
Sant Quirze del Vallès	371	86%
*Terrassa	175	95%
*Sabadell	340	67%
Sant Boi del Llobregat	372	23%
Quatre Camins	154	60%
Martorell	116	51%
Les Fonts	288	Dades temporalment no disponibles

*Consulteu aquí les tarifes

Aparcament d'enllaç

Puja al tren

Or it is not

5G: It is not for tomorrow

The features of 5G technology that are essential are:

Low latency

Slicing

Cybersecurity

As of today, what seems most likely is to have two overlapping 5G networks in the medium term, one of them reserved for internal mission-critical uses, and the other for the rest of the applications (internal and commercial)

Can you help us?

There are many challenges that we face in present and future time sensitive applications ...

... so, how can you help us and another railway operators to solve this time related issues?



Since, in the end, what we want is to make travel safer and more attractive, and make life easier for **all** our customers

A white dog with a red collar is standing on a train platform, looking out from the open door of a red train car. The platform is tiled and has a yellow tactile strip. The train is stopped at a station with other passengers visible in the background.

Many thanks for your attention !!!

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