Europe's Rail

Co-funded by the European Union

FP6-FutuRe

Cost effective regional lines

Europe's Rail Flagship Project 6

Delivering Innovative rail services to revitalise capillary lines and Regional rail services

Info, News and Public Project Deliverables @:

https://projects.rail-research.europa.eu/eurail-fp6/

EU-Rail Multi-Annual Work Programme

Network management planning and control & Mobility Management in a multimodal environment

Digital & Automated up to Autonomous Train Operations

Intelligent & Integrated asset management

A sustainable and green rail system

Digital Enablers

Innovation on new approaches for guided transport modes

+ Exploratory Research and other activities

Regional rail services / Innovative rail services to revitalise capillary lines

Decreasing cost while offering a high quality of service and operational safety + increase customer satisfaction and attractiveness

Sustainable Competitive Digital Green Rail Freight Services

FutuRe in a nutshell – Key highlights

Project motivation

- Regional railway plays a crucial **role in Europe´s regions** and **as feeder lines for or passenger and freight traffic** for the main network and has an essential function **as green transport** as well as **connecting other public transport services** (e.g., bus) and first & last mile services (e.g., bike sharing, cycling, walking or car) to travel from/to railway stations **to remote locations**.

A clear project goal

To tackle these challenges and develop solutions the project FutuRe - Future of Regional Rail – has the following goals:

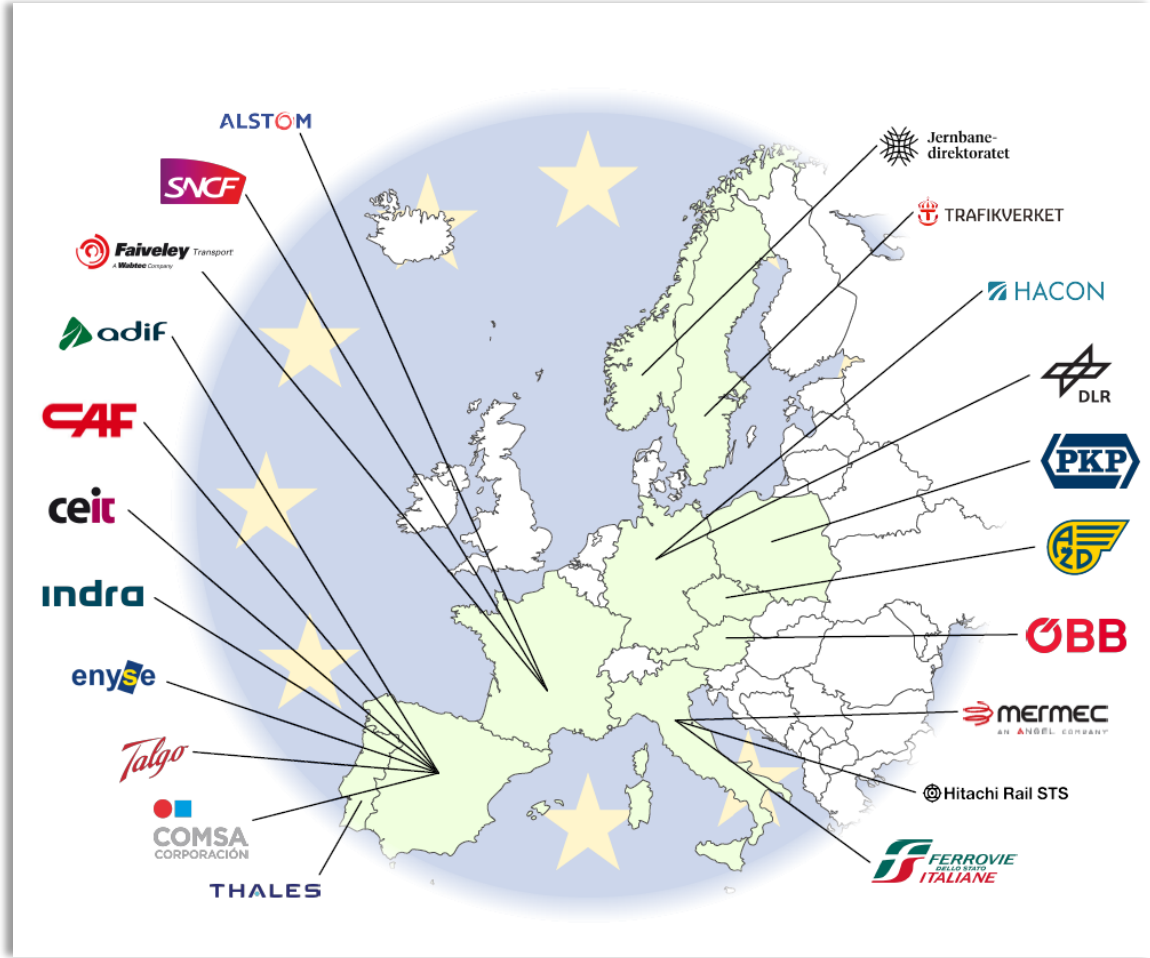
- ➢ **Lowering CAPEX system costs,**
- ➢ **Lowering OPEX,**
- ➢ **Increasing productivity** (unit costs per train kilometer),
- ➢ **Improving customer satisfaction**

for G1 Lines (i.e., TSI subjected)

for G2 lines (i.e., non TSI subjected)

FutuRe in a nutshell – Key highlights

A strong consortium with more than **21 partners**, including RU/IM and leading industry partners as well as plus over **30 affiliated entities** and subcontractors ensuring that project results will be achieved.



FutuRe in a nutshell – Key Highlights

12 Work Packages – with all technical WP linked to a demonstrator WP - to secure a solid delivery of all project results.

WP1: Project Coordination & **WP12: Communication & Dissemination**

WP2: Regional Rail System Solutions

- Defining the needs of regional lines and development of system architecture.
- Architecture and functional requirements for all WP and KPI achievement monitoring.

WP3 & WP8: Regional Rail CCS & Operations

- Preparatory work for ATO activities in different GoA, ETCS L3 demos, TMS demos, train positioning/integrity/length detection which will be demonstrated and tested.

WP4 & WP9: Regional Rail Assets

- Requirement specification for wayside assets (e.g., energy self-sufficient level crossings, switches), communication, connection between trackside/trackside and trackside/field devices, obstacle detection and their demonstration.

WP5 & WP10 Regional Rail Rolling Stock

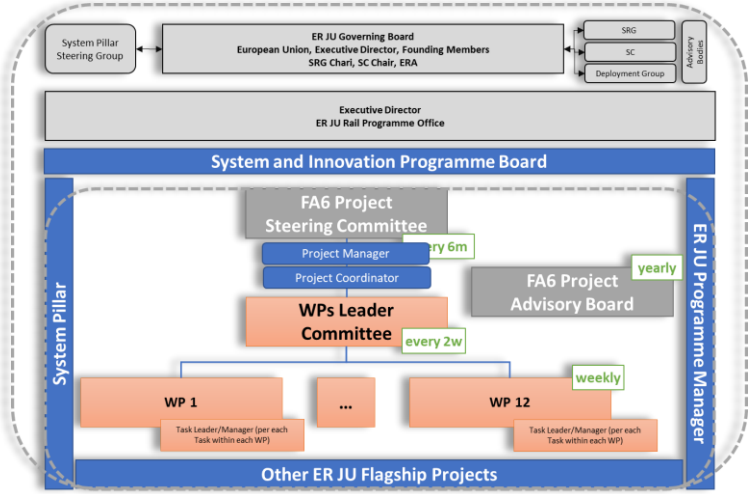
- Development of a cost-efficient vehicle concept (incl. traction/propulsion) and multimodal fuelling station as well as development and demonstration of CCS technologies for G2 lines.

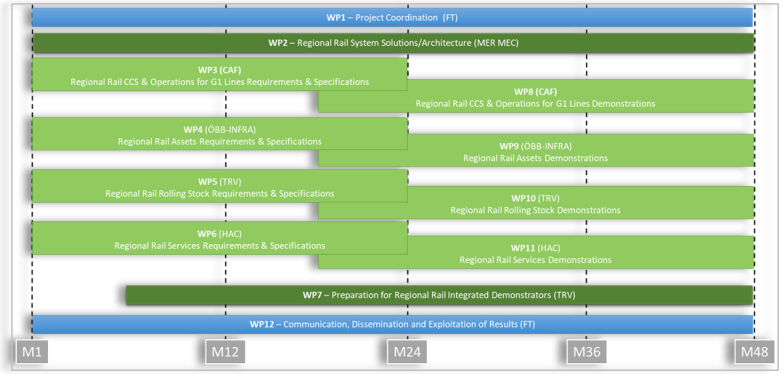
WP6 & WP11 Regional Rail Services

- Development and testing of multimodal travel solutions, integration of demand responsive transport services (incl. for PRM), integration of TMS and passenger information (incl. freight)

WP7: Preparation for Regional Rail Demonstrator

- Preparatory actions for demonstrations in particular for a fully integrated demonstrator under operational conditions in the following projects (e.g. mapping test sites, implementation plan)





FutuRe: final by 2026

Regional Railway System (CCS & Operations) Demonstration

- Demonstrate a single integrated Operations Control Center (OCC)
- Demonstrate a specific application for Traffic Management Systems for regional lines

Assets Demonstration

- Demonstrate a systemic approach with the implementation of different railway assets for cost-efficient wireless, energy self-sufficient wayside components

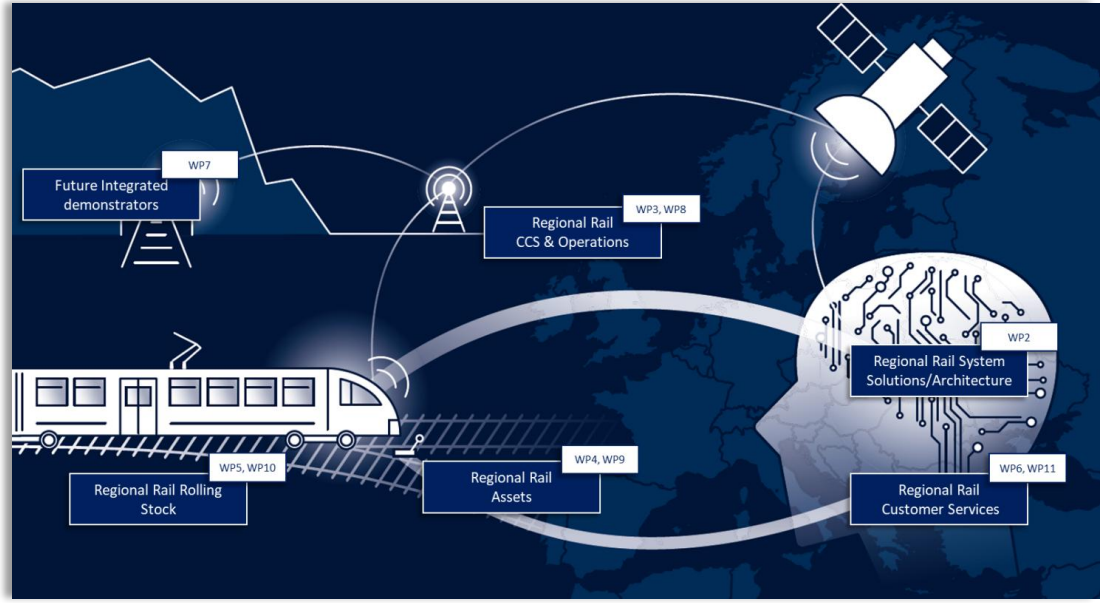
Suitable Customer Services

- Demonstrate cost-efficient integration of on-board information of multimodal services integrating regional multimodal services such as carsharing
- Demonstrate passenger congestion rate monitoring, flow optimization application as well as a low-cost passenger information system for regional services

Integrated demonstration tests

- To ensure that solutions can be tested and demonstrated in an integrated approach, necessary work to demonstrate a fully integrated demonstrator under operational conditions – in a succeeding project call - will be carried out.

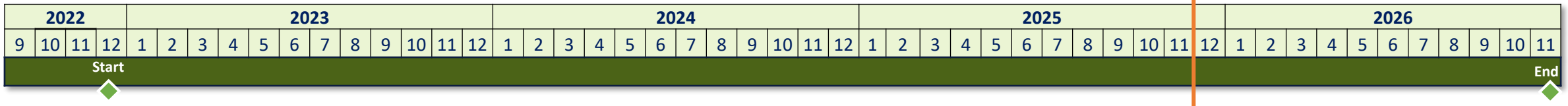
70 deliverables in scope, more than 90% of them are Public



Flagship Project 6 - FutuRe

Status @ November 2025

From concept to demonstration



Regional Railway System (CCS & Operations)

"G1 interop."

"G2 non-interop."

Y1 to Y2

Nine **(9)** deliverables addressing **Requirements, Architecture, Use Cases** for

- ATO
- ETCS
- Traffic Management Systems,
- High Precision Fail-Safe positioning
- Train Integrity/Length.

Y3 to Y4

For all these technical topics **18 demonstrators** involving **11 partners** in **5 countries** (TRL up to 5, lab and track based)

Assets and Infrastructure

"G1 interop."

"G2 non-interop."

Y1 to Y2

Five (5) deliverables addressing **Requirements, Architecture, Use Cases** for

- Wayside Asset
- Communication Infrastructure

Y3 to Y4

For all these technical topics **9 demonstrators** involving **12 partners** in **7 countries** (TRL up to 5, lab and track based)

Suitable Customer Services

Y1 to Y2

Nine (9) deliverables addressing **Requirements, Architecture, Use Cases** for services dedicated to

- Multimodality
- TMS-PIS integration
- Passenger Congestion Monitoring
- Freight.

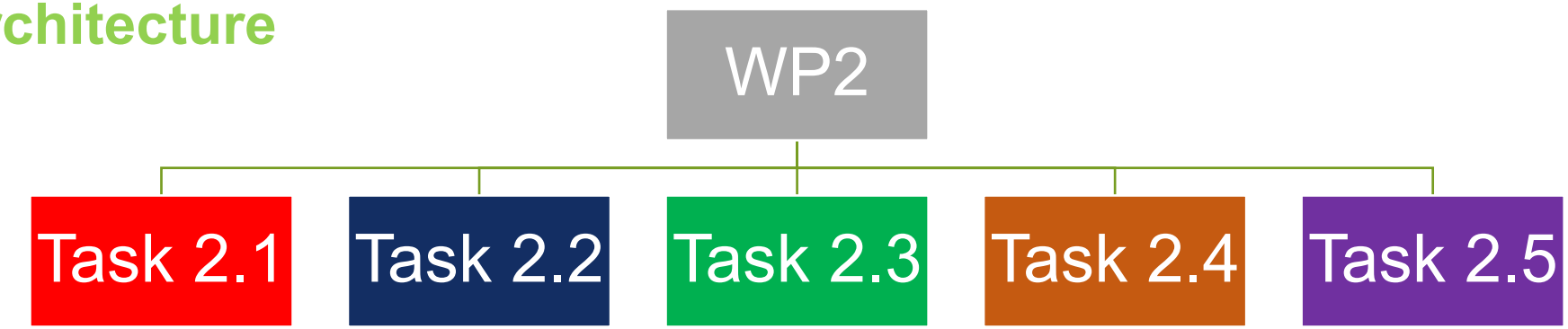
Y3 to Y4

For all these technical topics **4 demonstrators** involving **7 partners** in **3 countries** (TRL up to 6)

Flagship Project 6 - FutuRe

WP 2
Regional Rail System Solutions/Architecture

WP2 -Regional Rail System Solutions/Architecture



Task 2.1: Architecture requirements
Task 2.2: Regional lines operational and functional requirements
Task 2.3: Verification of KPI achievement
Task 2.4: Safety and security analysis
Task 2.5: Regional migration strategy

These five tasks are the reference for the FP6 “domain-specific” WPs, which ultimately lead to a **harmonized solution** for each regional line. the interconnection and interaction between these 5 tasks is physiological and necessary.
WP2 includes **all the FP6 partners** because it represents an area of comparison between the various technical solutions developed.
These five areas are also, due to their specificity, necessary to **interact** with the technical components present in the other **Flagship Areas and in the System Pillar**.

WP2 - Task 2.1: Architecture requirements

Objective: *Provide comprehensive architecture requirements for regional lines including CCS as well as for multimodality. A continuous interaction with the System Pillar is needed*

Formal and informal interactions with the **System Pillar** are very frequent as it is responsible for defining the architecture of the entire European railway system.

Up to now, a high-level architecture has been created that is able to harmonise the needs coming from the railway world with the objectives of **reducing costs (OPEX & CAPEX)**. Five areas of research (related to the project WPs) have been identified including the reciprocal functional interactions characterising them:

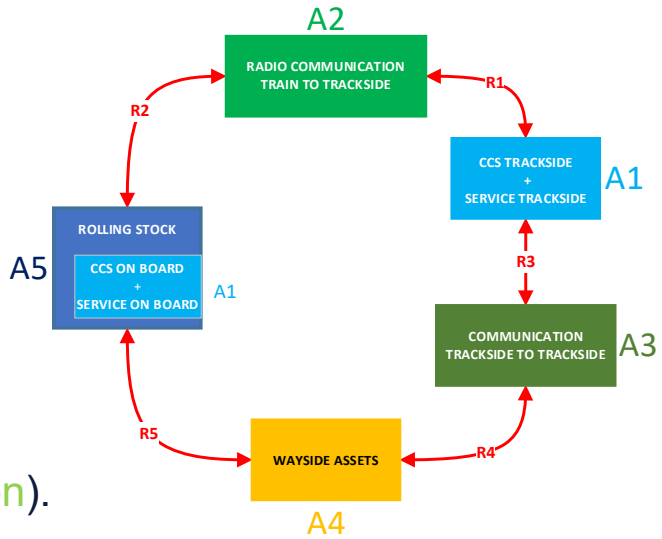
A1. CCS and Service Architecture;

A2. Train-to-trackside Communication Architecture;

A3. Trackside-to-trackside Communication Architecture;

A4. Wayside Assets Architecture;

A5. Rolling Stock Architecture.



The output of this task is the FutuRe D2.1 deliverable(currently at its 3rd preliminary version).

D2.1 final version is scheduled for the end of the project and will incorporate feedback from demonstrator activities to verify the feasibility of the proposed solution.

both G1 and G2 Lines, with parallel developments, are in scope to this task

WP2 - Task 2.2: Regional lines operational and functional requirements

Objective: *Continuous analysis of operational and functional of regional lines resulting into a consolidation of operational and functional requirements of the regional rail system*

Up to now, a set of specific requirements (**Operational, Functional and Non-Functional**) for regional lines has been identified. The requirements cover all the areas affected by FP6 developments.

This set of high-level requirements is continuously evolving, taking into account the feedback from demonstrator activities. Many of these have been consolidated.

A traceability matrix between the requirements in WP2 and those developed in the other WPs is evolving and consolidating, allowing for feedback on the degree of requirements coverage.

The output of this task is the FutuRe D2.2 deliverable (currently at its 3rd preliminary version).

D2.2 final version is scheduled for the end of the project and will incorporate feedback from demonstrator activities to verify the feasibility of the proposed solution.

both G1 and G2 Lines are in scope to this task

Operational Requirements	Contains all the Regional Line operation requirements
Functional Requirements	Reports the Regional Functional Requirements
Non-Functional Requirements	Reports the Regional Non-Functional Requirements
differences from SP and/or other FPs	Reports the main differences compared to the work done in other parts of the ERJU project.
Impact on TSI	Reports the impact on the current TSI

WP2 State of Art: Task 2.3: Verification of KPI achievement

Objective: *Describe the specific metrics and methods to measure and achieve impacts of the project, check the achievement of KPI for each technical solutions in each WP and write them in a comprehensive report.*

This task provides a measure of the achievement of the overall objectives of FP6.

The general rules and how to measure the achievement of the KPIs assigned to each demonstrator have been defined.

These can be assessed **quantitatively or qualitatively**.

The output of this task are the FutuRe D2.3 and FutuRe D2.6 deliverables.

Task 2.3 is waiting to receive test results from each demonstrator, confirming the degree of achievement of the assigned KPIs.

SEO/KPI / Items	1	2	3	4	5	6	7	8	9	10	11	12
ATO on G1 lines					X	X	X					
ETCS L3 on G1 lines	X		X	X	X			X				
Traffic Management System on G1 lines					X		X					
Absolute Safe Train Positioning on G1 lines	X		X	X	X			X				
Train integrity & train length on G1 lines	X		X	X	X			X				
Wireless enabled energy self-sufficient level crossings					(1)			X	X			X
Wireless enabled energy self-sufficient switches					(1)			X	X			X
Wireless connection between trackside/trackside and trackside/field devices	X				X			X				
Train-to-track communications		X			X			X	X			X
Mechanical architecture of rolling stock					X					X	X	
Traction/propulsion and energy architecture of rolling stock					X					X		
Other system elements (rolling stock)					X					X		
CCS technologies for G2 lines	X		X		X			X				
Multimodal travel solutions					X		X					
Train control system architecture (rolling stock)					X					X		

Items of FutuRe vs SEO/KPI

WP2 State of Art: Task 2.4: Safety and security analysis

Objective: *Identify security/safety problems related to the architecture to be implemented.*

It was performed an analysis of associated **hazards for safety and security** issues associated to the regional railways. All detected hazards are shared with other WPs so that mitigations can be developed.

Some mitigations are already identified; the solution are developed in conjunction with the technical FP6 WPs.

The output of this task is the FutuRe D2.4 deliverable.

The activities are in progress and the final version of the D2.4 reports all the security/safety issues elaborated.

WP2 State of Art: Task 2.5: Regional migration strategy

Objective: *Identify a common core of migration strategies rules valid for all lines, ensuring that all solutions can be also migrated.*

It was started to analyse for each **developed demonstrator** the **migration strategy** to be applied.

The approach followed partially solve the aspect that may be differences between the lines taken into consideration.

The proposal provided include a migration plan to migrate developed solutions on existing lines

The output of this task is the FutuRe D2.5 deliverable.

The activities are in progress and the final version of the D2.5 reports will contain also the result of the System Pillar interaction.

WP2 State of Art: Contribution to standardization/regulation

WP2 Contribution to standardization/regulation. All the proposal are within the **interaction with the SP and other FPs**.

WP2 reports if inside the FP6 there are foreseen modification to the **TSI** or there are request for standards modification.

All possible deviations, specific to regional context, are tracked and reported in documents D2.1 and D2.2

Flagship Project 6 - FutuRe

WP 3+8

Regional Rail CCS & Operations for G1 Lines Requirements, Specifications & Demonstrations

Description and objectives of WP3

- The objective of this WP was to find suitable CCS solutions for **regional G1 lines** and define preparatory activities for demonstrators (WP8).
- Technologies:
  - T3.1: Automatic Train Operation (**ATO GoA2** and **GoA3/4)**
  - T3.2: European Train Control System L3 (**ETCS L3**)
  - T3.3: Traffic Management System **(TMS)**
  - T3.4: Absolute fail-safe train positioning **(ASTP)**
  - T3.5: **Train integrity & train length**
- Main outcomes: **Use Cases** and **Demonstrator Set-ups**
- Strong cooperation with other WPs:
  - WP2: Requirements and future expectations for G1 lines
  - WP7: To secure the proper set-up of future fully integrated demonstrators, results of this WP were transferred to WP7

Description and objectives of WP3

- Technical topics:

ATO

- Remote Driving (IM)
- Detection of Objects on the track (Industry)
- Autonomous Level Crossings (IM)
- Discretional stops (IM)
- Adhesion Management (Industry)
- ATO-OB & ATO-TS Interoperability (Industry)
- Radio holes (IM)
- …

ETCS L3

- Hybrid Level 3 (Industry):
  - Radio Holes
  - Degraded Operational Scenarios
  - Level Crossing Management
  - …
- Moving Block (Industry)

TMS

- Conflict Resolution (Industry)
- Mixed Regulation (Industry)
- Mixed Planning (Industry)

ASTP

- Speed Supervision (Industry)
- Critical Locations (IM)
- Radio Holes (IM)
- Start of Mission Procedure (Industry)
- Continuous Train Position (Industry)
- …

Train Integrity & Length

- Loss of train integrity (Industry)
- Start of Mission (Industry)
- Coupling (Industry)
- Splitting (Industry)
- …

Description and objectives of WP8

- Based on the findings of WP3, WP8 focuses on targeting the subsequent TRL:
  - Use of different **GoA of ATO over ETCS** (TRL4/5)
  - Use of different **ETCS L3** system types including **HL3** or **Moving Block** (TRL 4/5)
  - Use of **TMS** and specific functionalities applicable for regional lines (TRL 4/5)
  - Use of **fail-safe highly accurate train positioning** including integration with ETCS, use of digital maps and virtual balise concept (TRL 4/5)
  - Use of cost-effective fail-safe **train integrity** & **train length** required to any ETCS L3 implementation (TRL4/5)
- Strong cooperation with other WPs:
  - WP2: Requirements and future expectations for G1 lines
  - WP7: To secure the proper set-up of future fully integrated demonstrators, results of this WP are being transferred to WP7
- Tasks:
  - Develop and test selected use cases for demonstrators on one or more available potential locations
  - Perform tests adapted to regional lines reaching TRL5 on a representative environment
  - With at least one railway operator/infrastructure manager and at least one supplier develop, test and validate the demo
  - Deliver in a report the covered system requirement, a high-level design of the test set-up, tests specification/use cases, and tests result report.

T8.1 – ATO GoA2 Demonstrator

Demonstrator leader: CAF

Objectives:

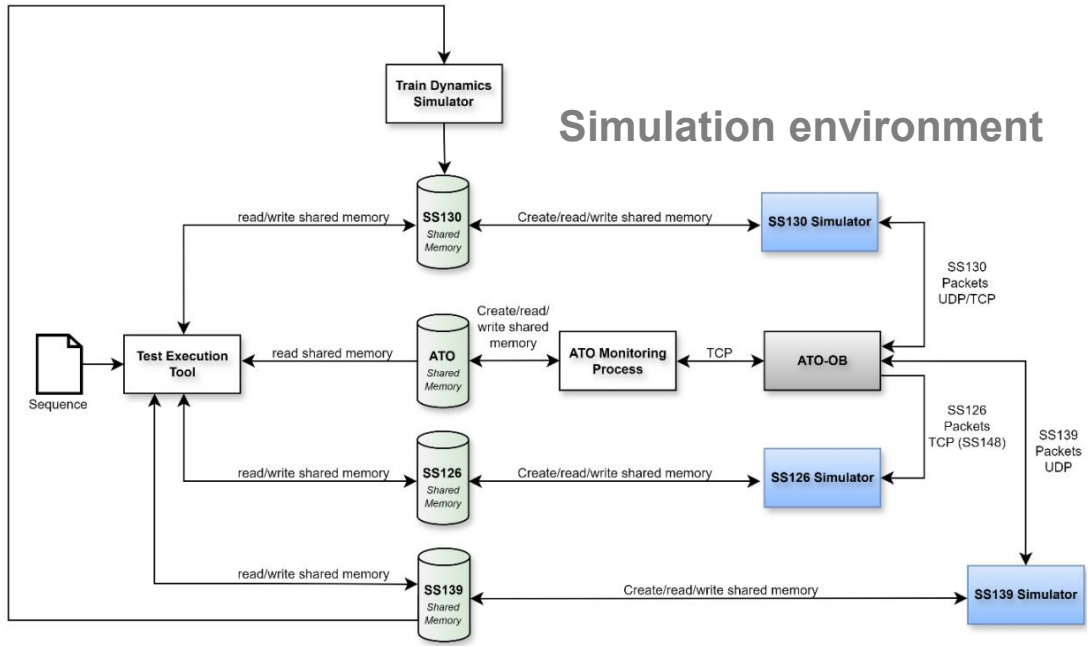
- ❑ Check that the interface between ATO-OB and ATO-TS is **technically interoperable** between regional G1 lines and main lines
- ❑ Conduct a preliminary analysis into the potential positive impact that reporting a range of **adhesion categories to ATO-OB via TCMS/Train** could have on the overall operation of a regional line.
- ❑ Analysis of **punctuality** optimization
- ❑ Analysis of **energy consumption** optimization

Link to FP6-FutuRe SEO:

- ❑ Overall reduction of OPEX and CAPEX
- ❑ Optimized energy consumption
- ❑ Optimized punctuality.

Achievements:

- ❑ Test campaign completed ✓
- ❑ Deliverable ready for review ✓



Lab testing in Spain

Reduction in energy consumption
Punctuality increase

T8.2 – Remote Driving Demonstrator

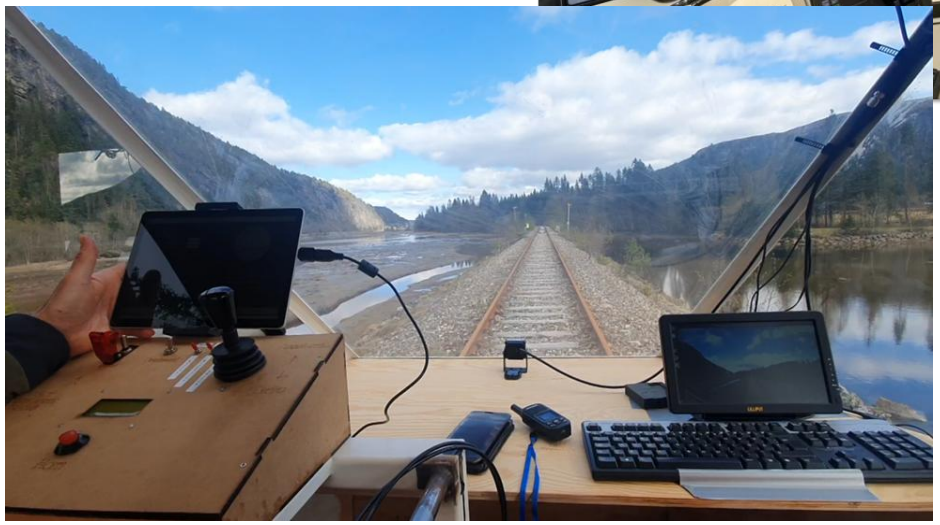
Demonstrator leaders: TRV/NRD

Objectives:
- ❑ Research into RD as an **intermediate stage prior to full ATO**
- ❑ Research into RD as a **backup/emergency option** in case of ATO failure
- ❑ Research into RD as **enabler of unmanned operation** in areas not covered by ATO

Link to FP6-FutuRe SEO:
- ❑ Overall reduction of OPEX and CAPEX
- ❑ Optimized energy consumption → Reduction of unnecessary starts and stops
- ❑ Optimized punctuality. → backup solution that takes over in case of failure

Achievements:
- ❑ Test campaign completed ✓
- ❑ Deliverable contribution ready ✓

Remote Driving Testing Environment

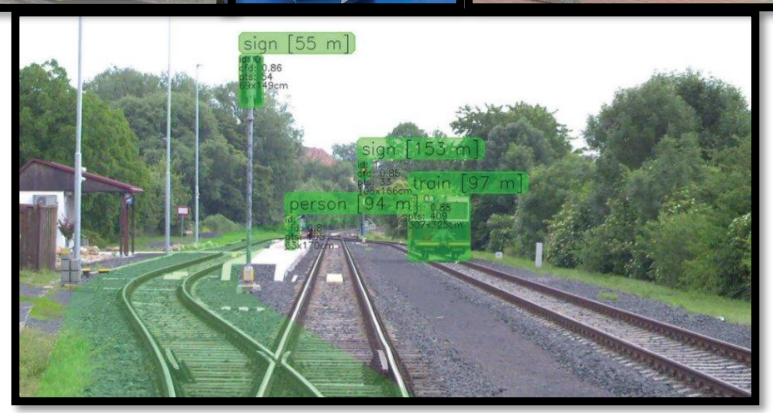


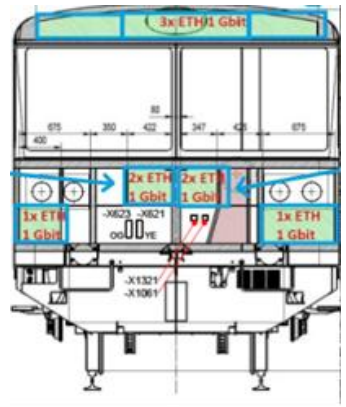
On-site testing in Sweden & Norway

Reduction in energy consumption
Punctuality increase

T8.2 – ATO GoA3/4 Demonstrators

Demonstrator leaders: AZD & INDRA





Objectives:

- ❑ Research into **stop-on-request functionality** as a tool to:
  - ❖ Improve punctuality
  - ❖ Optimize braking curves, which can be translated into a reduction in energy consumption
- ❑ Research into **replacing or complementing human perception** in the context of typical operational scenarios on regional lines:
  - ❖ Unprotected level crossings
  - ❖ Unexpected incursions into the track
  - ❖ Fire/parking lot near the track
- ❑ Research into ATO performance when radio outages occur (**Radio Holes**)

Link to FP6-FutuRe SEO:

- ❑ Overall reduction of OPEX and CAPEX
- ❑ Optimized energy consumption
- ❑ Optimized punctuality.

Status:

- ❑ Laboratory preparation in progress

On-site testing in Czech Republic
Lab testing in Spain

Reduction in energy consumption
Punctuality increase

T8.3 – HTD and MB Demonstrators

Demonstrator leaders: CAF, ALSTOM, INDRA, MERMEC

Objectives:

- Research into **HTD** and **MB** implementations as tools to reduce infrastructure cost:
  - Reduced implementation of trackside train detection devices
  - Reduced implementation of fixed balises for relocation purposes

Link to FP6-FutuRe SEO:

- **Increased system availability** due to reduced trackside asset failure and more reliable CCS
- **Reliable cost-effective** fail-safe on-board train integrity, train length detection and train positioning
- Overall **reduction of OPEX and CAPEX**
- **Reduced OPEX costs/km** for trackside railway assets

Status:

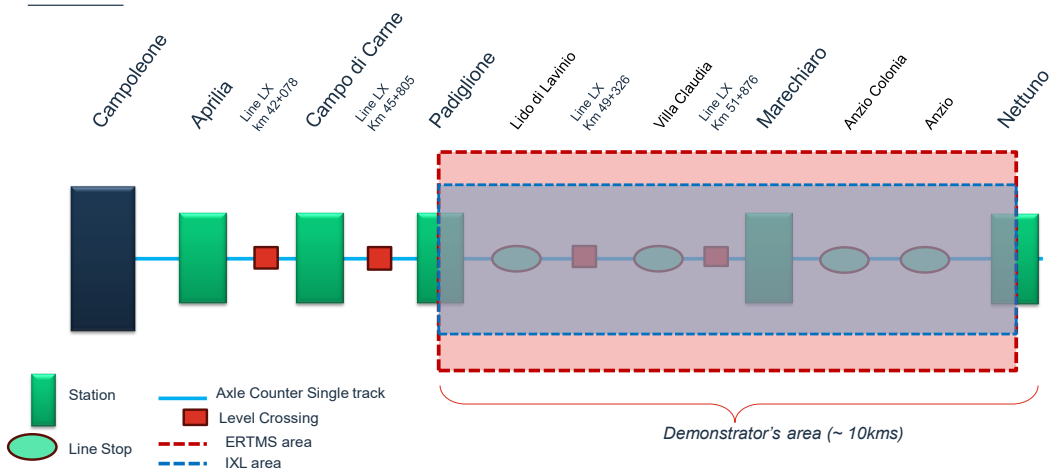
- Laboratory preparation in progress

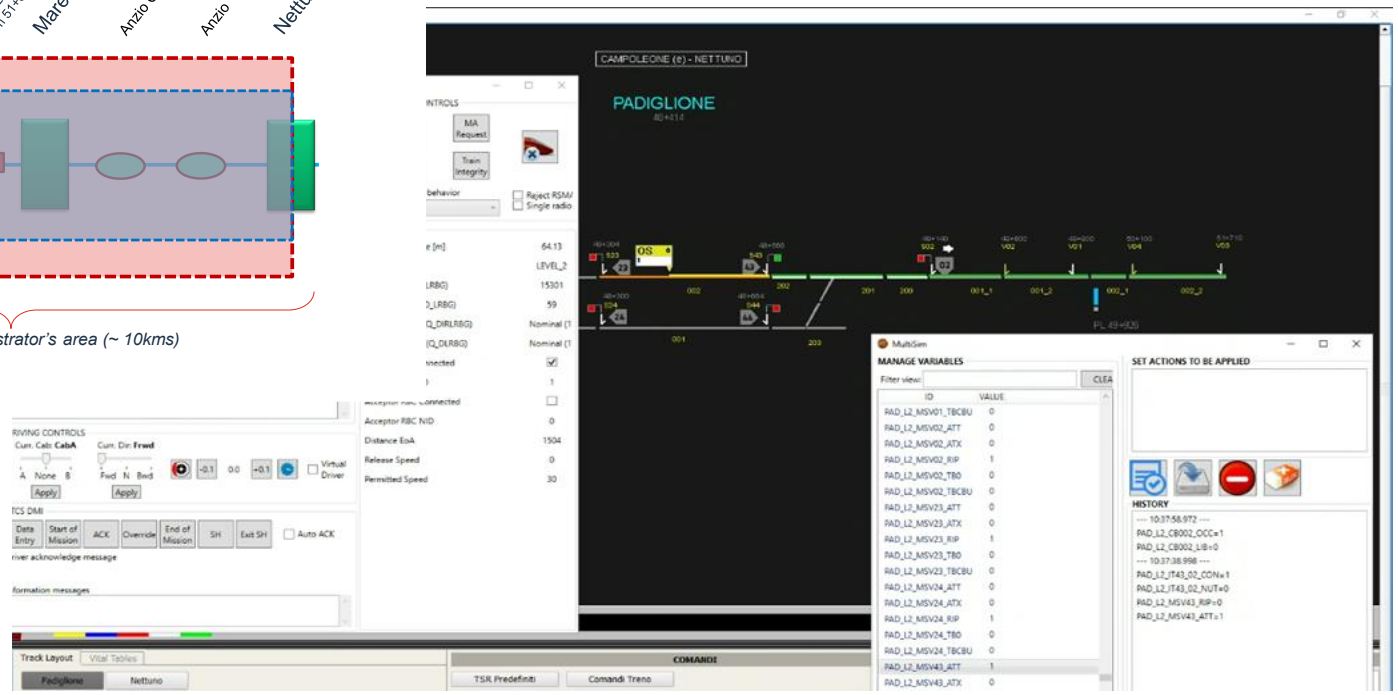
Lab testing in Spain & Italy
On-site testing in Italy

Reduction of infrastructure related cost

T8.3 – HTD and MB Demonstrators

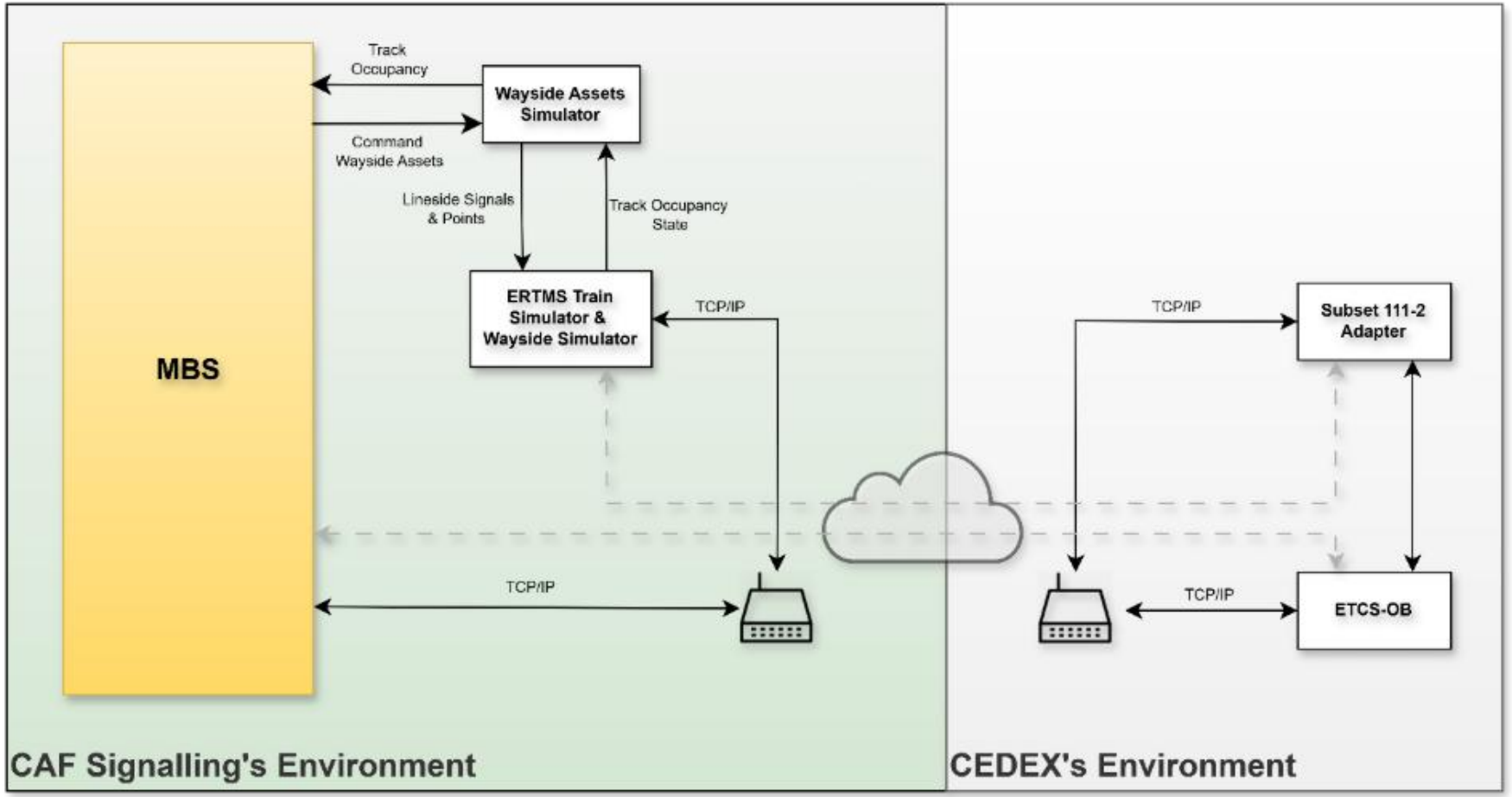
HTD Demo – Target regional line





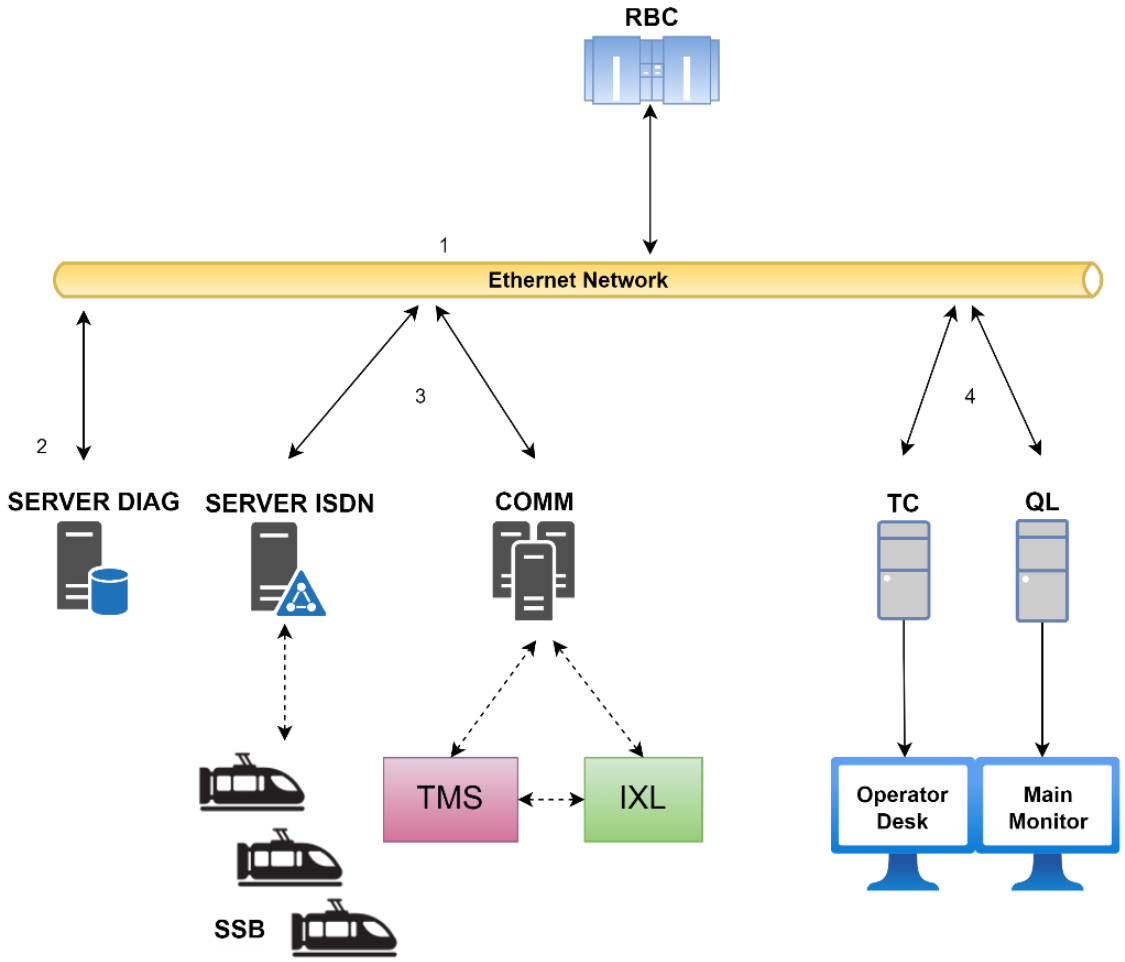
T8.3 – HTD and MB Demonstrators

MB Demo – Testing Environment



T8.3 – HTD and MB Demonstrators

HTD Demo – Testing Environment



T8.4 – TMS Demonstrators

Demonstrator leaders: CAF, ENYSE & MERMEC

Objectives:

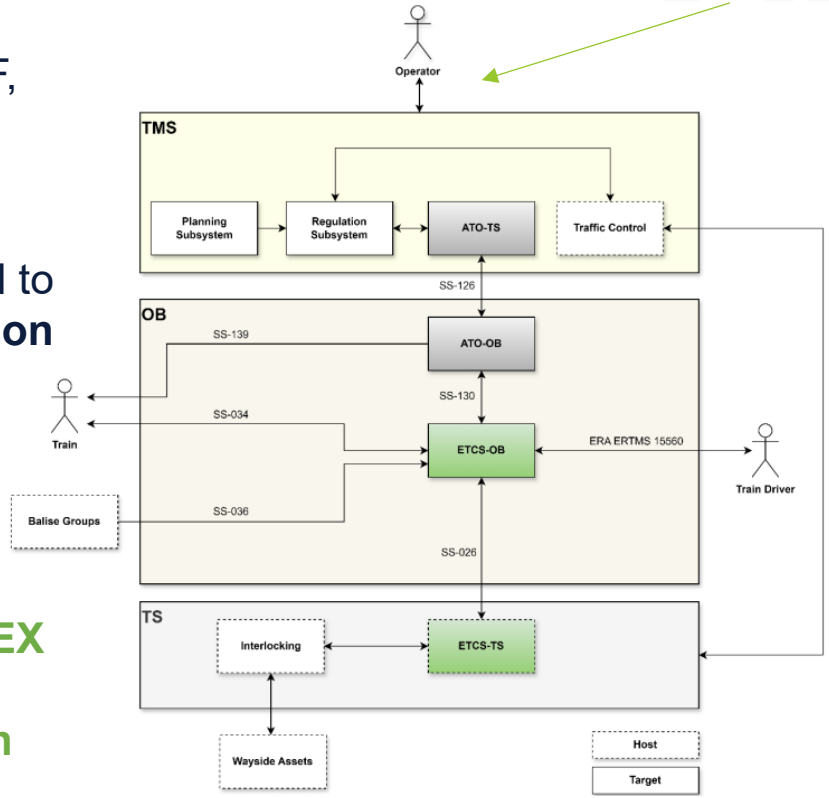
- ❑ Research into AI as a tool to address **conflict resolution**
- ❑ Research into adhesion management by TMS in cooperation with ATO

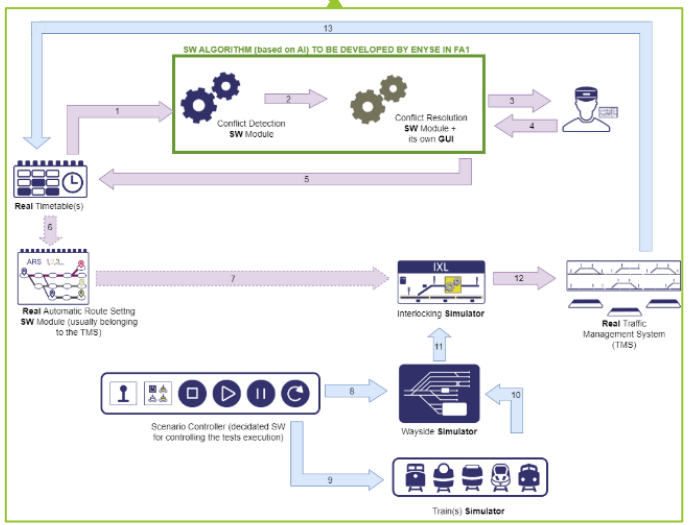
Link to FP6-FutuRe SEO:

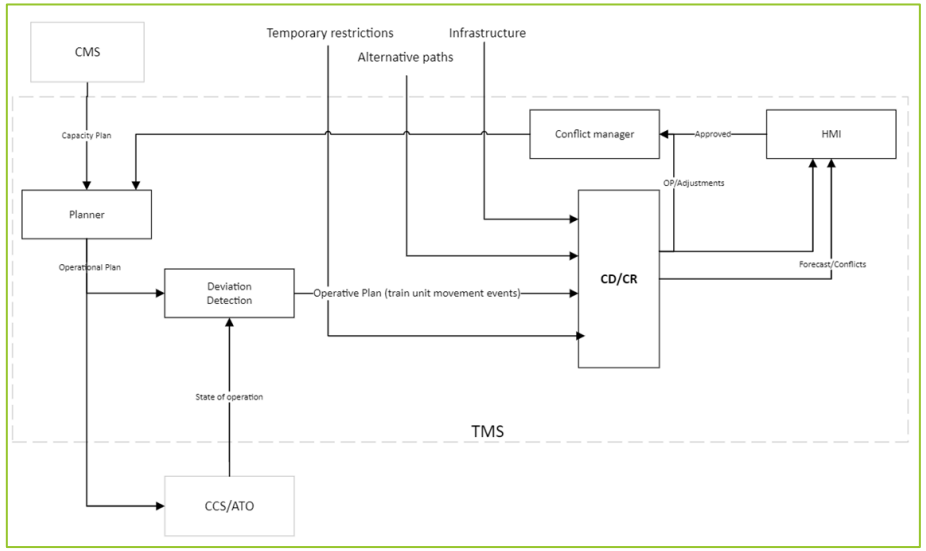
- ❑ Overall **reduction of OPEX and CAPEX**
- ❑ **Punctuality optimization**

Status:

- ❑ Laboratory preparation in progress







Lab testing in Spain

Cost reduction by lowering disruption

T8.5 – ASTP Demonstrators

Demonstrator leaders: AZD, ALSTOM, INDRA, NRD, MERMEC

Objectives: Conduct research into:
- ❑ Alternative virtual/physical reference points different from physical eurobalises
- ❑ Reducing the distance to be run in non-protected ERTMS modes
- ❑ Simplifying trackside infrastructure while ensuring sufficient performance of ASTP from an operational point of view.
- ❑ Managing radio holes
- ❑ Reducing railway track maintenance cost by providing faulty track locations
- ❑ Providing accurate geo-position under challenging conditions

Link to FP6-FutuRe SEO:
- ❑ Overall **reduction of OPEX and CAPEX**
- ❑ **Punctuality optimization**

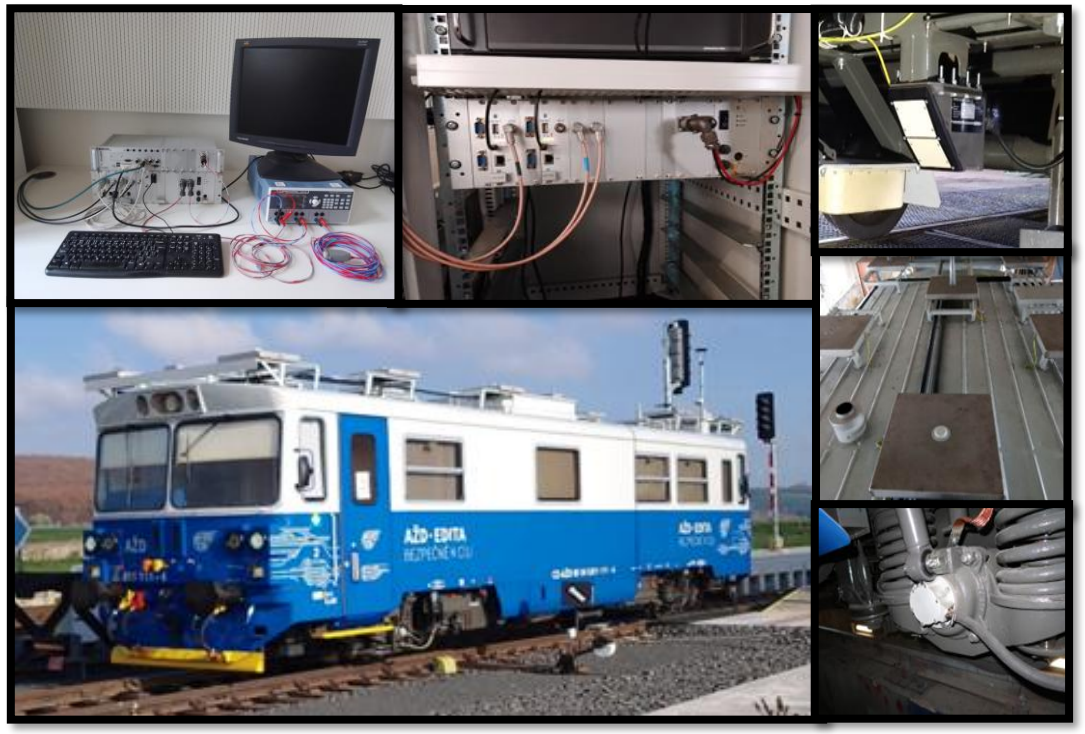
Status:
- ❑ [ALSTOM, INDRA, MERMEC] Laboratory preparation in progress
- ❑ [NRD] Testing campaign ongoing as well as evidence elaboration
- ❑ [AZD] Testing campaign ongoing

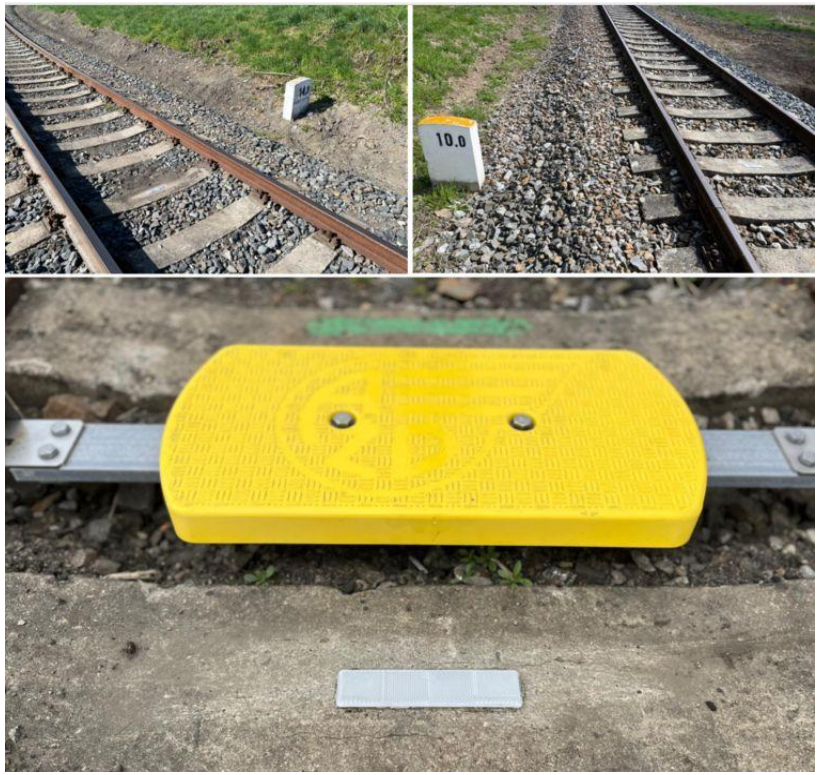
On-site testing in Norway, Italy, and Czech Republic
Lab testing in Spain and Italy

Cost reduction by e.g. reducing infrastructure related costs

T8.5 – ASTP Demonstrators

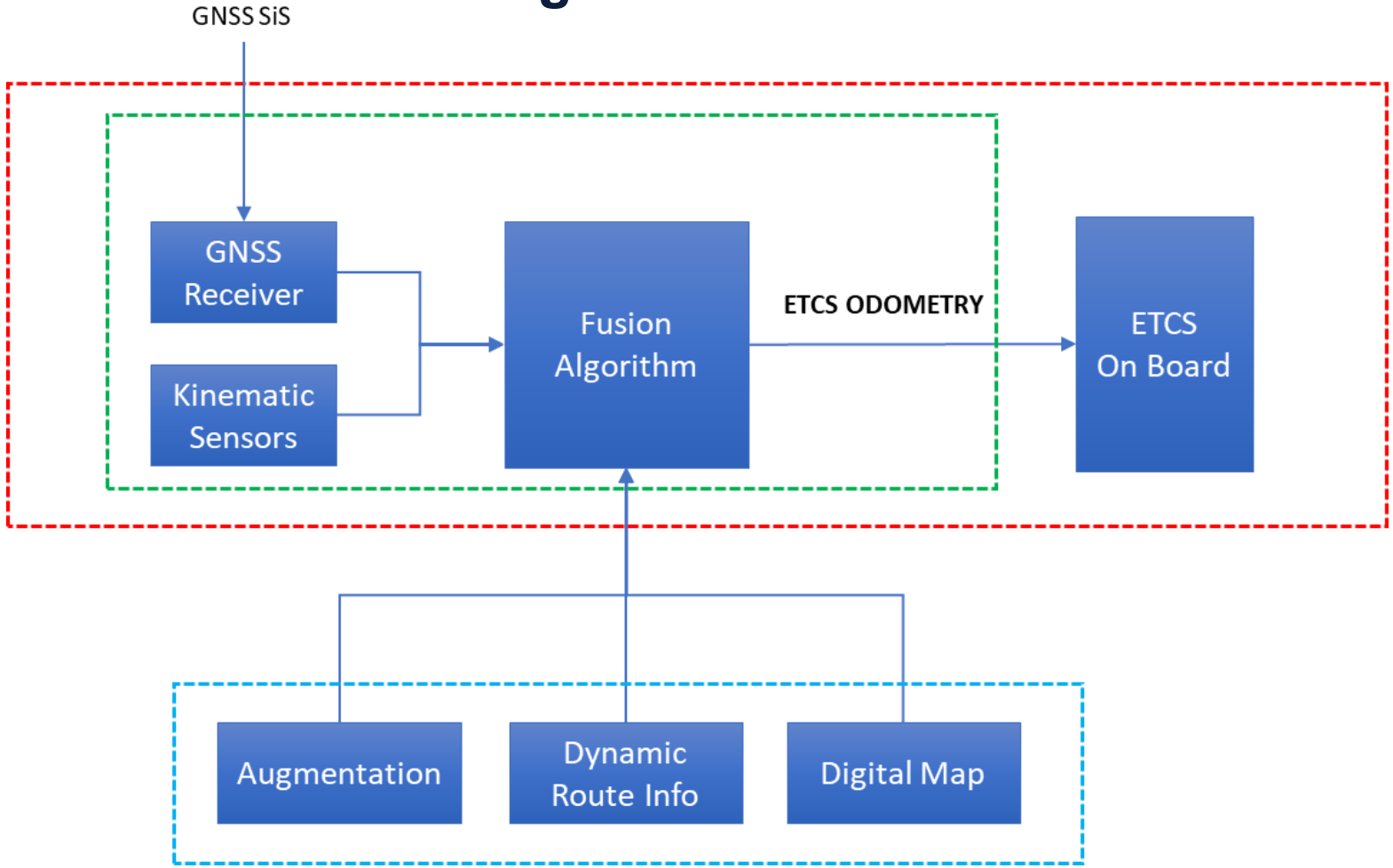
ASTP Demo – Testing Environment





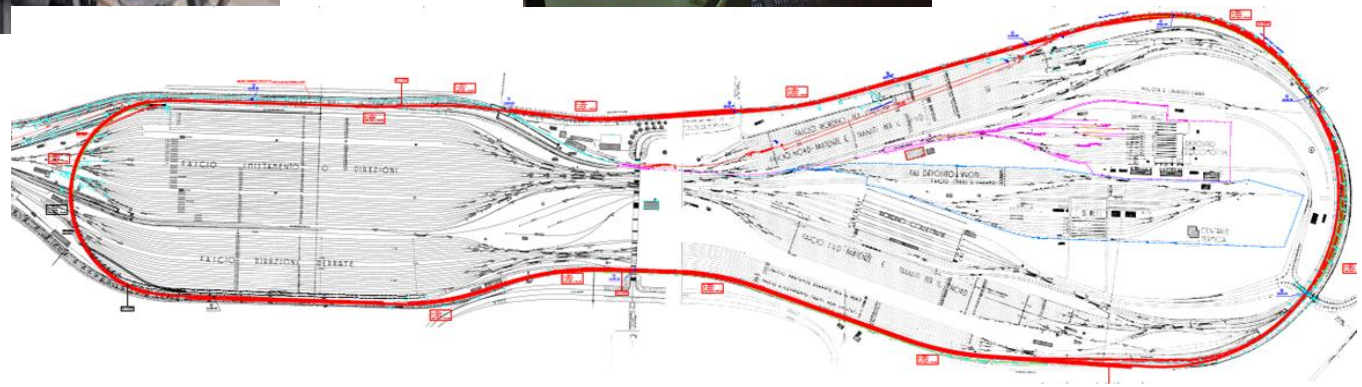
T8.5 – ASTP Demonstrators

ASTP Demo – Testing Environment



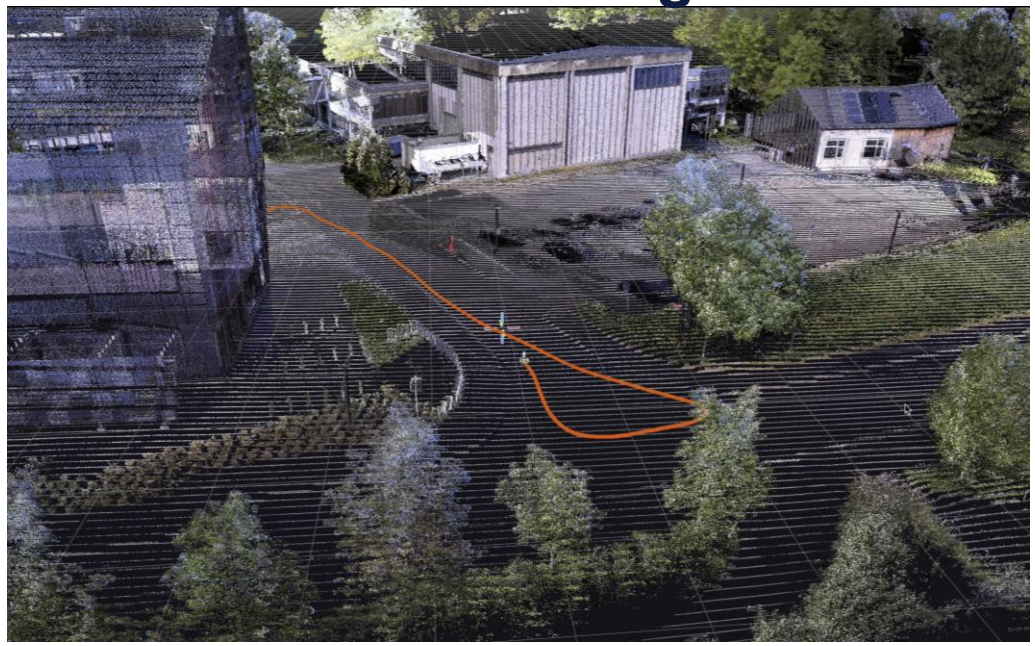
T8.5 – ASTP Demonstrators

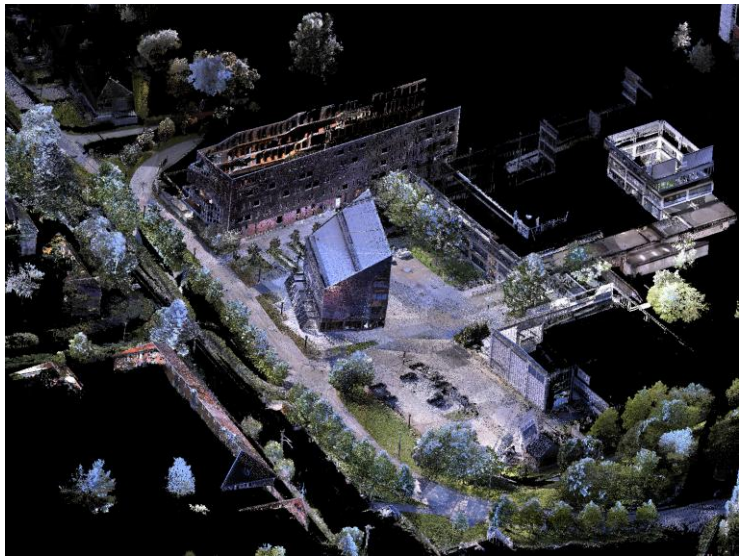
ASTP Demo – Testing Environment

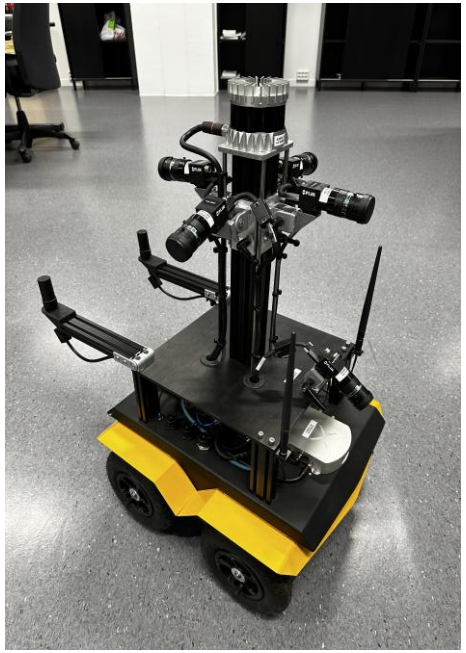


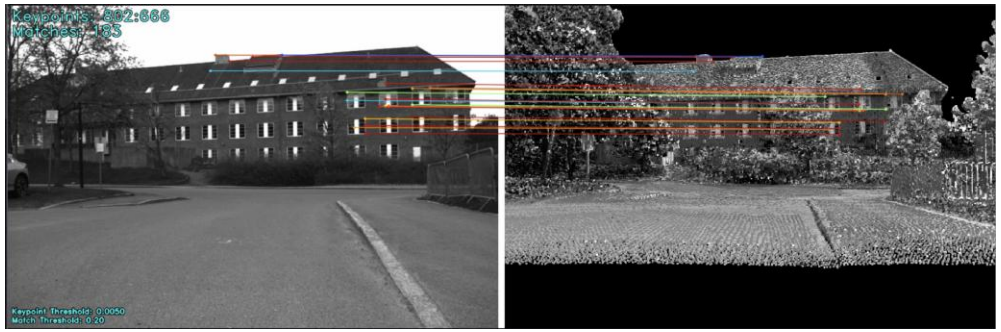
T8.5 – ASTP Demonstrators

ASTP Demo – Testing Environment



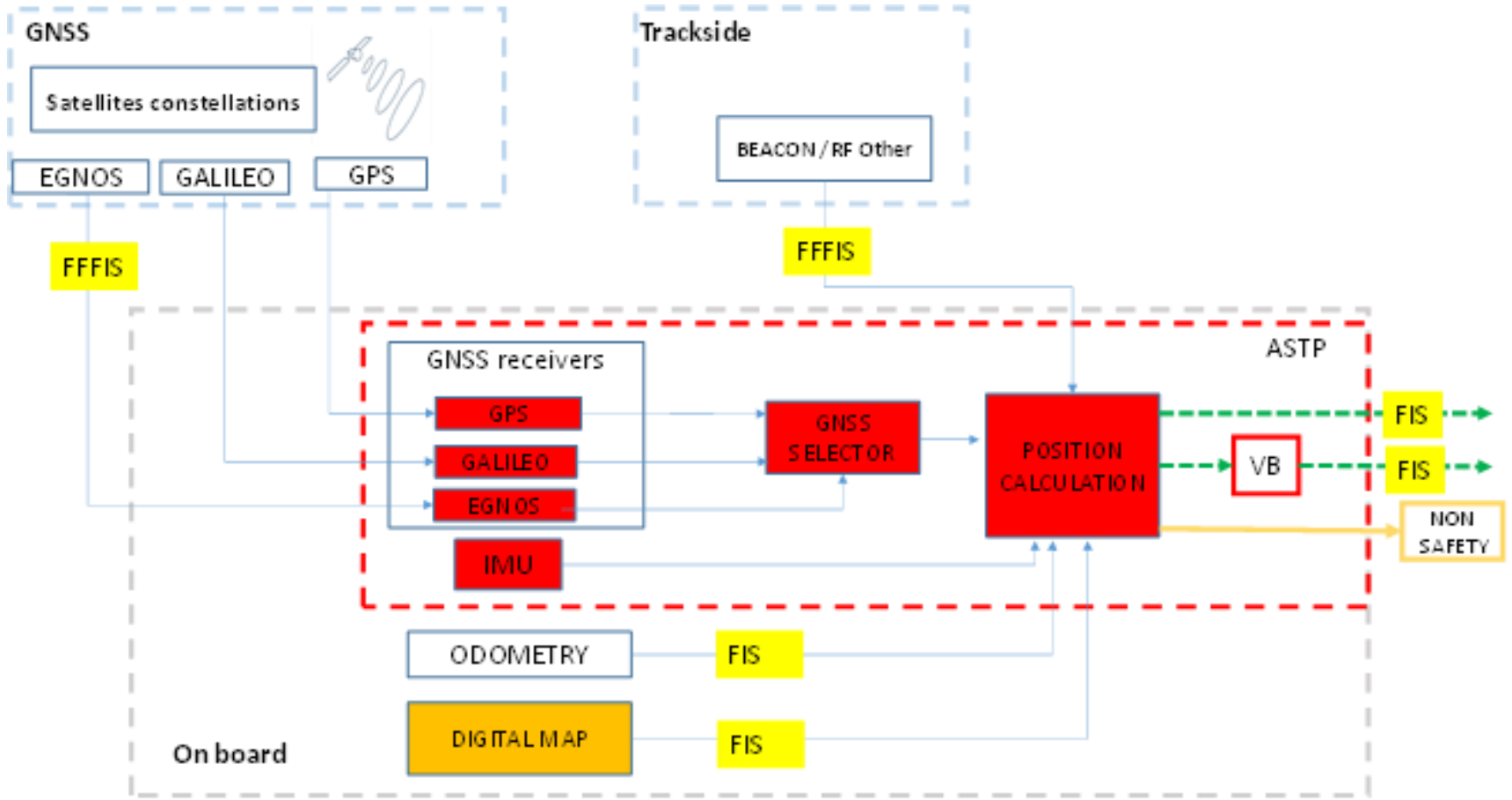






T8.5 – ASTP Demonstrators

ASTP Demo – Testing Environment



T8.6 – Integrity and Length Demonstrator

Demonstrator leader: MERMEC

Objectives. Conduct research into:

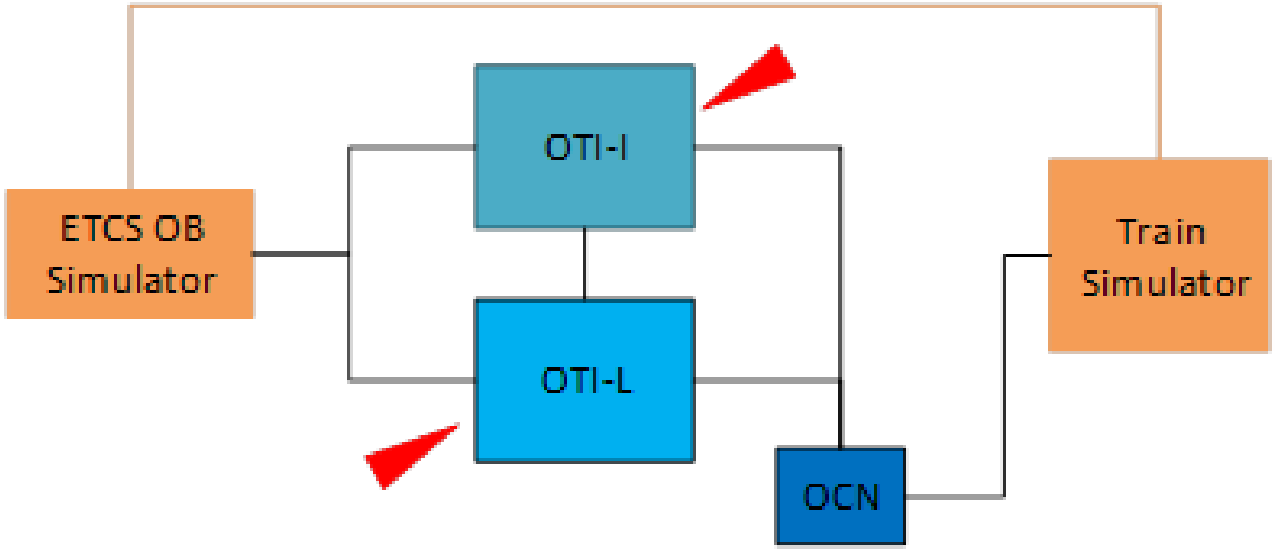
- ❑ Train integrity and length determination solution for regional lines as a key actor in ETCS L2

Link to FP6-FutuRe SEO:

- ❑ **Increased system availability** due to reduced trackside asset failure and more reliable CCS
- ❑ **Reliable cost-effective** fail-safe on-board train integrity, train length detection and train positioning
- ❑ Overall **reduction of OPEX and CAPEX**
- ❑ **Reduced OPEX costs/km** for trackside railway assets

Status:

- ❑ Laboratory preparation in progress



Lab testing in Italy

Reduction of infrastructure related cost

Flagship Project 6 - FutuRe

WP 4+9

Regional Rail Assets
Requirements, Specifications & Demonstrations

WP4/WP9 Regional Assets - Requirements and Demonstrations

Technical aim: Developing and demonstrate **cost-efficient** components and technologies including **wireless and energy self-sufficient infrastructure** components to decrease the operational and overhead cost, considering the multimodal approach.

WP4

Specification of requirements of cost-efficient assets and communications tailored for regional railway

Functional and non-functional requirements for:

- ✓ Wayside Assets
- ✓ Communications
- ✓ On-Board CCS

Results from WP4:

D4.1 – Requirement specification for Wayside Assets Report FP6_D4.1_FINAL.pdf

D4.2 – Requirements specification for Communication Report

D4.3 – Design and architecture specifications for communications Report

D4.4 – SWOC LX Solution for Multimodality Report

WP4/WP9 Regional Assets - Requirements and Demonstrations

Technical aim: Developing and demonstrate **cost-efficient** components and technologies including **wireless and energy self-sufficient infrastructure** components to decrease the operational and overhead cost, considering the multimodal approach.

WP4

Specification of requirements of cost-efficient assets and communications tailored for regional railway

WP9

Performance of demonstrators with at least TRL4 with validation of specified requirements

In total 10 Demonstrators

4 Working Cluster:

- **Wireless energy self-sufficient wayside assets**
- **Wireless communication link to wayside assets**
- **Solutions for Communication Systems**
- **Obstacle Detection Systems**

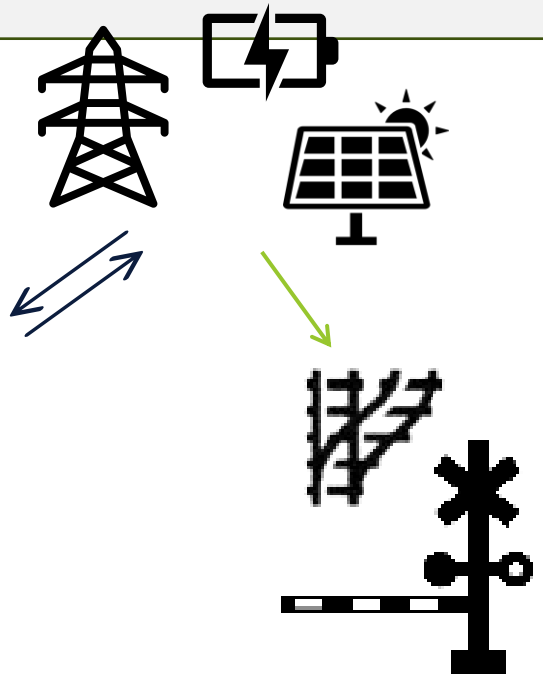
DEMO Wireless energy self-sufficient wayside objects

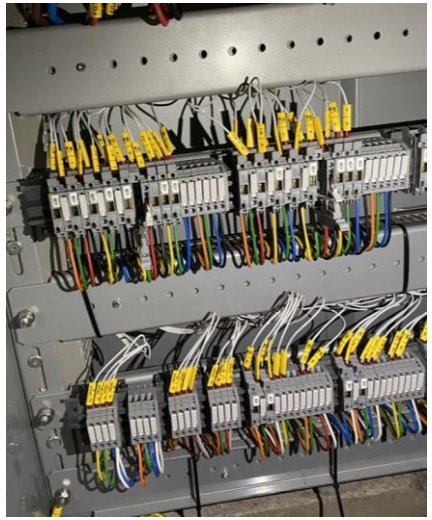
Project Goal:

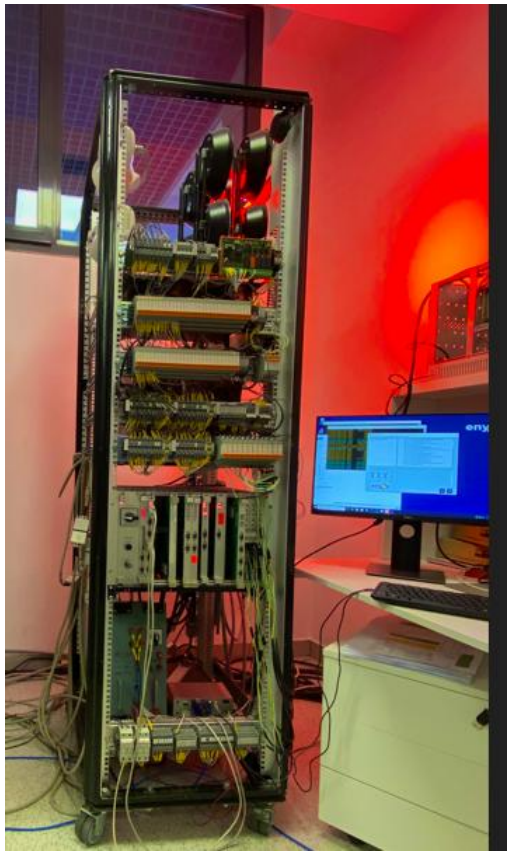
- Reducing the energy consumption
- Improve energy efficiency
- Increase the share of renewable energies
- Reduced OPEX costs/km

Technical Objectives:

- Reduction of cabling
- Reduction of power supplies
- Removal & simplification of wayside elements







Modules for energy control, incl. Use of renewable energy, core functions, juridical recorder, road traffic signals, road bells.

Spain

End of 2026

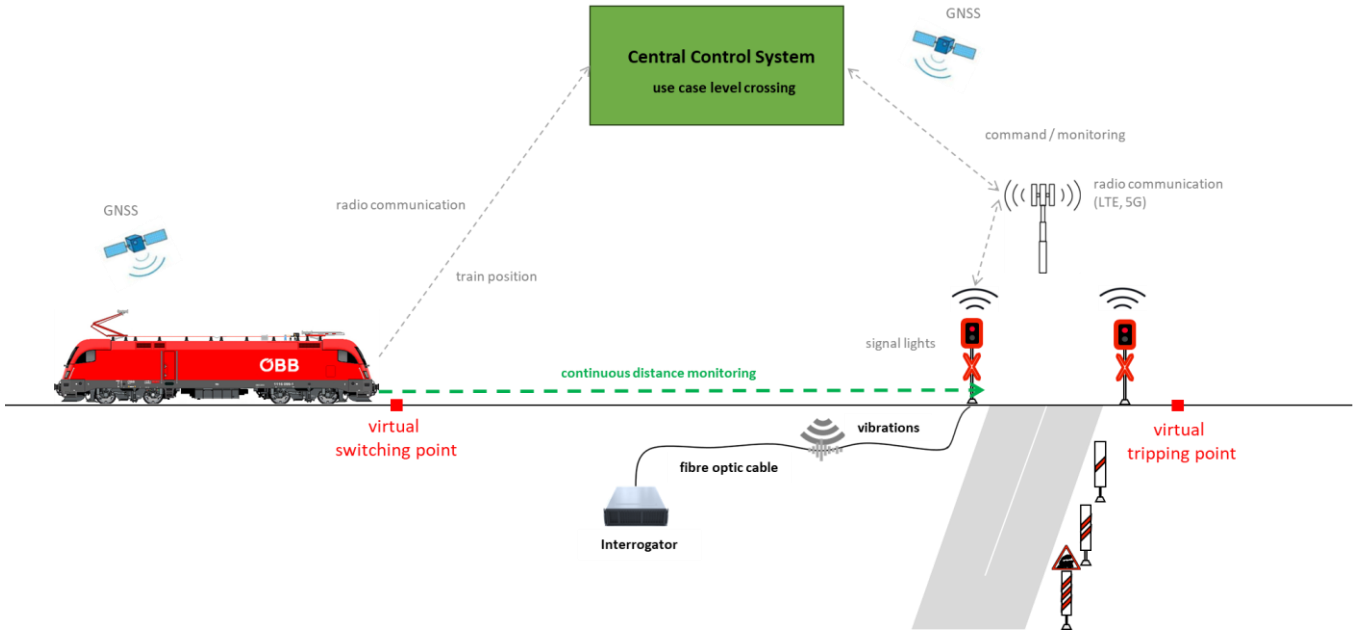
DEMO Wireless communication link to wayside assets

Project Goal:

- Cost reduction of trackside installation and maintenance
- Reduced OPEX costs/km
- Overall reduction of OPEX & CAPEX

Technical Objectives:

- Optimization of LXs open/closing times
- Reduction of reliance on cable connections
- prevention of cable thefts
- higher reliability



Active line north of Vienna

Test campaign & evaluation of data ongoing

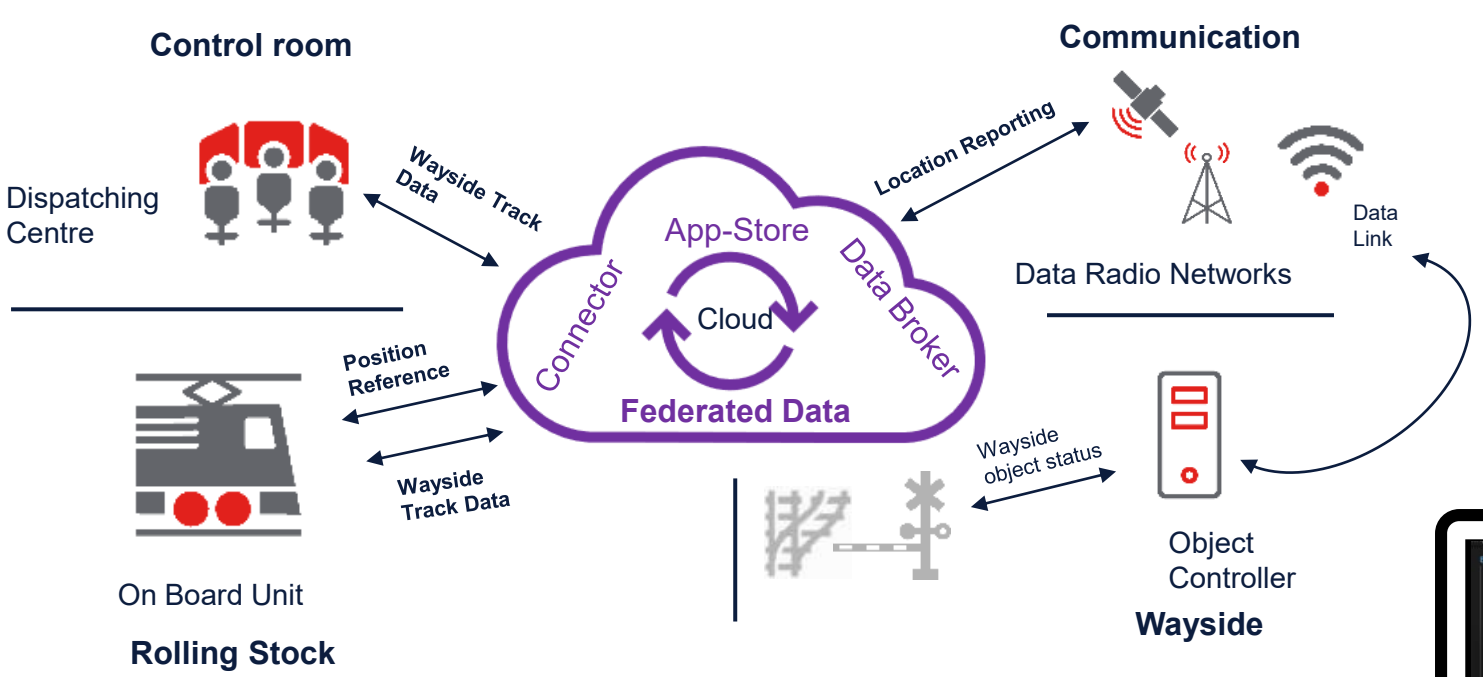
DEMO Solutions for Communication Systems

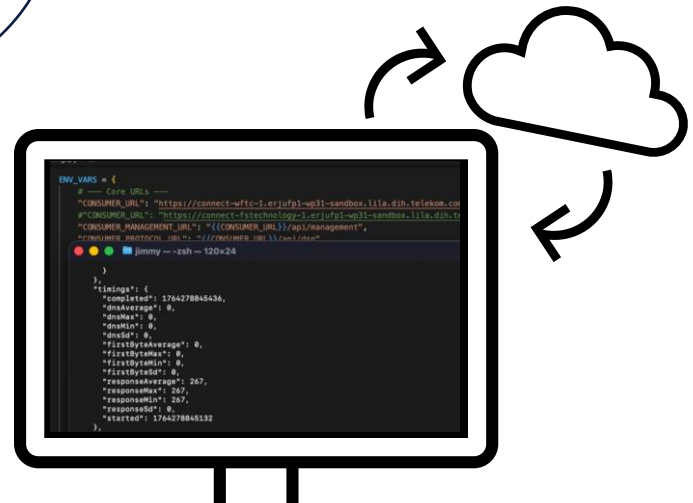
Project Goal:

- Improvement of safety & efficiency
- Improvement of attractiveness to users
- Reduction on CAPEX & OPEX
- Improvement on energy efficiency

Technical Objectives:

- Enabling the support of railway application for railway operations and service to passengers
- Minimizing telecommunication infrastructure costs





Sweden / USA

End of 2026

Flagship Project 6 - FutuRe

WP 5+10

Regional Rail Rolling Stock and G2 Lines Requirements, Specifications & Demonstrations

WP5-10, Regional Rail Rolling Stock

Objectives:

- Development of a **cost-efficient vehicle concept** for up to 100 passenger or freight
- Concept for a novel **lightweight regional vehicle** with significant weight reduction
- **Emission free** solutions for vehicles and multimodal **refueling / recharging**

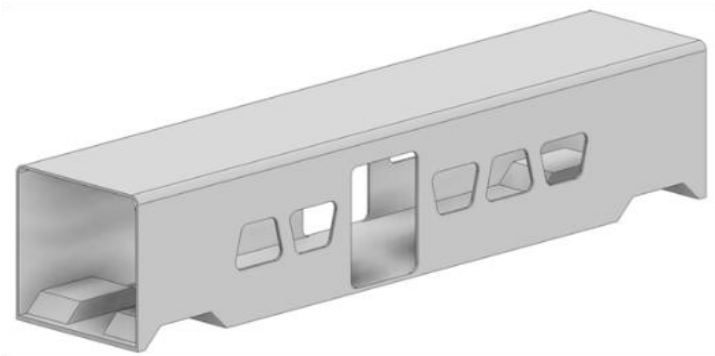
- Development of efficient and sustainable vehicle-centric **CCS for G2 lines**

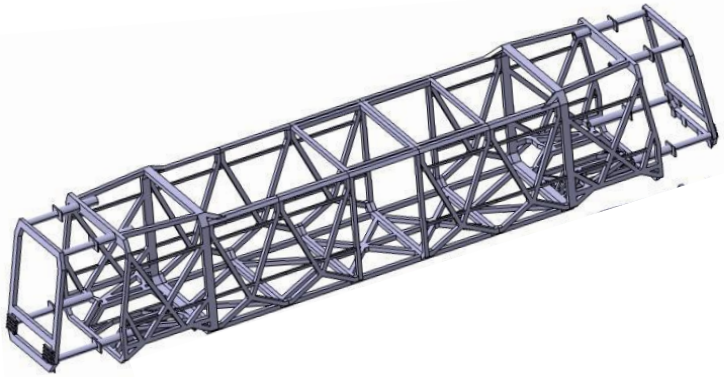
Deliverables:

- D5.1 State-of-the Art Report for regional lines rolling stock (**approved**)
- D5.2 Specifications CCS for Group 2 (**approved**)
- D10.1 Preliminary Rolling Stock Concept (expected M36 → end of 2025)
- D10.3 Report with a concept of multimodal fueling station (expected M36 → end of 2025)

WP5-10 - lightweight regional vehicle

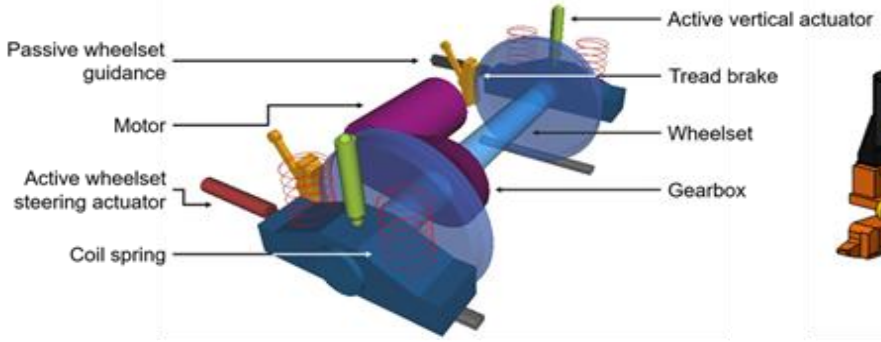
Lightweight body





Composite or topology optimized steel?

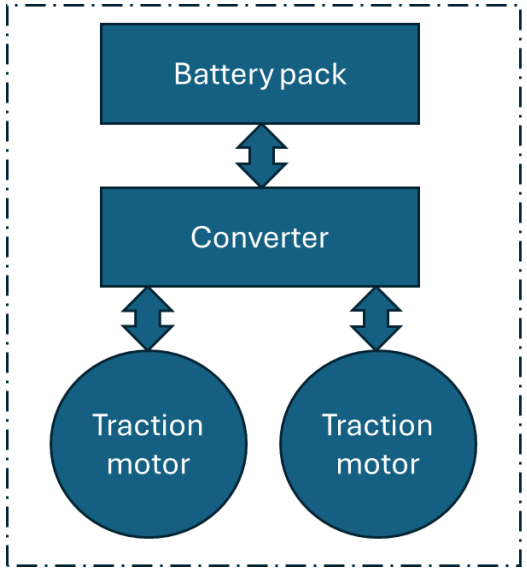
Lightweight running gear



Solid axle or independently rotating wheels?

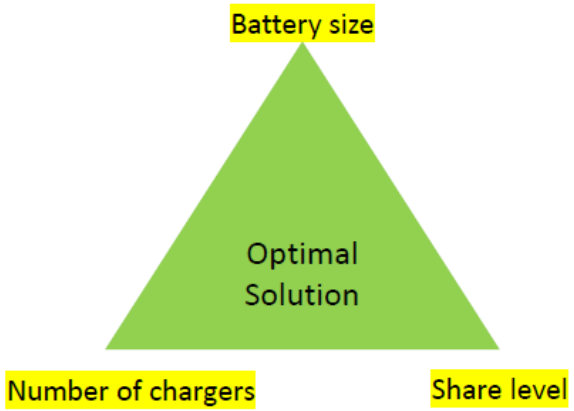
WP5-10 - Emission free vehicles and multimodal refueling / recharging

Base vehicle



Options

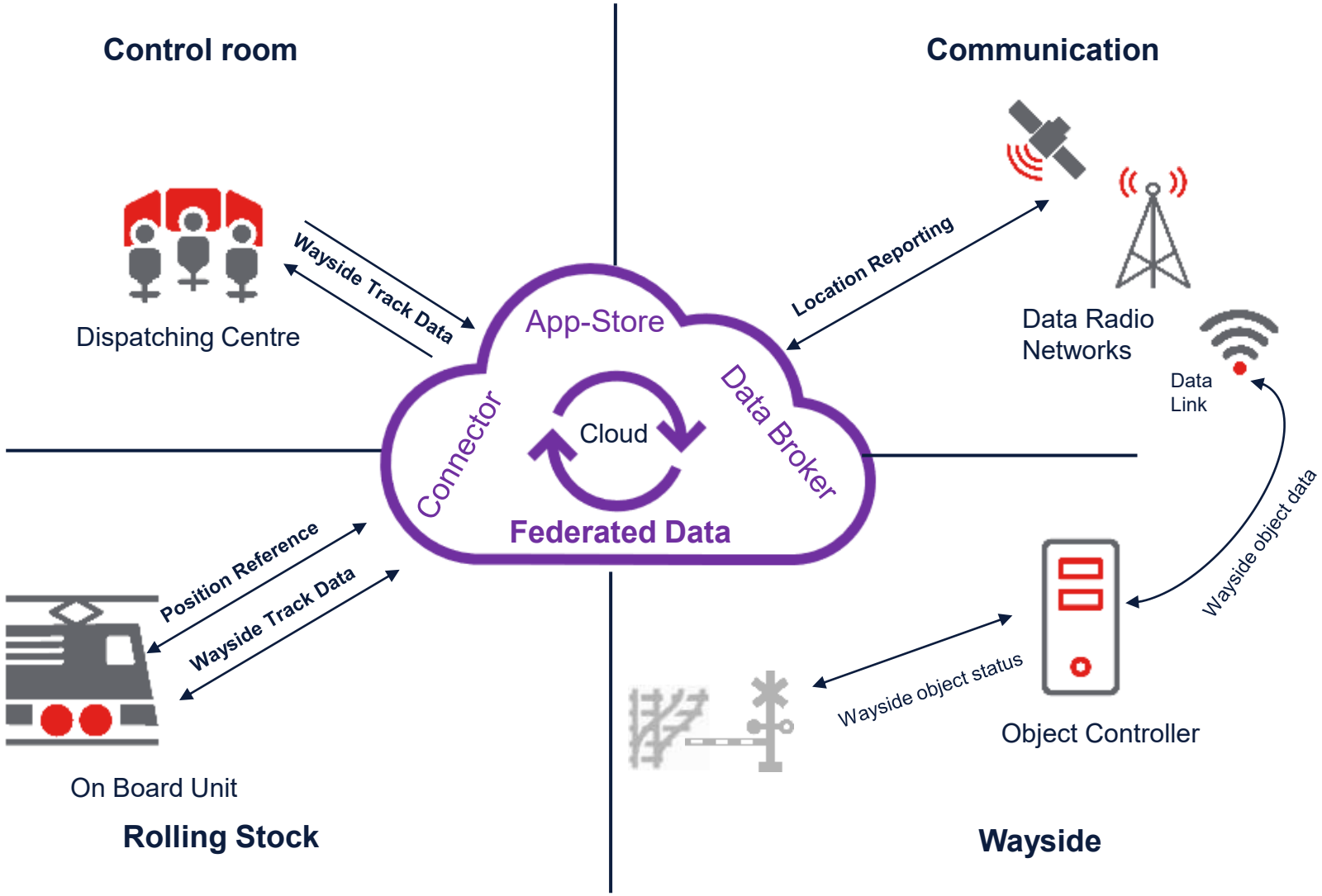
- Battery pack for range extending
- Hydrogen range extender
- Catenary charging



The optimal solution depends on the use case

FP1 WP31 integrated in WP10 FP6 demo

WP5-10 – G2 Lines concept



Demonstrator Scenario

Communication

- Worldwide mobile radio network, base stations in Sweden and USA
- Global navigation positioning satellite systems (Galileo, GPS, Iridium)
- COTS satellite receiver
- Railway industrial satellite receiver

Control Room

- Server interfacing the cloud (Wabtec, USA

Rolling Stock

- Maintenance of Way vehicle (TRV Sweden)

Wayside

- Test track on a not-interoperable regional stretch (TRV, Sweden)

Cloud facility

- Connectivity via secure cloud services (USA, Wabtec)

Federated Data

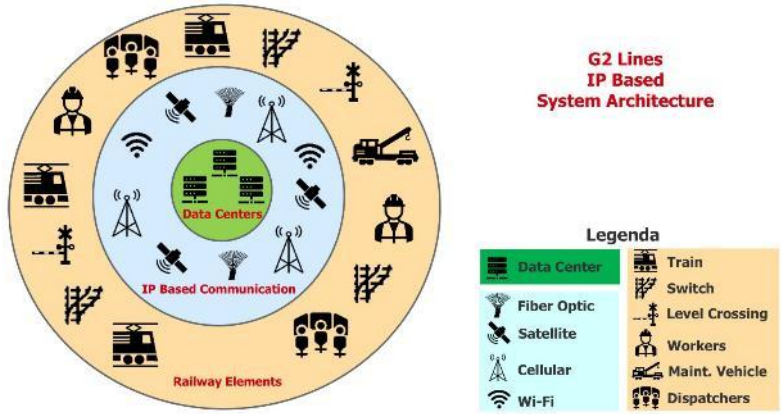
- Data Broker…
- Connector…
- App-Store….

Cost-effective fail-safe highly accurate train positioning on G2 lines

Demonstrator description

Demonstrators for Cost-effective fail-safe highly accurate train positioning on G2 lines (COTS based technologies for non-interoperable regional lines).

Integration with demo 9.10 and 10.3.2



Contribution demo leader (FT)

- Preparatory work for operational conditions.
- Demo concept documentation.
- Demo testing documentation.
- Railways industry satellite receiver.
- Partial On-board train protection system (not connected to train braking system).

Contribution 2nd participant (TRV)

- Support to preparatory work for operational conditions.
- Support to preparation of demo documentation.
- Selection of demo site; stretch of s line for tests.
- COTS satellite receiver.
- Rail vehicle (locomotive, On Track Machine, Infrastructure Inspection Vehicle, testing vehicle).
- Permission to perform the tests from the NSA.
- Path allocation

RU CFL cargo Sweden

Swedish intermodal Train from the harbour of Gothenburg to Nässjö
Five times a week
200 km one way

Sweden + USA (Jacksonville)

2026

Use COTS satellite receiver for absolute positioning, validated against reference measurements provided by railways industrial satellite receiver

Reduction of CAPEX costs positioning of at least 15% with respect to current figures for an equivalent scope.

Reduction of OPEX costs positioning of at least 15% with respect to current figures for an equivalent scope

Fail-safe interlocking+RBC on G2 lines

Demonstrator description

Demonstrators for Cost-effective fail-safe highly accurate train positioning on G2 lines (COTS based technologies for non-interoperable regional lines).

Integration with demo 9.10 and 10.3.1

Contribution demo leader (FT)

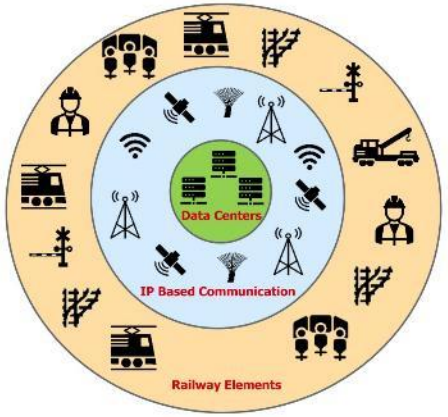
- Preparatory work for operational conditions.
- Demo concept documentation.
- Demo testing documentation.
- Integrated IxL/RBC system managed by the Operation Control Centre.
- Railways industry satellite receiver.
- On-board train protection system (not connected to train braking system).
- Site survey to collect input federated data for digital map

Contribution 2nd participant (TRV)

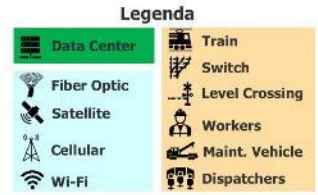
- Support to preparatory work for operational conditions.
- Support to preparation of demo documentation.
- Selection of demo site; stretch of line for tests.
- COTS satellite receiver

#2 Swedish steel

#1 Swedish intermodal



G2 Lines
IP Based
System Architecture



RU CFL cargo Sweden

Swedish intermodal
Train from the harbour of Gothenburg to Nässjö
Five times a week
200 km one way

Sweden + USA (Jacksonville)

Use COTS satellite receiver for absolute positioning, validated against reference measurements provided by railways industrial satellite receiver

2026

Reduction of CAPEX costs positioning of at least 15% with respect to current figures for an equivalent scope.

Reduction of OPEX costs positioning of at least 15% with respect to current figures for an equivalent scope

Flagship Project 6 - FutuRe

WP 6+11

Regional Rail Services Requirements, Specifications & Demonstrations

Customer Services

Customer Services

Integration of Demand Responsive Transport

Support of Persons with Reduced Mobility

Demand Forecast and Congestion Monitoring

Train platform allocation

Main objectives within FP6

- Implementing a multimodal travel solution including first and last mile
- Giving focus to Persons with Reduced Mobility (PRM)
- Providing and using demand information
- Integration of Passenger Information System (PIS) and Traffic Management System (TMS)
- Applying standard formats/interfaces
- Identifying gaps in standards/missing standardization

- Effective multimodality is a novelty, especially for regional low-density lines
- Easy exploitable customized services for PRM, covering their specific needs
- Managing travel demands is a new approach to favor the multimodal integration and customer satisfaction
- Predictions and travel demands' adjustments using innovative algorithms
- To allow easier integration of multimodal service, cost reduction, robustness and facilitate sharing of info through suitable data bases

Deliverables of WP6 (all approved)

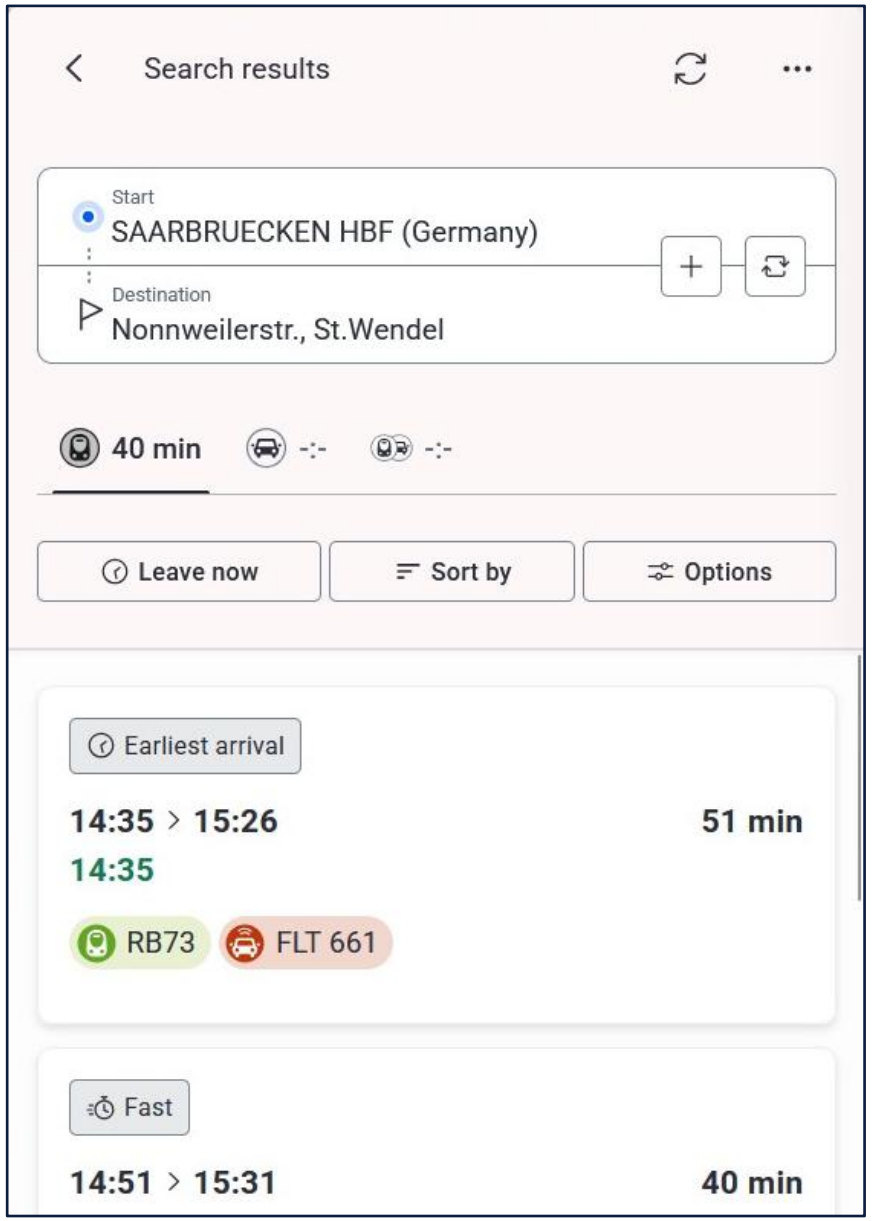
- D6.1 Specification of Multimodal Travel Solution (Alpha Release)
- D6.2 Specification of Multimodal Travel Solution (Final Release)
- D6.3 Requirements and interface design for TMS-PIS
- D6.4 Requirements and definitions on Data Bases for Regional Lines (Alpha Release)
- D6.5 Specification of demand analysis algorithms
- D6.6 Specification of Passenger congestion monitoring
- D6.7 Technical specifications for using regional lines for freight services
- D6.8 Investigation of standards in Public Transport and gap analysis (Alpha Release)
- D6.9 Requirement specification for services in regional lines (Alpha Release)

Deliverables of WP11 (expected by end of 2026)

- D11.1 Multimodal Travel Solutions implementation report
- D11.2 Implementation Report of TMS and PIS development
- D11.3 Mapping of available Data Bases for regional lines (Final Release)
- D11.4 Implementation Report of AI based demand analysis
- D11.5 Implementation Report of Passenger congestion monitoring
- D11.7 Investigation of standards in Public Transport and gap analysis (Final Release)
- D11.8 Requirement specification for services in regional lines (Final Release)
- D11.9 Analysis and assessment of demonstration results

Integration of Demand Responsive Transport (DRT)

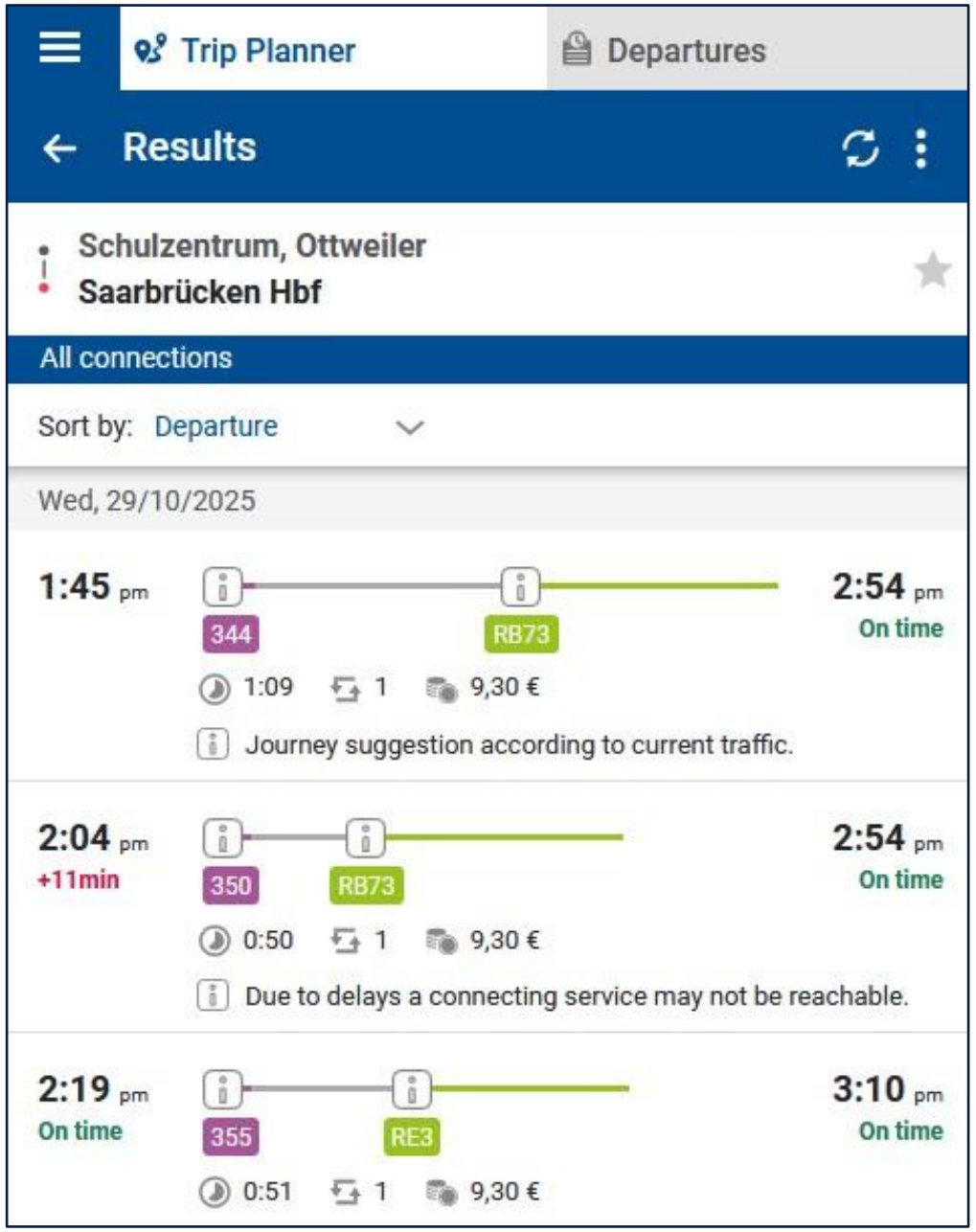
- Integration of DRT into a trip planner ☑
- Applying non-competition rules
- Enabling cross-platform trip planning ☑
- Simulation of DRT services to otimize the fleet size



Europe's Rail

Support of Persons with Reduced Mobility

- Integration of real-time information (delays, cancellations etc.) ☑
- Alternative route calculation ☑
- Profiles for PRM to ease trip planning
- Minimization of total walking distance

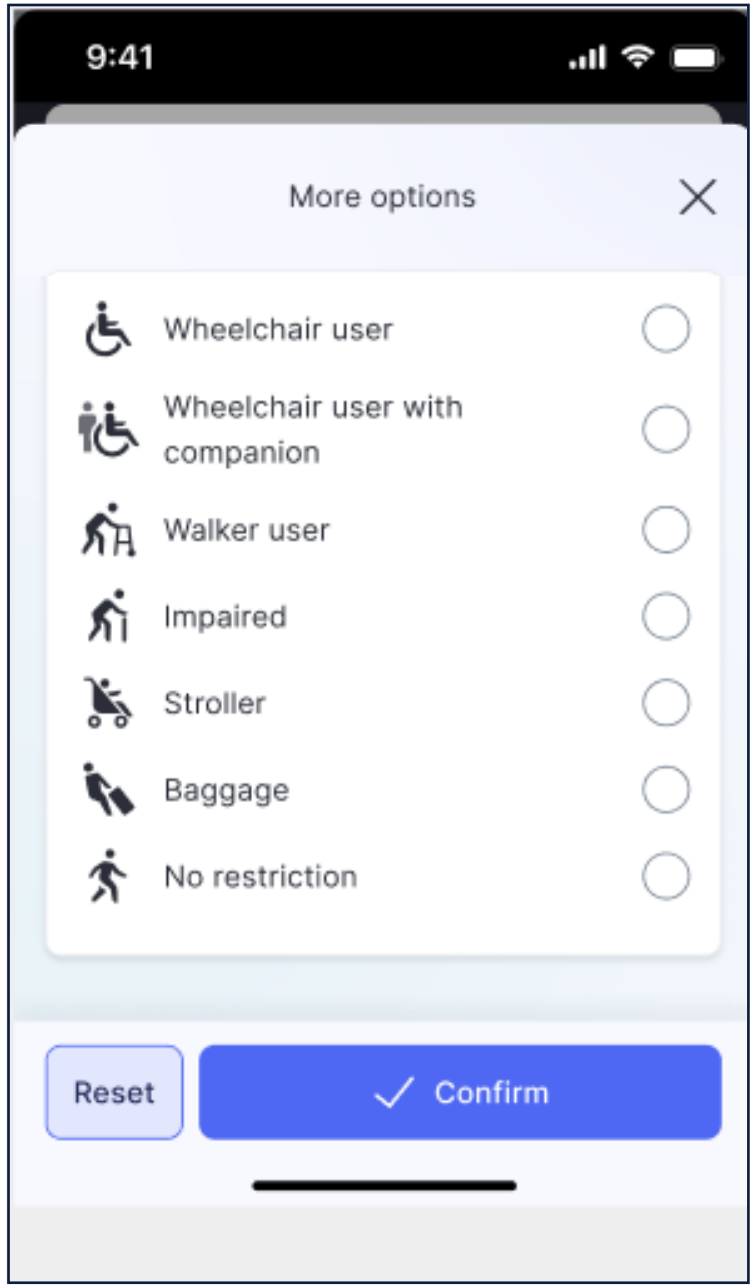


Europe's Rail

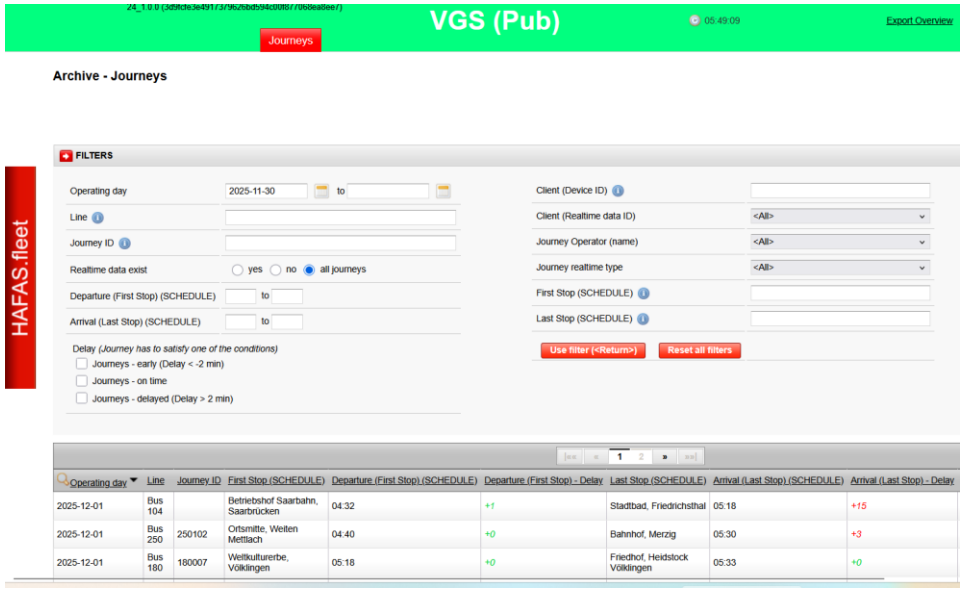
Support of Persons with Reduced Mobility

- Integration of real-time information (delays, cancellations etc.) ☑
- Alternative route calculation ☑
- Profiles for PRM to ease trip planning
- Minimization of total walking distance

To be implemented:



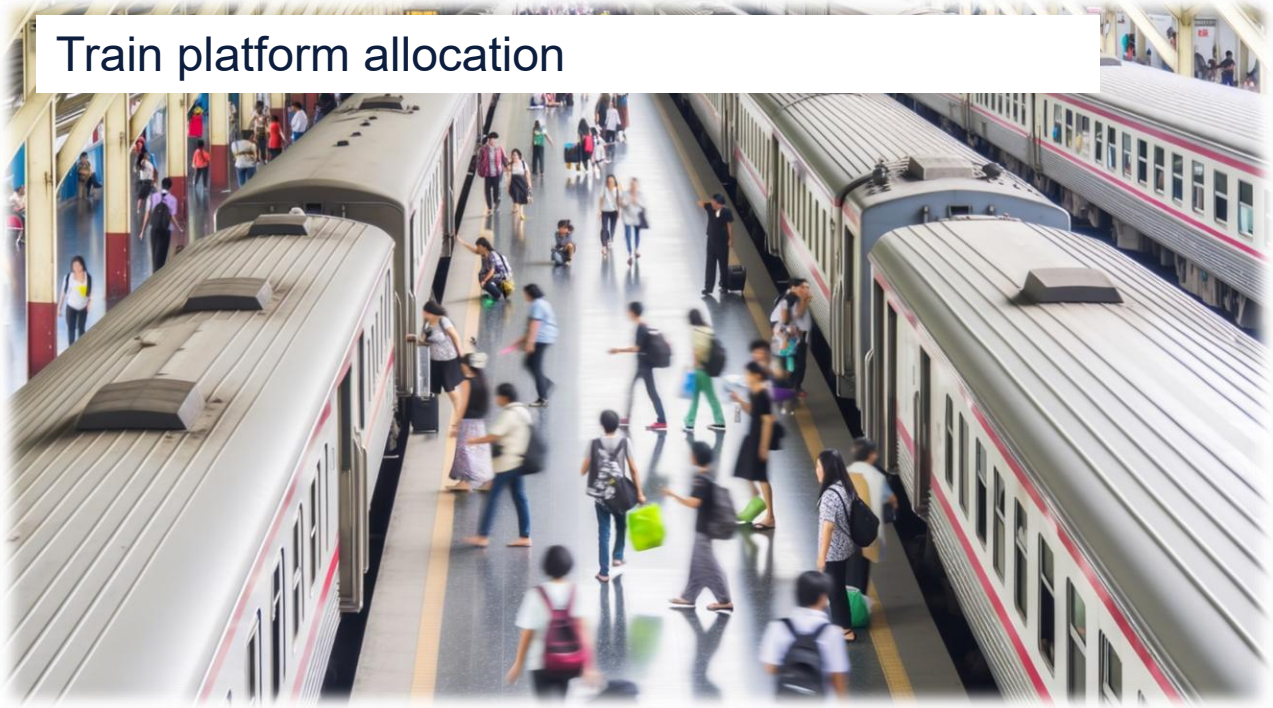
Demand Forecast and Congestion Monitoring

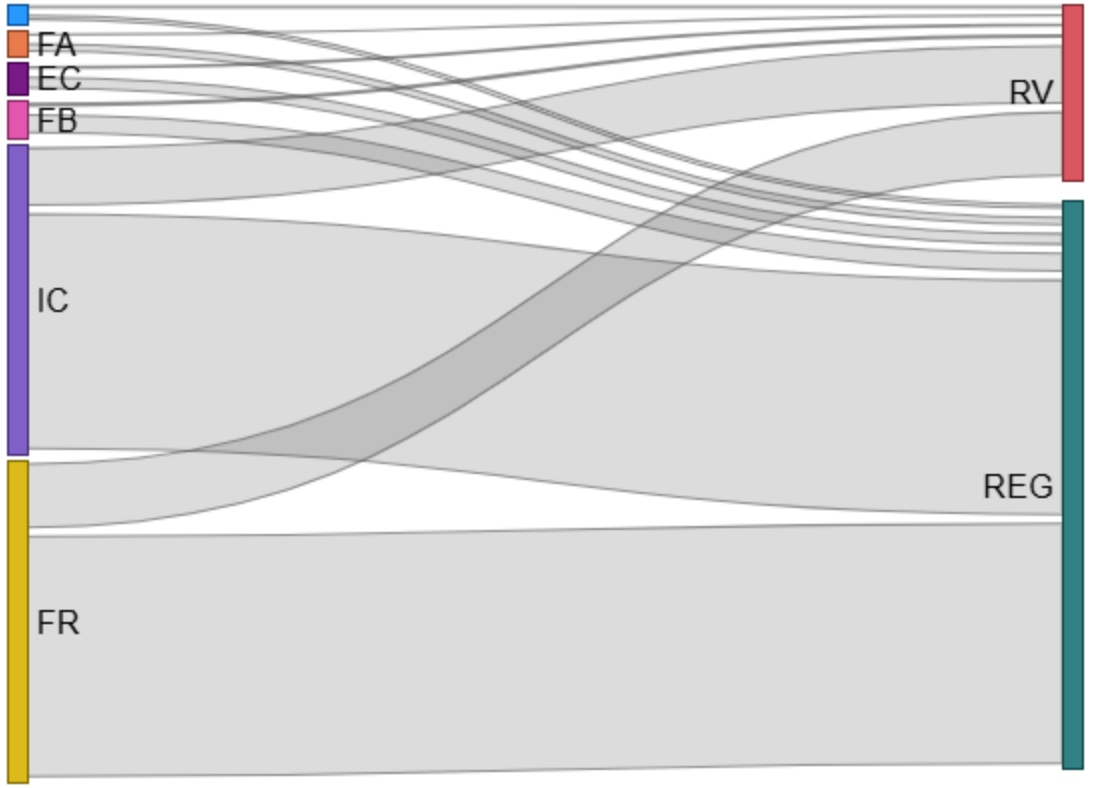


- Forecast travel demand
- Transfer travel demand to TMS
- Transfer first/last mile demand to DRT simulation
- Forecast demand peaks (events, weather)
- Reduce congestion by synchronization of timetables ☑
- Detect congestion by traveler feedback ☑

Europe's Rail

Train platform allocation





- Assign trains to platforms so that available transfer times for passengers are maximized ☑
- Optimization problem formulated as a Mixed-Integer Linear Programming (MILP) model ☑

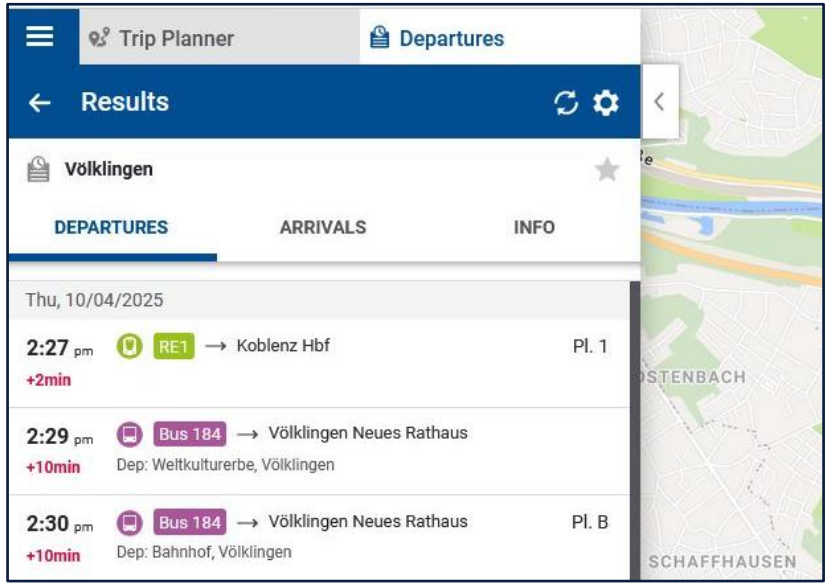
Demo 1: Multimodal Passenger Information System

Socio-Economic Objective

Increase customer satisfaction by providing relevant information in trip planning application and **reduce costs** by optimizing the fleet size of DRT vehicles

Technical Objective

Integrate and simulate DRT services, provide occupancy levels, real-time data and accessibility information



Demonstration together with transportation authority ZPS and test users in Saarland (Germany)

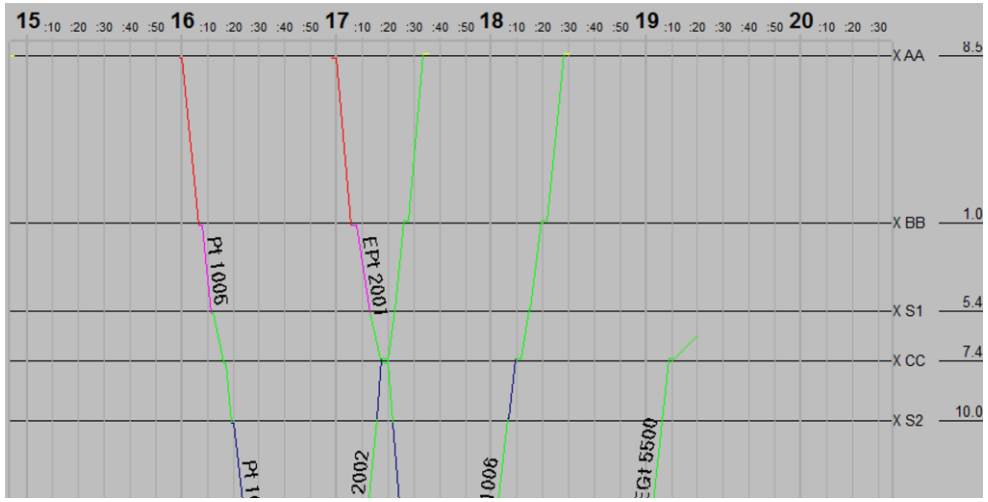
Demo 2+3+4: Operations and travel experience

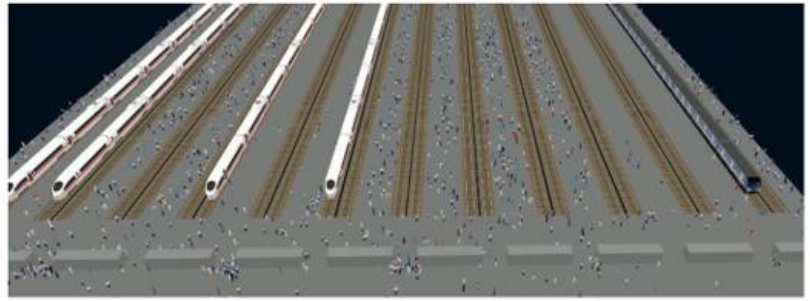
Socio-Economic Objective

Increase customer satisfaction by avoiding congestion;
reduce costs by aligning capacity and demand

Technical Objective

Provide demand forecast from PIS to TMS; predict congestion in trains and on platforms and identify mitigation options; reduce transfer walking times





HACON

GTSP

TRENITALIA
GRUPPO FERROVIE DELLO STATO ITALIANE

Three virtual demonstrations:
two demonstrations based on data of Saarland (Germany), one based on data from Rome (Italy)

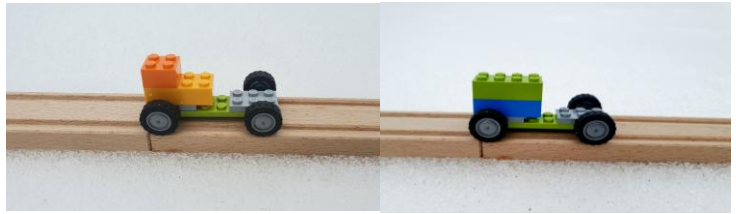
Flagship Project 6 - FutuRe

WP 7

Preparation for Regional Rail Integrated Demonstrators

Purpose of WP7 is to **perform preparatory actions for demonstrations** and **preparatory work for fully integrated demonstrators in the following projects.**

	CALL 1	CALL 2	CALL 3
WP 2			
WP 3-8			
WP 4-9			
WP 5-10			
WP 6-11			



WP7

7.1 **Requirements for test sites** (submitted)

7.2 **Digital platforms preparation**

7.3 **Mapping of test sites** (submitted)

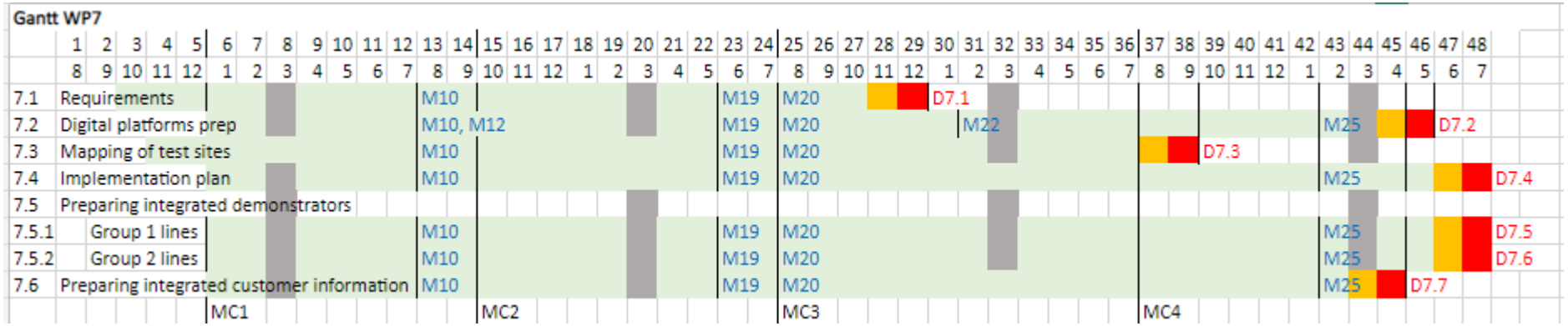
7.4 **Implementation plan**

7.5 **Preparing integrated demos**

7.6 **Preparing integrated customer information systems**

Partners: ADIF, ATSA, AZD, DLR,CAF, FS, FT, HACON, INDRA, MERMEC, ÖBB-INFRA, TRV

Duration M1-M48



Flagship Project 6 - FutuRe

Thanks for your attention!

Info, News and Public Project Deliverables @:

https://projects.rail-research.europa.eu/eurail-fp6/

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