

# sae-r®



## ADVANCED RAILWAY AVLS/PIS PLATFORM

**sae-r® meets the main needs of the railway transport operators:** service planning according available resources, permanent fleet monitoring, real-time management, information to passengers (on-board and at stations) and statistical exploitation of recorded information.

**sae-r®** is oriented both to passenger and freight transport operation.

**sae-r®** roll call of clients include **national operators** (freight and passenger transport) as well as **operators of urban railway networks** in countries such as Spain, Morocco, Poland, Taiwan or Australia.

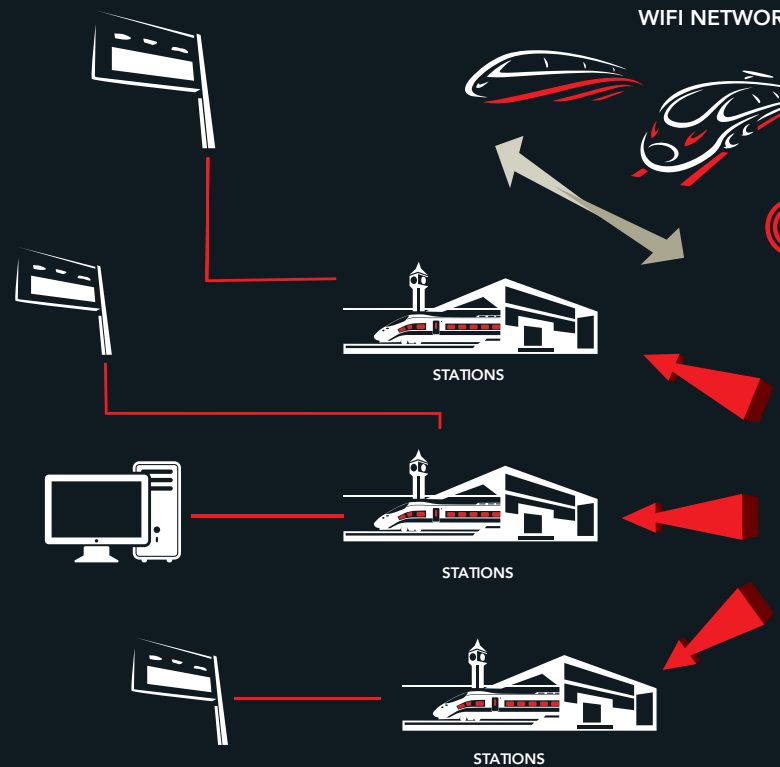
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**gmv®**  
INNOVATING SOLUTIONS

## ARCHITECTURE (ON-BOARD)

- Modular architecture, providing high scalability in the system
- The on-board basic elements are: On Board Unit (OBU), Human Machine Interface(s) (HMI) for the driver and (multiband) antenna. Other optional devices/systems can be added, such as: RFID readers and tags, passenger information elements (LED panels, TFT monitors, PA devices)
- Several OBU families are available, from simple microcontroller-based devices to high performance CPU platforms
- Multiple wireless communication interfaces are used: TETRA, Wi-Fi, cellular, satellite. Built-in redundancy is provided



## PRODUCT HIGHLIGHTS

**Precise rolling stock real-time positioning** by means of an advance multi-source algorithm that combines inputs from RFID tags, odometer, GPS, open-doors and active cabin signal. **sae-r**® precise positioning feature sets the ground for the generation of accurate passenger information.

**Multi-interface communications.** **sae-r**® supports the following communication technologies: TETRA, Wi-Fi, cellular (up to 4G/LTE), GSM-R, satellite. Automatic management of each interface and automatic switching between them (built-in redundancy). Protocols optimized to minimize bandwidth use.

**Interoperability** both on-board the trains and in the Operations Control Centre. GMV's **sae-r**® has been successfully integrated with the main rolling stock manufacturers' TCMS. Additionally, **sae-r**'s back-end communicates with corporate ERPs to exchange information on staff's working hours as well as rolling stock availability and usage.

## OPERATIONS CONTROL CENTRE

### SERVICE PLANNING & ASSIGNMENT

GMV's **sae-r**® is able to deal with different sources in order to input the timetables and planning information. The services can be planned on a planning tool supplied with the system or they can alternatively be imported from standard format files (Excel, cvs, ...) as well as retrieved from third party systems.

Services are assigned daily to available rolling stock, and can be modified in real-time during the day.

### SERVICE REGULATION

The aim of regulation functions is to **correct deviations arisen during the service**, keeping the trains as close as possible to the programed timetable or alternatively maintaining a given quality level of service, minimizing dead times.

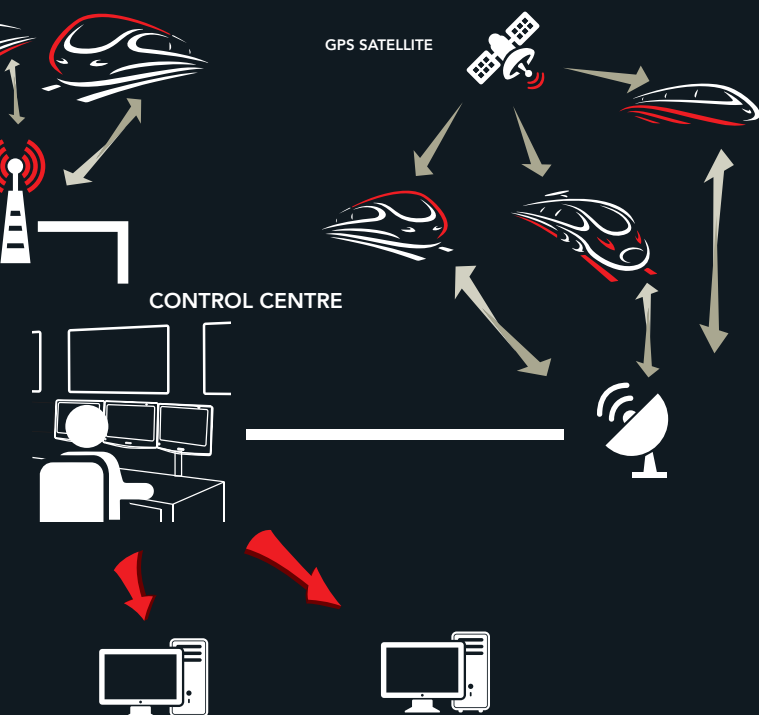
A **wide set of regulation actions** (planning modifications, swap of resources, commands to driver) are available to cope with the usual situations in the operation.

**sae-r**® supports both **timetable and headway regulation modes**. Provided an eventual loss of connection between the train and OCC, the OBU is autonomous to operate in timetable regulation mode.

### REAL-TIME FLEET MONITORING

Position of every train is updated typically every 5 seconds, while asynchronous events are updated immediately.

WORK IN DEPOTS



## ARCHITECTURE (GROUND)

- At Operations Control Centre (OCC), a hot standby redundant cluster architecture is usually proposed. Alternatively, a virtualized system into an existing server platform can be provided.
- Two kinds of workstations are available. A **desktop version**, in client-server configuration, with a higher performance and intended for daily intensive fleet monitoring. And a **web-based version**, intended to provide a reduced group of functions from any web browser with authorized connectivity.
- Different types of Information Panels provide the passengers at stations with information about the service. LED and TFT technologies are mainly proposed.
- Communications for panels at stations: Ethernet (copper and optic fibre), cellular (GPRS, 3G, HSPA, 4G/LTE) and TETRA.



**sae-r's innovative interfaces** offer different views to represent trains and stations in real-time (i.e. GIS, classic synoptic, vertical synoptic view). Every view implements **specific graphical tools** to manage its elements.

The **depots synoptic view** provides depot managers with critical information about the trains that are parked in each track as well as their order, necessary to take the right dispatching decisions.

## ALARMS AND EVENTS

**sae-r**® manages a **wide array of alarms**, such as HW failures (rolling stock, **sae-r**® HW and other interfaced systems), regulation alarms (advance, delay...), service alarms.

A **panic button** may be connected to the OBU in order for the driver to activate the panic alarm. Through its activation, the panic alarm triggers the transmission of the sounds from the train cab to the OCC.

The **speed warning system** alerts the driver by means of visual and audio signals when the train exceeds the current location's speed limit or speed profile.

## REPORTS AND STATISTICS

A set of reports is offered to **cover the needs of railway operators**: driving quality, occupancy, communications, alarms, punctuality along the service, among others.

Generation of operation reports is based on: speed profiles, advance/delay at set points, on-board monitoring elements, passenger occupancy figures.

## TRAIN ON-BOARD SYSTEM

### TECHNICAL CHARACTERISTICS

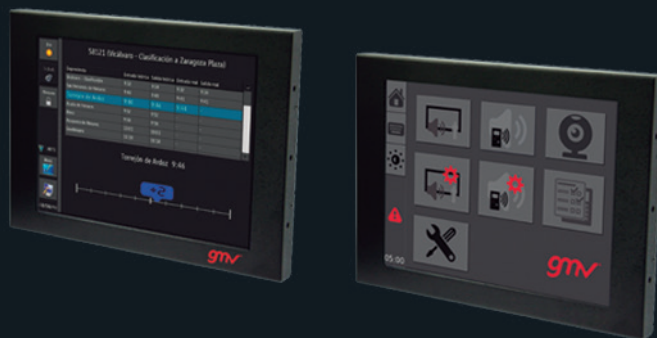
All hardware certified according to EN50155, EN50121-3-2, EN61373 and support nominal voltages: 24, 48, 72, 110 Vdc, according to EN50155.

GMV's in-house hardware design and development capabilities ensures our ability to offer different models of OBU, Audio Matrix and Information Panel Controller in order to suit customer needs.

### HUMAN MACHINE INTERFACE

The HMIs are **rugged touch screens** located in both cabins to provide the driver with the followings functions:

- Bi-directional OCC to driver text messaging
- Voice communication control
- Service information
- Reception of regulation commands
- Control of passenger information system
- Document viewer
- Monitoring and diagnosis information
- Speed profile information and warnings



### VOICE COMMUNICATION

sae-r<sup>®</sup> rounds its value proposition of functionalities offered on-board the trains with the seamless management of the following **voice communication modes**:

- Driver <--> OCC
- Driver --> OCC (panic alarm)
- OCC --> passengers (OCC to PA)
- Passengers <--> OCC (emergency intercom)

### PASSENGER INFORMATION

**Accurate real-time information is generated for passengers**, combining information from different sources: real-time positioning, service information, speed profiles (per type of vehicle, per segment).

The visual information is made available through different media, on-board, at stations and terminals (LED displays/ TFT monitors), customized webs, mobile webs and mobile APPs. For improved accessibility to the information, GMV's sae-r<sup>®</sup> also manages recorded or synthesized audio messages to be reproduced on public address systems.



### INTERFACING WITH OTHER SYSTEMS

sae-r<sup>®</sup> interfaces with a huge variety of systems, both in OCC and on-board.

- In OCC: CTC systems, planning/assignment tools, communication systems, SCADA, are some of the systems usually interfaced. Open XML or proprietary protocols.
- On-board: following systems are interfaced: P.I.S., PA, intercom, traffic priority, ticketing, passenger counting, diagnosis, energy metering, CCTV and JRU systems. Ethernet, RS485, USB, MVB, IBIS, CAN interfaces are used.