RadioLabs

Expertise & Profile

July 2019

Our Mission

RadioLabs is a non-profit research Consortium of Universities-Industries established in 2001. Since 2011 has been involved in the study, design and test of high-integrity localization systems, GNSS simulators, multi-bearer TLC and anti-jamming anti-spoofing technologies for train control systems.

The headquarter is in Rome, Corso d'Italia 19, Italy and the associated laboratories are in the University of Rome Tor Vergata, University of L'Aquila and University of Roma Tre.

RadioLabs mission is to contribute on Applied Research, Innovation, and Knowledge Transfer in the emerging fields of ICT and GNSS technologies and relevant applications.

Moreover, RadioLabs trains high level technical personnel, assists young researchers with grants and any other applicable support to their research activities, provides support to PhD activities of the partner Universities, and promotes the dissemination of results through conferences, workshops and specialized publications.

Research Areas

RadioLabs

Communications

Bearer-independent applications

3/4/5G – Satellite - TETRA

NGN - Next Generation Networks

SDN- Software Defined Network

Navigation

High Integrity applications

Multi constellations

Anti-jamming-spoofing

Rail Automotive

Security

Network security protocols

GNSS - Security application

Security policies and strategies

always connected, geo-referenced and secure
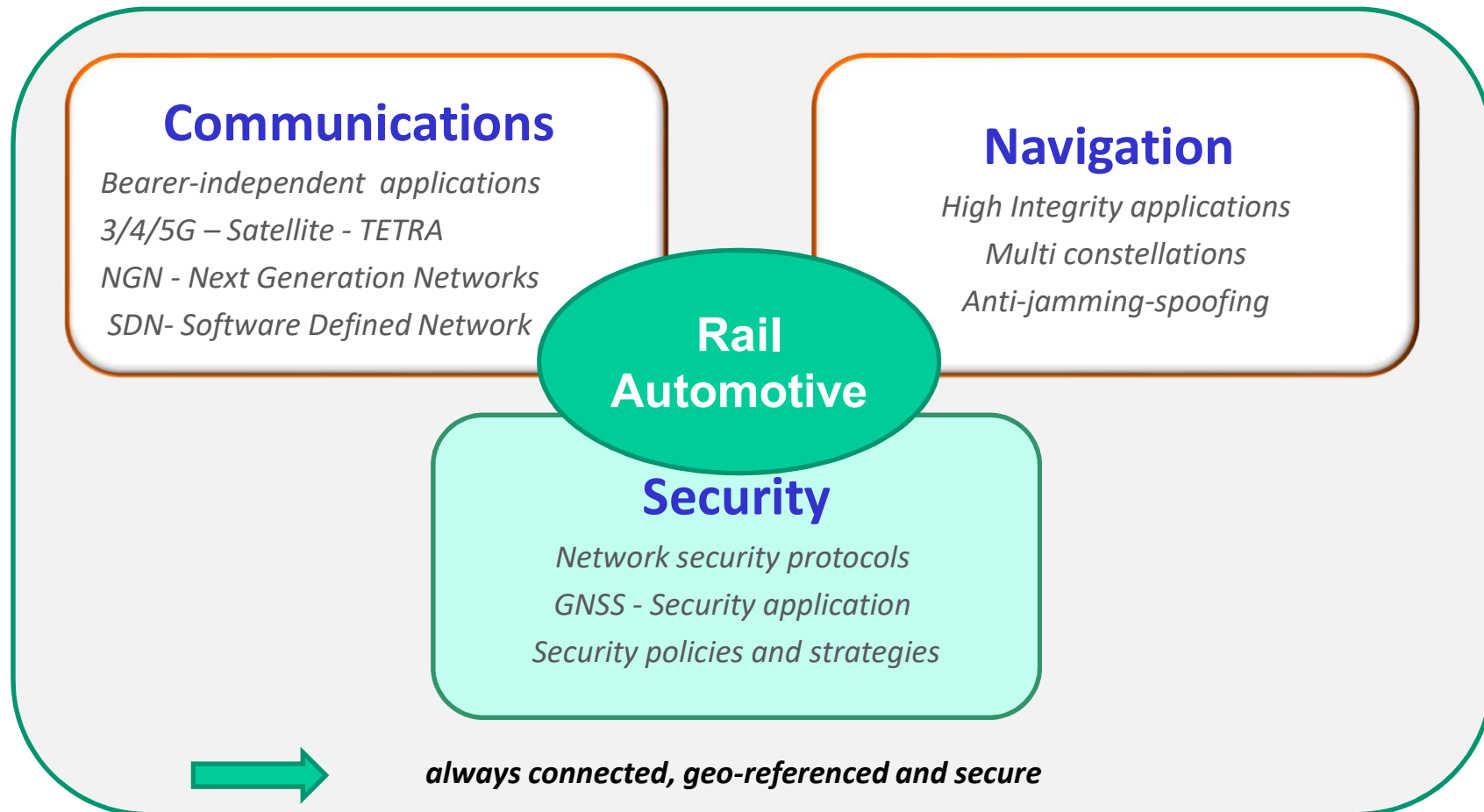
Radiolabs collaborates with:

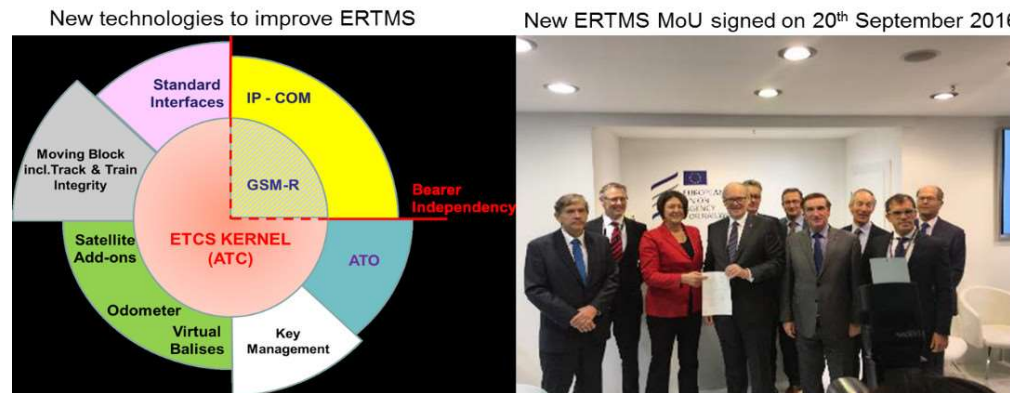# Outlook 2015 - 2020

Market status & trend
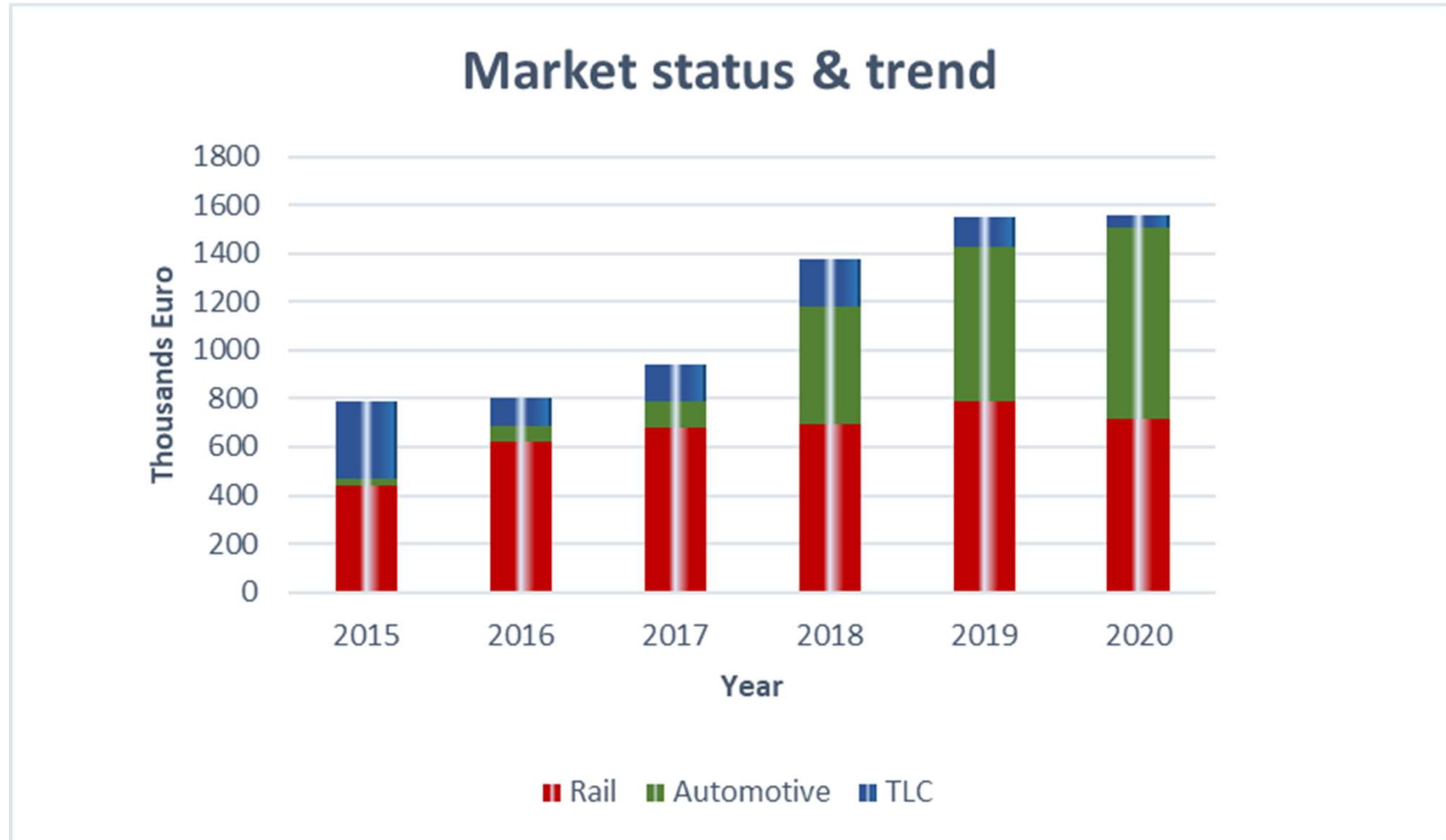
Main Projects

The RadioLabs team includes 10 staff dedicated to specific projects (PhD, Masters and Engineers) with specific skill in the areas of telecommunications, including wireless, railways communication and navigation, and new media technologies. Other 23 researchers are affiliated through the Universities. Thanks to the close relationship between University and Industry partners strongly committed to research and innovation, RadioLabs is able to set up joint teams able to gather a wide range of high level and complementary research expertise.

In the last 10 years, RadioLabs has developed research projects for a value of approximately 10 M€ and has published more than 40 Papers.

Follows a Short Description of Main Projects

ERSAT GGC

ERSAT GGC (Galileo Game Changer) innovation project represents a fundamental contribution to the roadmap of the ERTMS for the adoption of the EGNSS satellite technology, already identified as one of the game-changer technologies of the ERTMS evolution. Particular focus is given to the certification process of the satellite assets to allow the ERTMS to operate seamlessly with Virtual Balises which are functionally equivalent to the physical balise in order to ensuring the end to end compatibility with the ERTMS. ERSAT GGC is linked with previous projects achievements on ERSAT EAV, NGTC, RHINOS and STARS co-funded by GSA and EC. The objective is to create a unique flow of information to bear fruits on the best exploitation of the EGNSS infrastructures already available and the new game-changer features of GALILEO that is expected to be fully operational by 2020.

New technologies to improve ERTMS

New ERTMS MoU signed on 20th September 2016

ERTMS platform → *Game Changers*

Develop ERTMS game changers compatible with the actual specification: • ATO (incl. ATS interface) • Level 3 • Satellite Integration • Future radio & Coexistence	SNCF supported by DB, FSI,.. DB supported by SBB FSI DB supported by UIC	Early implemented in 2020

Ref: Roadmap CER-UIC Sept.2016

EMERGE

EMERGE is a strategic initiative aiming to **develop & validate the enabling technologies for the Connected Car**:
➤ Develop and validate the enabling technologies;
➤ Deploy a living test bed with **5G** and **GALILEO**;
➤ Develop & test the electronic horizon platform for Level 3 automation;
From the implemental and experimental points of view, it is planned to equip a fleet of commercial vehicles with a platform that integrates the most accurate geo-localization, connectivity and cybersecurity solutions for the prevention of hacker attacks, to enable advanced dynamic navigation functions and security.

DB4RAIL
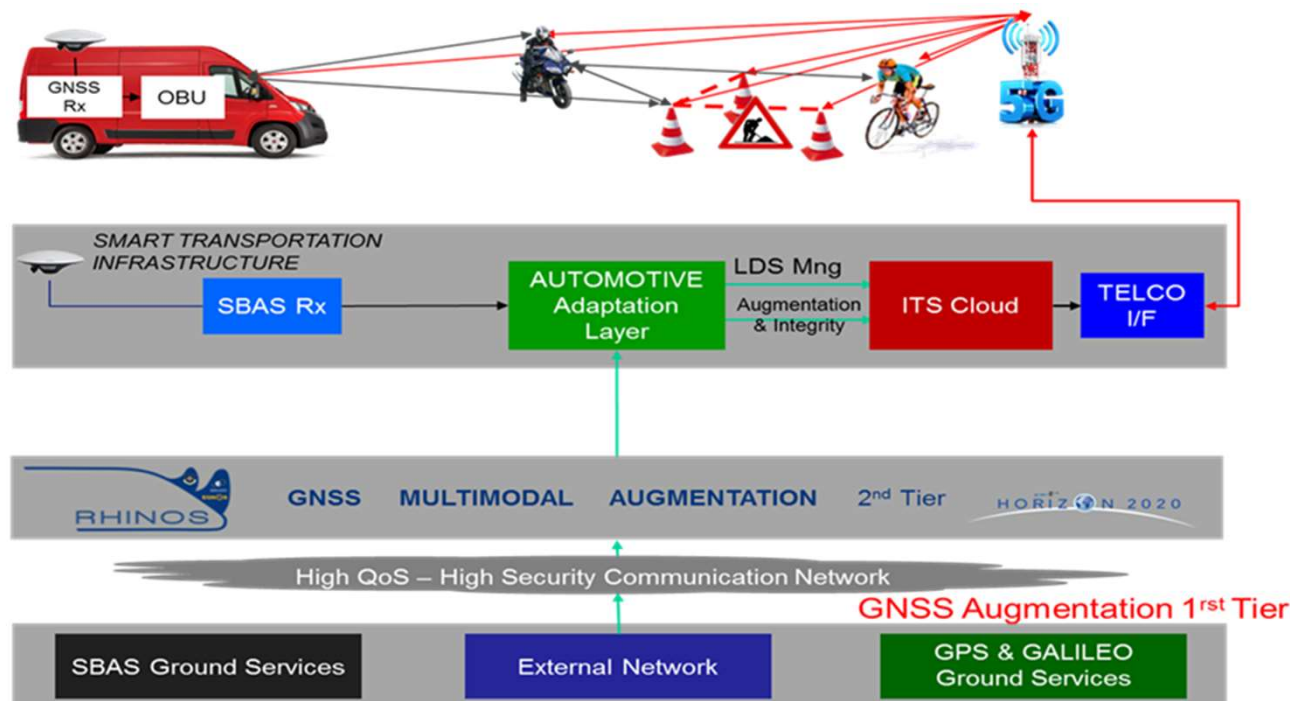
The Digital Beamforming for RAIL project aims to design, develop and prototyping a Digital Beamforming Platform coupled with advanced GNSS signal processing techniques for high rejection of GNSS interfering and counterfeit signals, fully exploiting the characteristics of the railway context, in order to support the evolution of the LDS based on GNSS in European ERTMS/ETCS.

Currently, no commercial anti spoofing and anti-meaconing solution has been designed for the railway context.

The proposed solution exploits both beamforming interference rejection capability and a DSP and Navigation stage spoofing mitigation operating in the temporal domain based on the tracking channels correlators. During the project, a 4-element antenna array and the RF front-end based on COTS components has been assembled, in order to support the development and test of the time-space adaptive beamforming, and the DSP and Navigation stages.
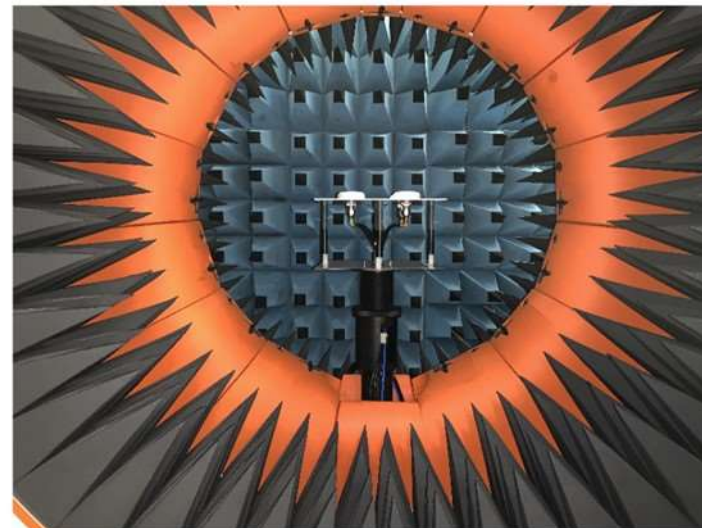
GATE4RAIL

GNSS Automated Virtualized Test Environment for Rail (GATE4Rail) deals with tasks TD2.4 and TD2.6 of the Shift2Rail Multi Annual Action Plan. Particularly, its main goals are: i) achieving a realistic characterization of the environment in terms of railway and GNSS infrastrustructures able to evaluate the performances and properties of some fail-safe train positioning components in nominal and fault conditions; ii) defining a common test process framework for zero on-site testing instead of testing on-site saving effort and time.
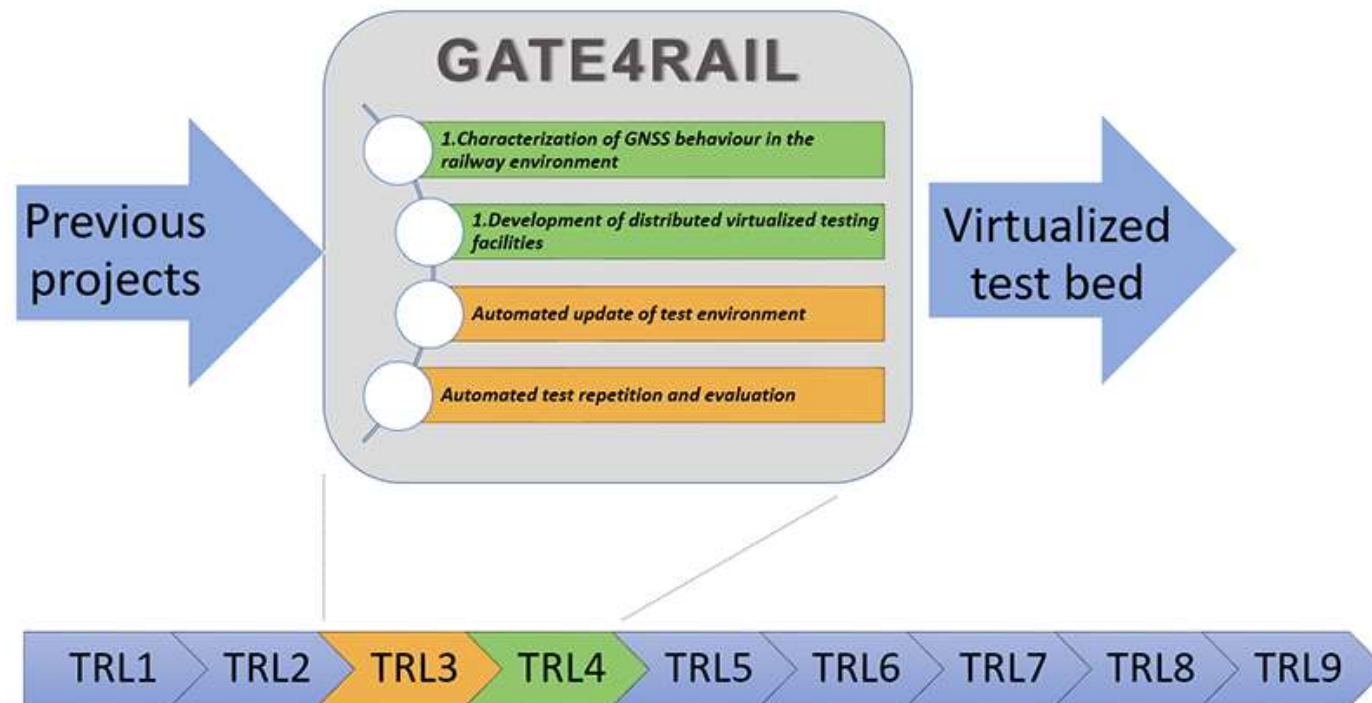
VIRGILIO

VIRGILIO is the latest simulation tool for high integrity GNSS applications in the land transportation domain. With flexible and customizable interfaces for the input data, VIRGILIO has everything going for supporting the design of augmentation networks. VIRGILIO is transparent to the input sources allowing the acquisition of GNSS data from field equipment and the synthetic generation representing the raw observations of the GNSS receivers at any earth location and at any time. Accurate navigation data can be downloaded from IGS or synthetically generated and used to improve the quality of the synthetically generated observables. VIRGILIO's main capability is the accurate simulation of the GNSS location determination system as well as the impact of local faults due to communication channels, multipath and Electromagnetic Interference (EMI).
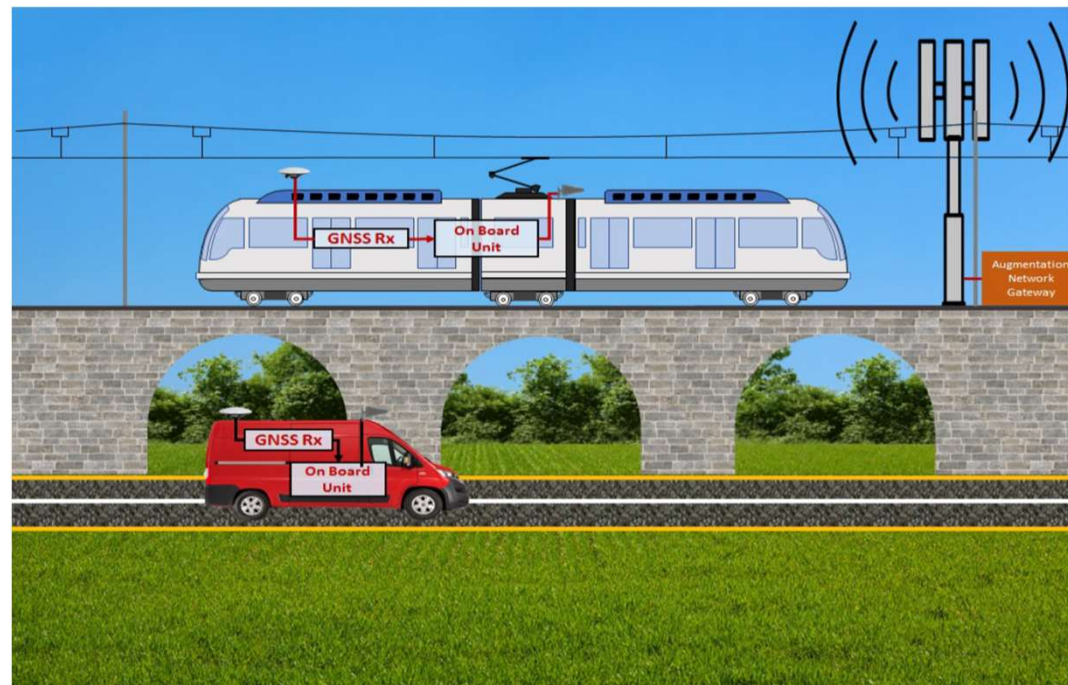
RHINOS

The RHINOS will develop candidate concepts for the provision of the high integrity needed to protect the detected position of the train:

➢ **EGNSS (GPS and GALILEO**) plus the SBAS constitute the reference infrastructure that is available worldwide. In addition to that, local augmentation elements, ARAIM techniques and other sensors on the train are the add-on specific assets for mitigating the hazards due to the environmental effects which dominates the rail application.

➢ **International cooperation with the Stanford University** researchers that have been involved in the aviation application since the birth of the GPS. They have indisputable knowledge of the GNSS performance and high-integrity applications.

➢ Ambition is a **global solution** a step beyond regional GNSS platforms.
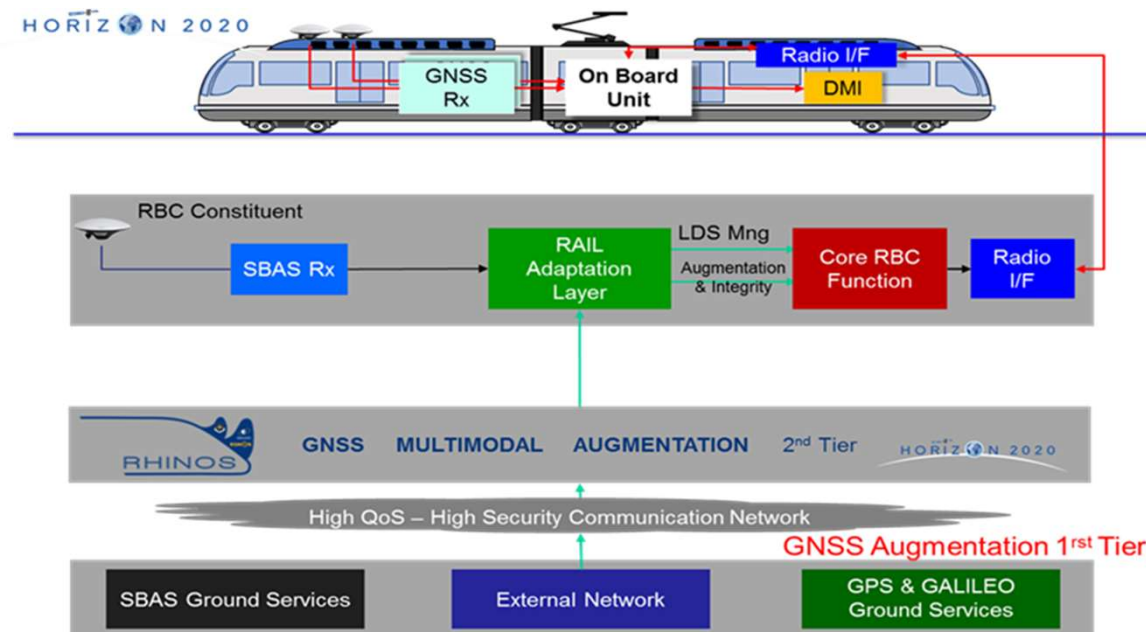
ERSAT EAV

The main **ERSAT EAV** objective is to verify the suitability of EGNSS as the enabler of cost-efficient and economically sustainable ERTMS signalling solutions for safety railway applications.

The outcome of ERSAT-EAV is a priority for reusing the ERTMS standard architecture to satisfy the needs of the regional and local lines and for supporting the UNISIG Satellite Positioning Working Group that has been created (June 2012) to specify and standardize the application of the satellite positioning for the harmonization with the European ERTMS standard, by implementing and testing the solution on a pilot line as reference.