



**MISTRAL WORKSHOP #1**  
**Trends on future train-to-wayside communications**  
**Barcelona, 07/07/2017**



**Introduction: MISTRAL Project**

**Future technological trends** for train-to-wayside communications

**Future economic trends** for train-to-wayside communications

**MISTRAL project solutions and wrap-up**

The innovation process of the railway transport is slow compared with the pace at which new technological advances become available today and it is a time to investigate new paradigms.

One of the investigation streams in this area is to provide an enhanced adaptable train-to-wayside IP communication system which will take advantage of new technologies and will be economically feasible for its application.



**The MISTRAL project** funded from the Shift2Rail Joint Undertaking under the European Union's Horizon 2020 research and innovation programme, responds to this necessity.

**MISTRAL** will elaborate the **Technical Specification** for future train-to-wayside **IP communication system for all railways**. The new system will leverage the broadband capacity of IP-based wireless communication to enhance signalling but also to make possible innovative services for both users and railways. Also, MISTRAL will analyse the **economical feasibility** of the new system.

## Future **technological trends** for train-to-wayside communications

In the world of digitalisation and IP, existing railway mobile communication systems, especially circuit switched GSM-R, must be updated both for technological and economic reasons



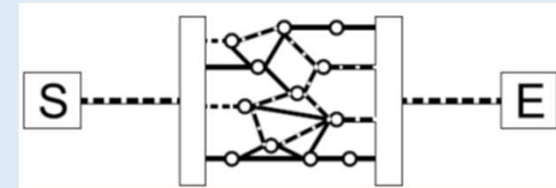
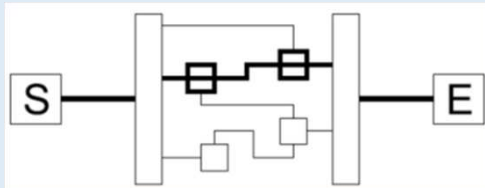
IP communication candidates should offer **major benefits** to train operators and infrastructure managers.



IP-based transmission systems will provide the **improved performance** and capacity of railway telecommunications.

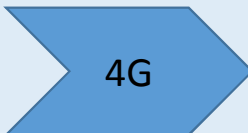
In **circuit-switched networks** a dedicated channel has to be established before the data transmission can be started. The channel is reserved between the entities as long as the connection is active.

In **packet switched networks**, it is not required to establish a connection initially. The connection/channel is shared and thus available to various entities. These packets switched networks are optimized for data and voice applications.

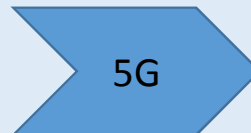


- ✗ Outdated technology
- ✗ Frequency interference issues
- ✗ Capacity issues
- ✗ Limited capabilities
- ✗ Dedicated technology
- ✓ The transmission channel is only used when data must be transmitted
- ✓ The message arrives as a whole
- ✓ High quality of voice communications

- ✗ Voice-over-IP is of less quality than circuit switched
- ✗ Packets can arrive in wrong order, protection is needed
- ✗ Switching Nods required more proccession power to reconstruct packets
- ✓ Efficient use of Network
- ✓ High Data Transmission
- ✓ Enables digital data to be directly transmitted
- ✓ A variety of available technologies



**Long Term Evolution (LTE)** is the wireless technology standardized in 2008 with Release 8 by the 3GPP. LTE is commonly named as the 4th Generation of mobile technology – 4G LTE.



**The fifth generation of mobile networks**  
The International Telecommunication Union (ITU) defined the framework and it specified the objectives of the future International Mobile Telecommunications (IMT) system.

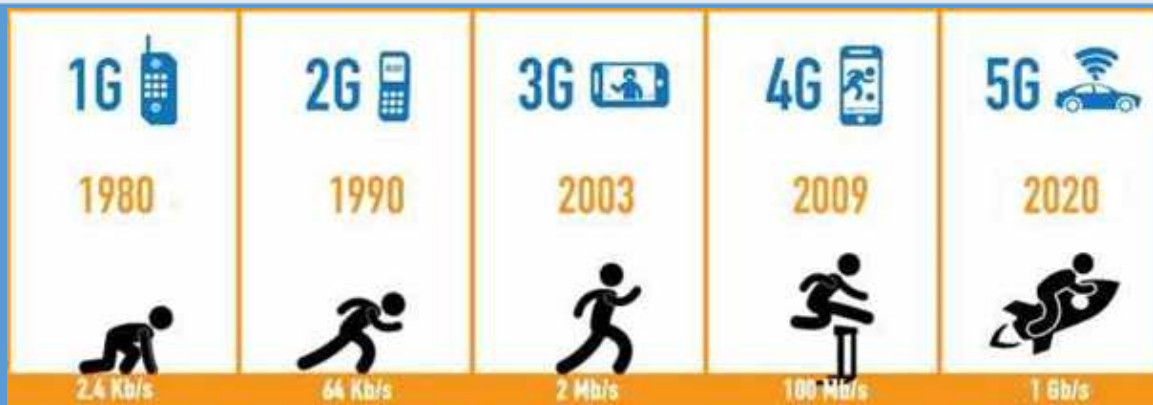


Image: norbertogallego.com

4G 

5G 

- ✓ LTE provides broadband performance
  - ✓ Flexible and economical deployment
  - ✓ LTE is open, secure, reliable and easy to operate
  - ✓ LTE is the 4G convergence standard worldwide
- 
- ✓ 5G peak data rate should reach 10 Gbit/s
  - ✓ Over-the-air latency of 1 ms should be provided
  - ✓ Mobility support up to 500 km/h with acceptable QoS
  - ✓ A connection density of up to 106/km<sup>2</sup>



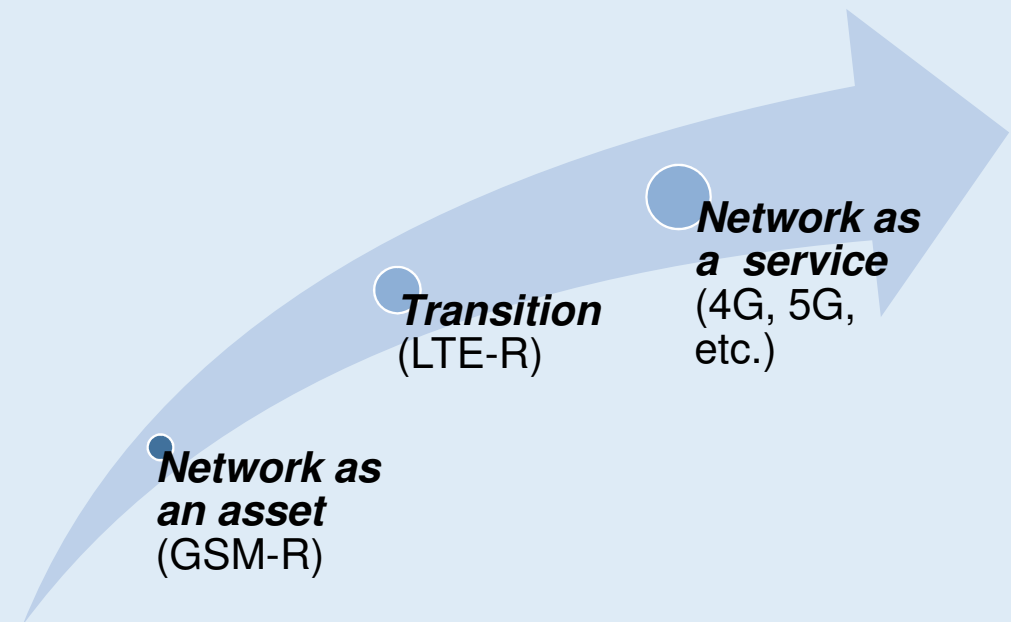
## Future **economic trends** for train-to-wayside communications

### 'Network as an asset'

**GSM-R** is the standardized digital radio communication system based on the second generation technology (2G) GSM (Global System for Mobile Communications).

The **GSM-R** is a 'private', 'dedicated' and 'non-commercial' network not accessible to the public and it has become now an international standard to mobile phone for railway communication.

- ✓ GSM-R is interoperable and secure platform for voice and data communication on railways that, along with ETCS (European Train Control System), forms parts of ERTMS (European Rail Traffic Management System).
- ✓ Obsolescence of GSM-R means higher costs for Infrastructure Managers and difficulties to provide long run maintenance.



## Why shift to ‘network as a service’ model?



Low return on investment that railway sector gets from the market.



The number of passengers using Railways is constantly growing and so the amount of data to process.



The necessity to maintain and improve the quality of service for railway communications.



The necessity to provide new and competitive services to passengers.



“Seamless” experience: new communication technologies can provide the possibility to integrate all railways into a continuous network.

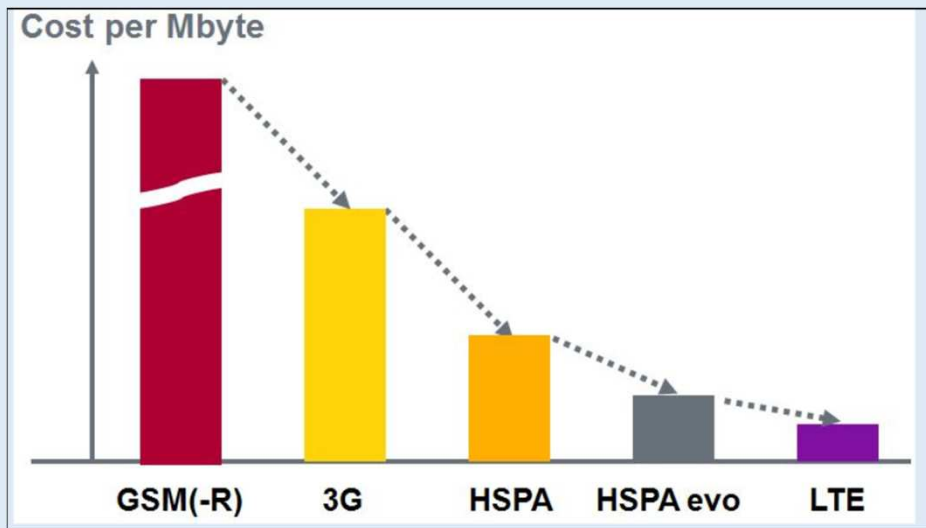


The challenge of introducing new technologies for communications will help to increase the demand of railway services and to improve all these indicators

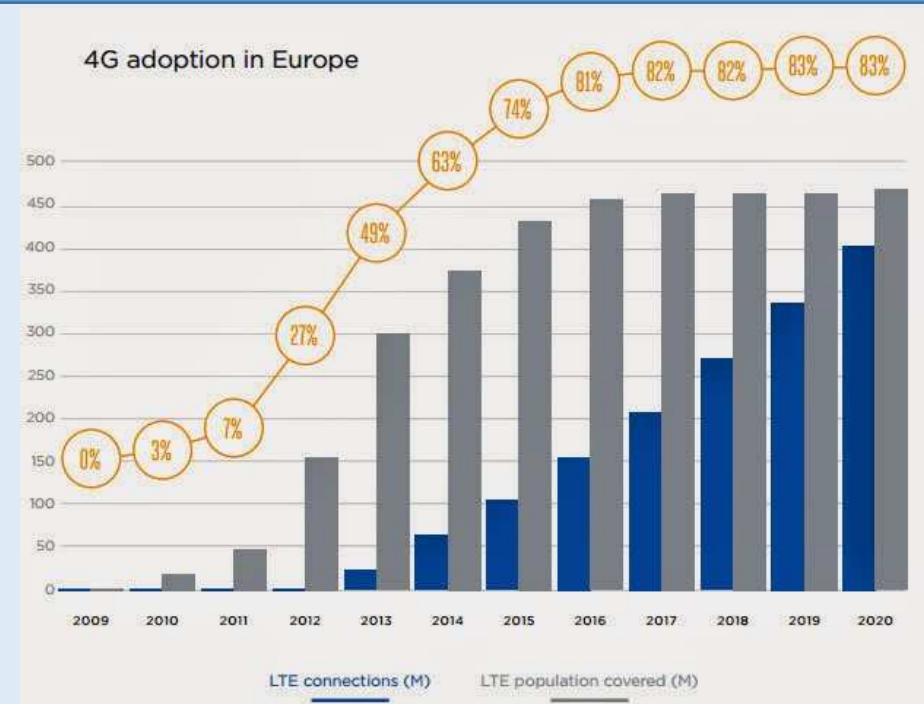
## ‘Network as a service’ advantages

✓ **Lower costs**

✓ **Larger coverage**



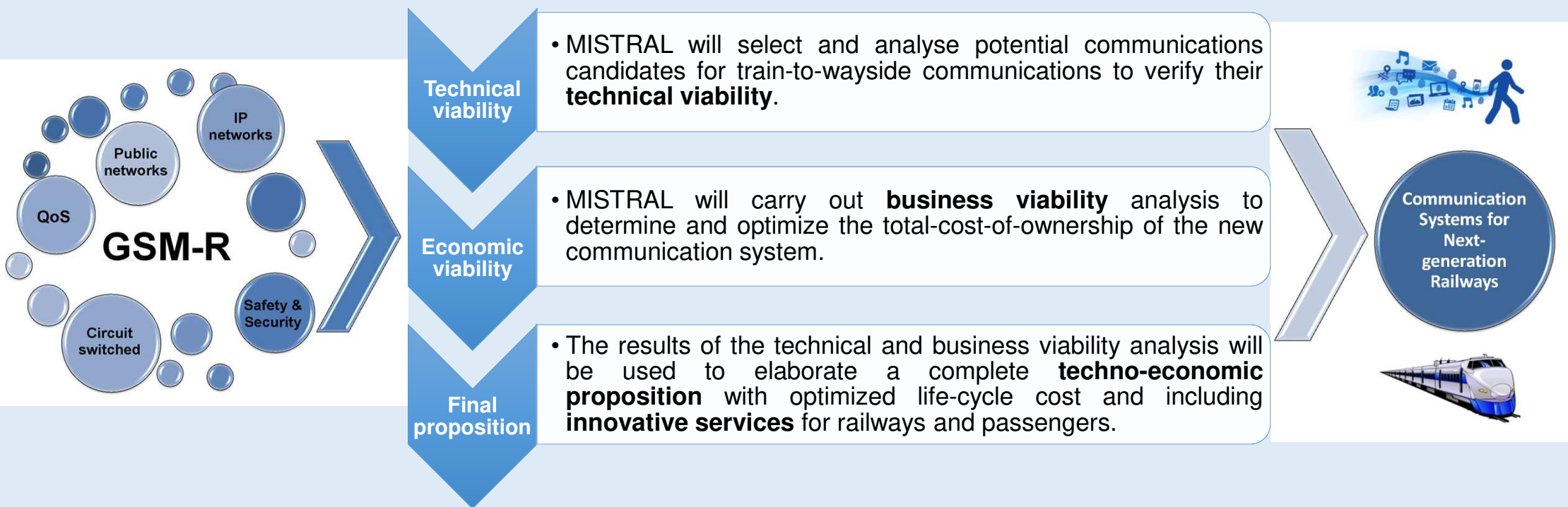
COST PER MBYTE COMPARISON  
(Source: Garstenauer, 2010)



LTE COVERAGE IN THE EU – Year 2020  
(Source: <http://www.onlinemarketing-trends.com>)

## MISTRAL project solutions and wrap-up

IP- based communication solutions offer significant improvements that could solve the limitations of the GSM-R. These future broadband communications will have sufficient capacity to enhance the operation, maintenance and safety. They will enable novel system for surveillance, passenger information, up-to-date travel information, access to online resources and much more. MISTRAL will investigate on all these aspects.



# Thank you for your attention

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