

*Track Side – On Board  
Mobile Communications*

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# Track Side – On Board Operational Communication

In Europe, the radio system supporting track side-on - board communications is GSM-R, solution enforced by the European CCS TSI

By **operational communications** we understand the support for vital data transmission needed for **ETCS**, and for voice application needed for the **Train Radio** – where train drivers, dispatchers and in some country cases maintenance teams are involved.

# GSM-R is based on ETSI GSM

> Based on standard GSM functionality and equipment

– All GSM 2+ functionalities can be used for GSM-R

Standard GSM functionality

# GSM-R is an ETSI standard

> Uses more GSM functionalities than public operators

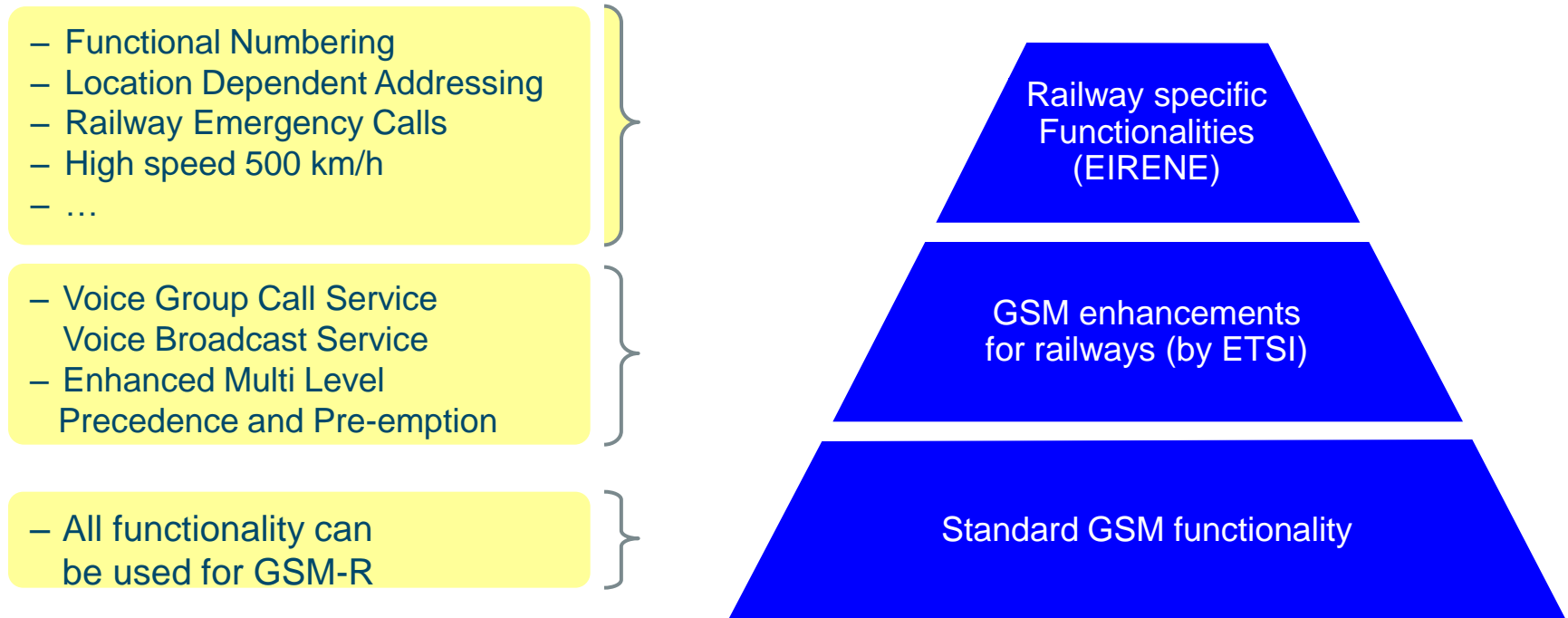
- Voice Group Call Service
- Voice Broadcast Service
- Enhanced Multi Level Precedence and Pre-emption

- All functionality can be used for GSM-R



# Additional Railway features – part of the TSI

- Functionalities specified by the railways



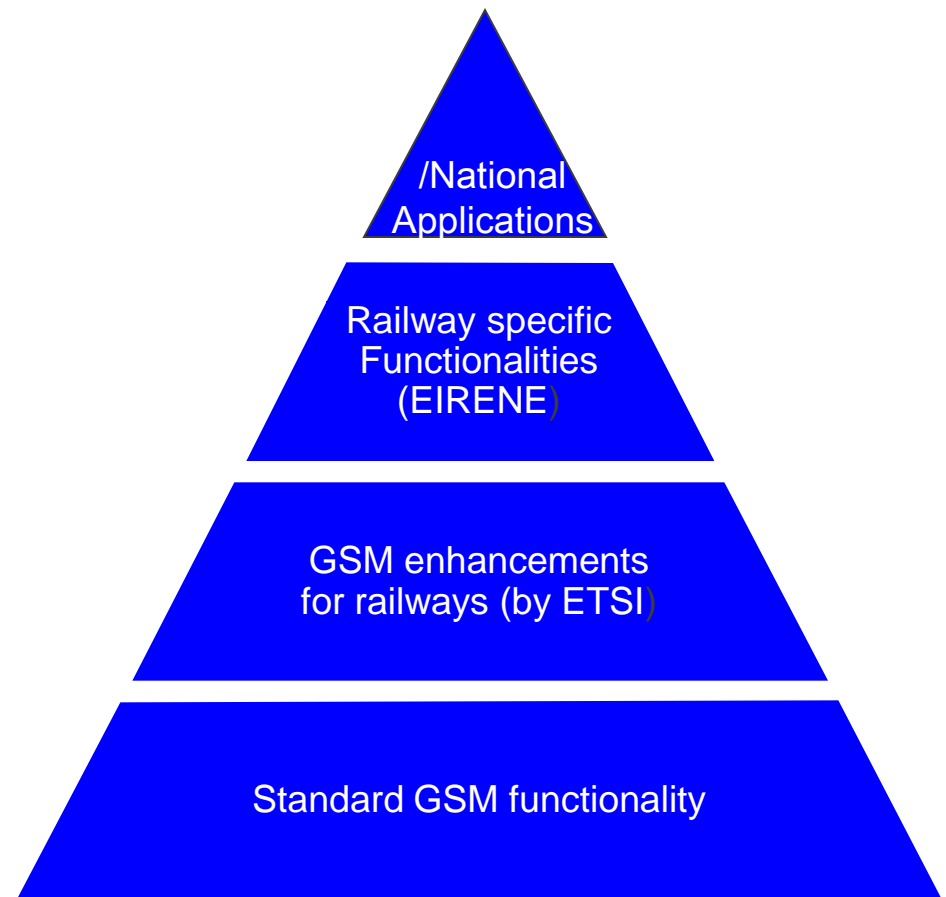
# GSM-R National Features

- e(enhanced) LDA
- eREC
- SMS to Functional Number
- ...

- Functional Numbering
- Location Dependent Addressing
- Railway Emergency Calls
- High speed 500 km/h

- Voice Group Call Service
- Voice Broadcast Service
- Enhanced Multi Level Precedence and Pre-emption

- All functionality can be used for GSM-R



# GSM-R Definition

## GSM-R

- GSM-R is a European Standard, developed by and for the Railways, based on ETSI GSM 2+ (Release 99 and recently release 4 – being validated)
- It provides the features of a GSM network, plus ASCI (Advanced Call Speech Items) specific features for Railways operations and Railway Specific (EIRENE)
- It has dedicated radio spectrum for rail use, all over Europe
- It is the bearer for ETCS, voice, and various data applications

## \*Rail features for GSM-R

- Dedicated Frequency Band (876-880 / 921-925 MHz)
- Priority and Preemption (eMLPP)
- Functional Addressing (FN)
- Location Depending Addressing (LDA, eLDA)
- Voice Broadcast Calls (VBS)
- Voice Group Calls (VGCS)
- Fast Calls Set-up
- Railway Emergency Calls (REC, eREC)

**GSM**

+

**ASCI**

+

**Railway Specific  
Features**

+

**Quality of Service**

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**GSM-R**



# GSM-R Applications

ETCS  
Data

Train Radio  
Voice calls, FN, LDA, REC...

GSM-R

GSM-R

Shunting

Point to Point, & Group Calls

Operational Voice Communication  
for Railway Staff  
Point to Point, Group Calls, REC, Data

GSM-R

GSM-R

Diagnostics, Energy Data, Train  
Maintenance  
Data, SMS

GSM

Back- up for GSM-R,

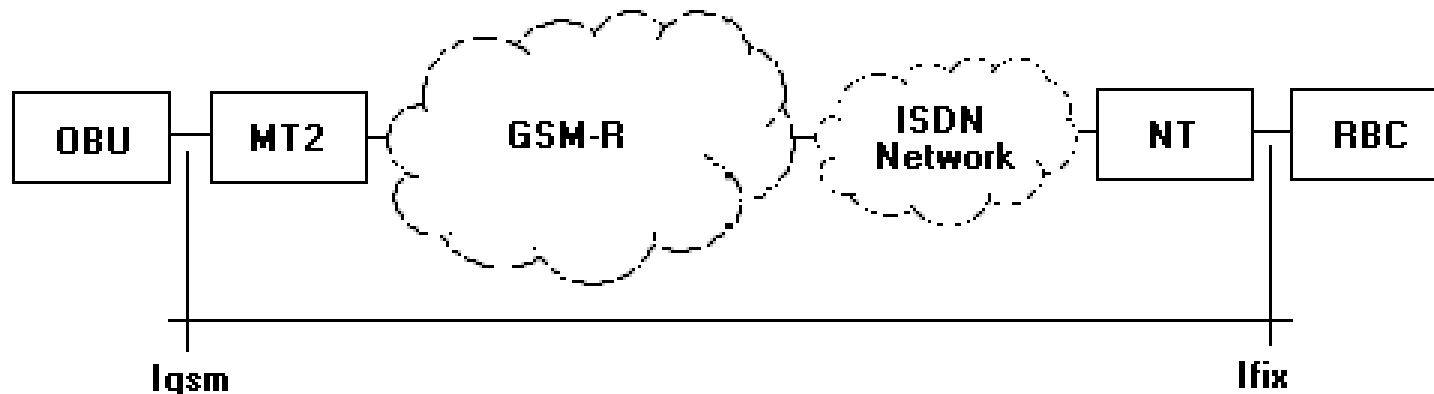


One single Platform for Voice and Data



# GSM-R Applications - ETCS

- GSM-R is the bearer for ETCS.
- GSM-R has to guarantee a high level of Quality of Service in order to fulfill the needs of ETCS.
- ETCS requires critical real time interactive data transfer - if the Movement Authority (MA) is not available at the right time, the train will brake
- Strictly telecom point of view, small messages are sent periodically or when required, both ways
- For now, the TSI allows only Circuit Switched Transmission Mode



# GSM-R QoS for ETCS

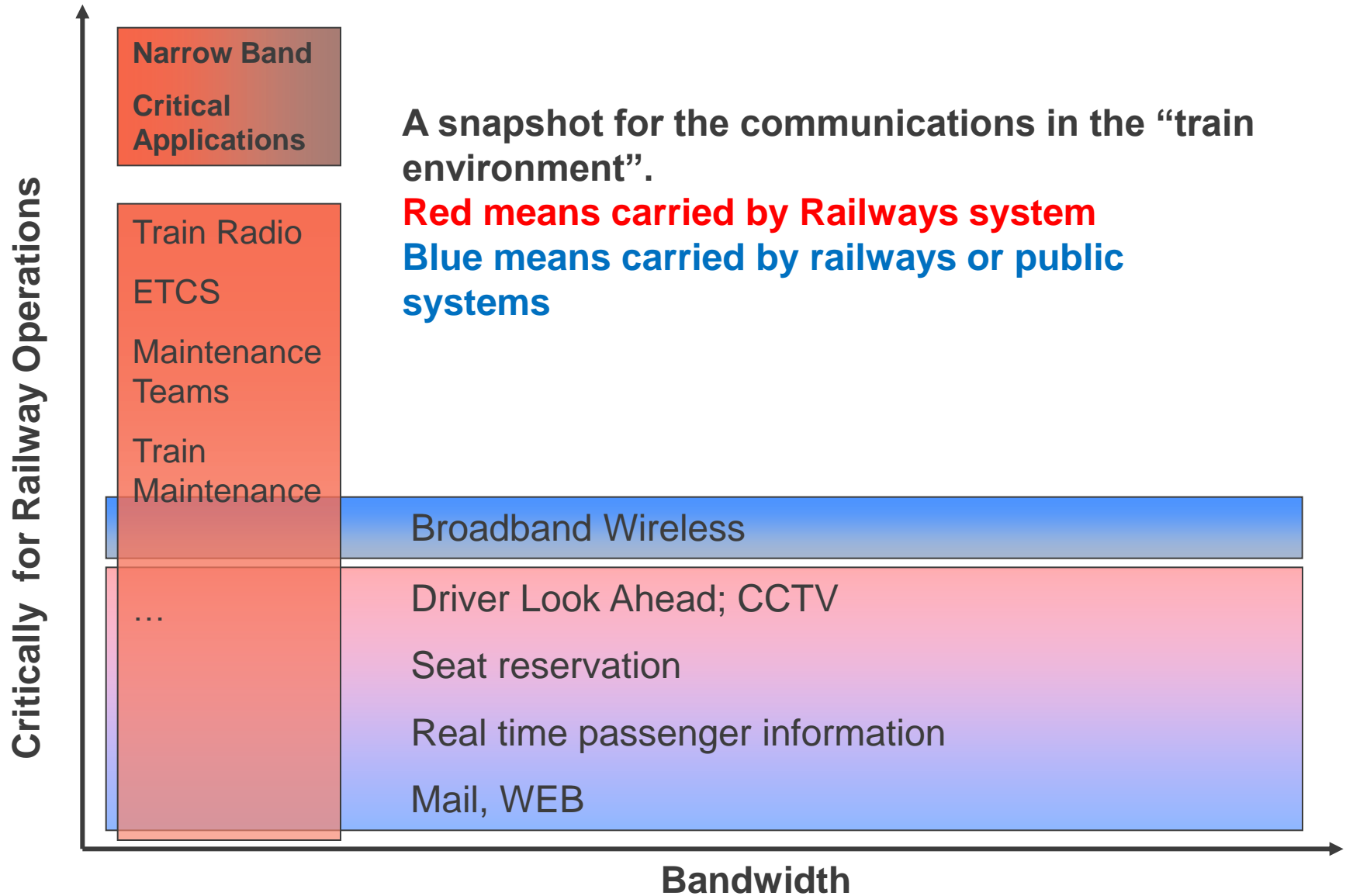
**GSM-R Quality of Service requirements for ETCS, defined in Subset 093**

QoS Parameter	Value (see 6.3)
Connection establishment delay of mobile originated calls	< 8.5s (95%), ≤10s (100%)
Connection establishment error ratio	<10 <sup>-2</sup>
Maximum end-to-end transfer delay (of 30 byte data block)	≤ 0.5s (99%)
Connection loss rate	≤ 10 <sup>-2</sup> /h
Transmission interference period	< 0.8s (95%), <1s (99%)
Error-free period	>20s (95%), >7s(99%)
Network registration delay	≤30s (95%), ≤35s (99%), ≤40s (100%)

**Subset 093 defines the ETCS requirements for GSM-R (TSI CCS, Annex A, informative section) - it is designed for Circuit Switch Transmission Mode**

**Compared to voice applications, ETCS applications requires:**

- **Stronger coverage**
- **Fall back solutions (e.g. double coverage of Public Network Roaming)**
- **Disaster Management**



# Train-Ground communications snapshot

- The Mobile internet booming is visible also in Railway environment
- Making a train-ground telecom applications snapshot, we will find:
  - Operational communications (voice and data) – using the railway telecommunication system,
  - Train & train crew related communications – train maintenance, train diagnostic, crew communications, security, catering, etc – using the railway or a parallel telecommunication system
  - Passengers private communications – 3G modems, mobile phones – public mobile operators
- Lately Internet in Train – access to mail and limited internet, public operators in cooperation with the train operators, using Satellite transmissions, M-OFDM, leaking feeders technologies.
- Most of these aspects were covered in the UIC Final Report of the project E-Train, finalized in 2010



# Train Communication Network

- > > As scope of the TCN – General architecture, it is noted that this part of IEC 61375 applies to the architecture of data communication systems in open trains, i.e. it covers the architecture of a communication system for the data communication between vehicles of the said open trains, the data communication within the vehicles and the data communication from train to the ground.**
- > > As UIC is the Technical Body for radio standardization processes, there is a strong need that we are part of any discussion which takes into account track side – on board communications – applications, systems, requirements, etc, to make sure that compatibility with existing systems and requirements is ensured.**

# *Thank You for Your Attention*

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