FP6 FutuRe

Regional Railway services for the Customer: seamless services from door to door

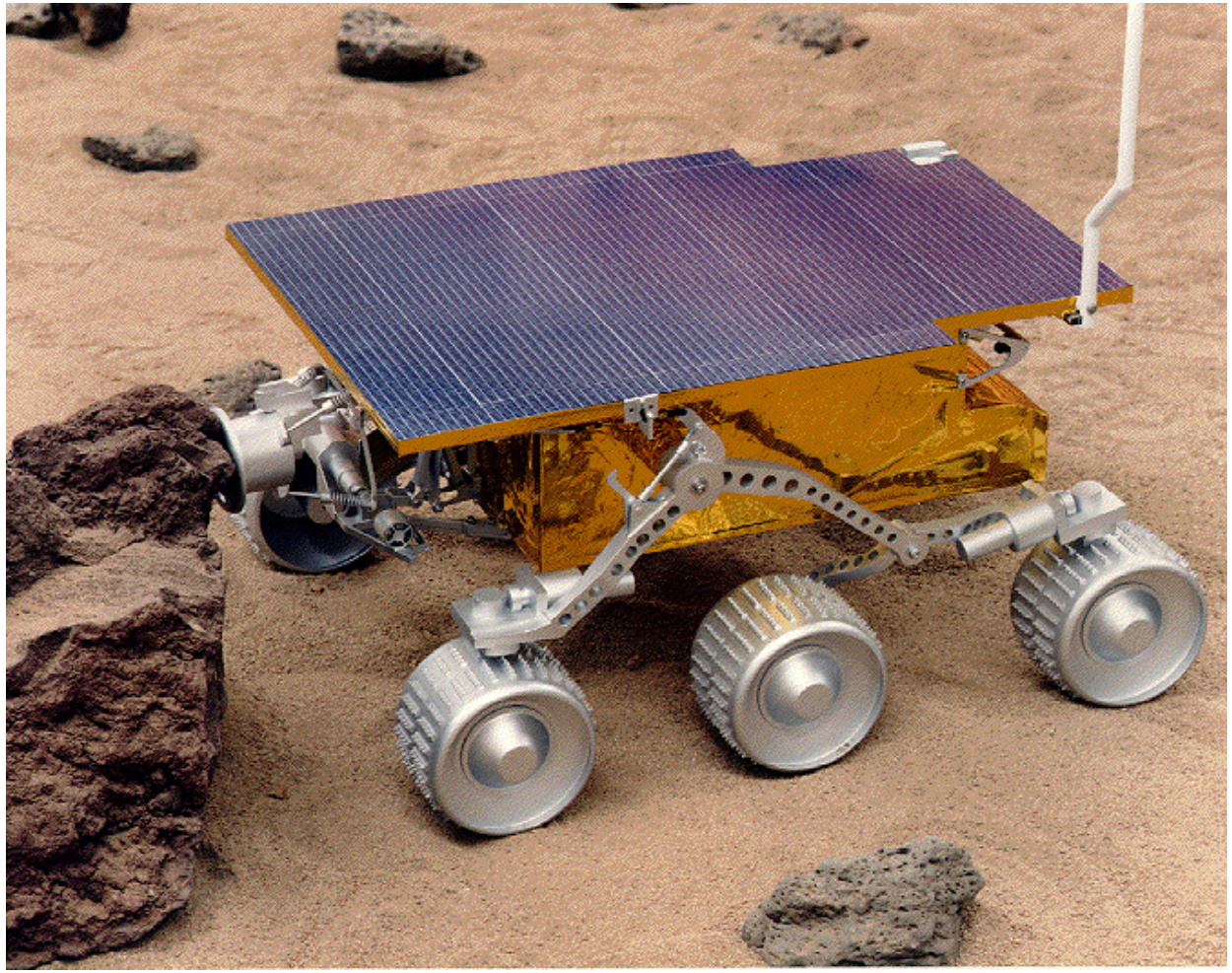
Final Event

Brussels

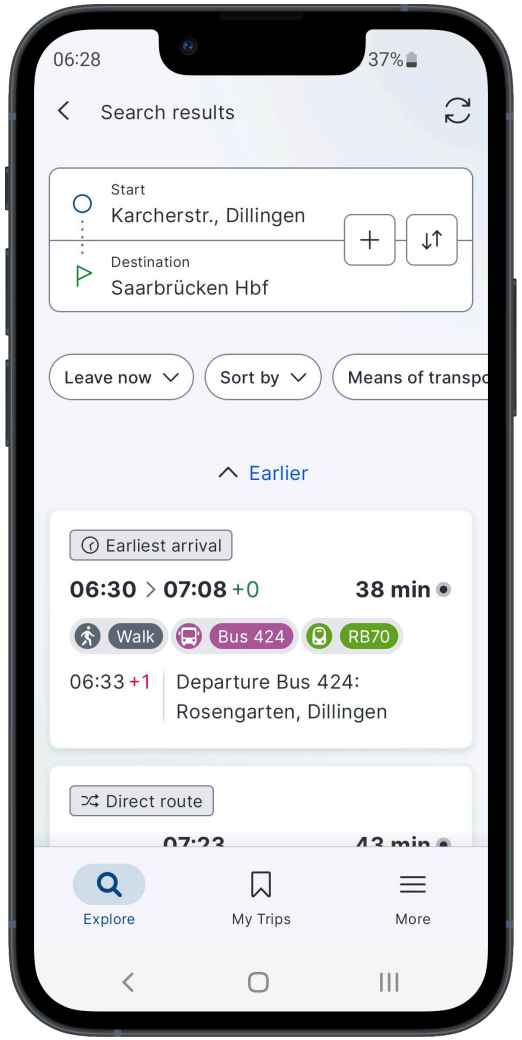
4th November 2026

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Tiago Fonseca, Rui Eirinha (GTSP), Sveva Marcocci (Trenitalia)

What have we done in Customer Services?



Mars Pathfinder
(Rover Sojourner)



Pathfinder for Regional Travel

What did we solve here?

In areas where population density is low, and classic public transport options are limited, passengers often face several issues

- The first-mile/last-mile gap
- Siloed operations and missed connections
- Reactive operations, not proactive
- Accessibility barriers
- Surprises from weather changes and events

The Services Solution

Regional Railways for the Customer: seamless services from door to door

For whom?



Seamless, accessible, door to door journey

Passengers



Operators

Demonstration Locations

May 2026

Saarland, Germany

Passenger Information Systems,

TMS-PIS exchange and

Passenger Congestion Monitoring



June 2026

Rome, Italy

Train Platform Allocation

Validated by experts using productive and production-like data, at TRL 6, confirming applicability and economic viability for regional authorities.

Endorsed by real-world users, guaranteeing that technical digitalisation translates into tangible everyday mobility improvements

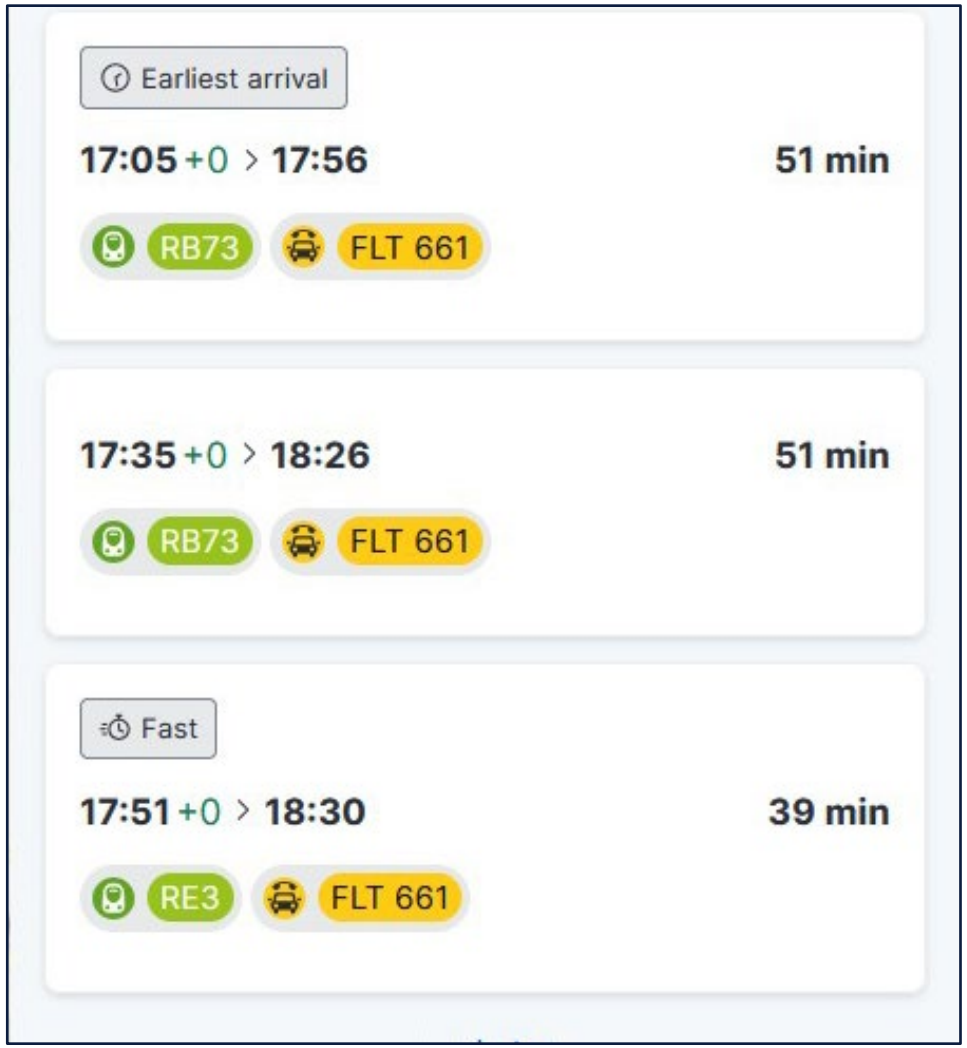
Regional Railways for the Customer: seamless services from door to door

Problems, Solutions and Demonstration Results

Problem 1: People don‘t want to travel long distances to railway stations

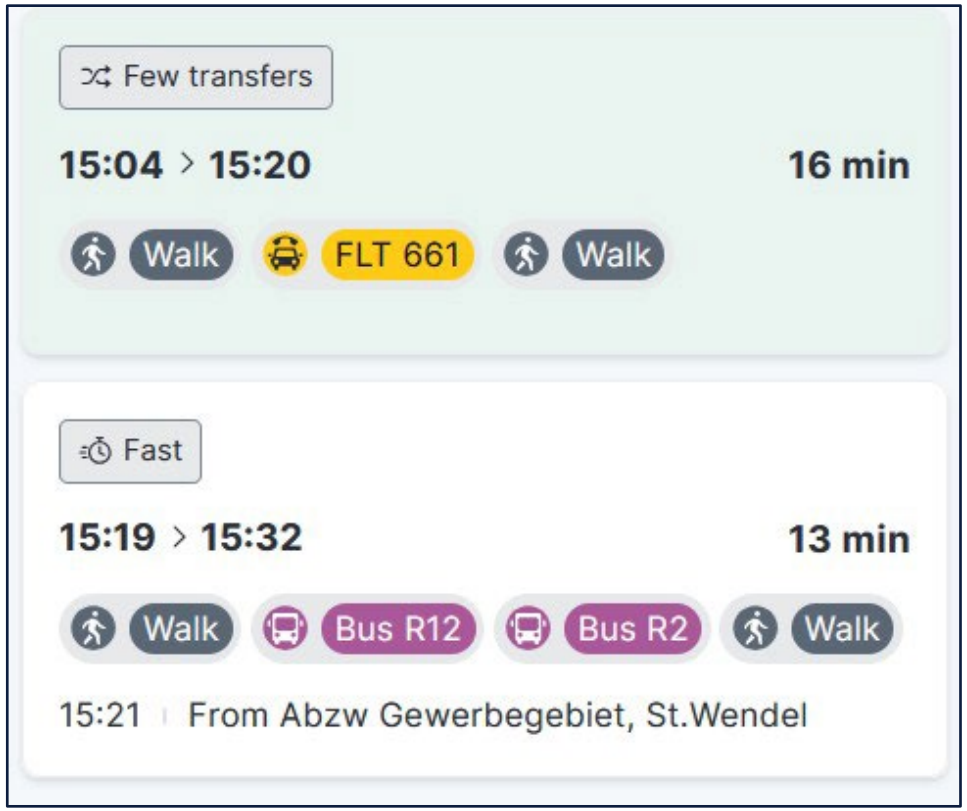


Solution 1: Smart integration of Demand Responsive Transport



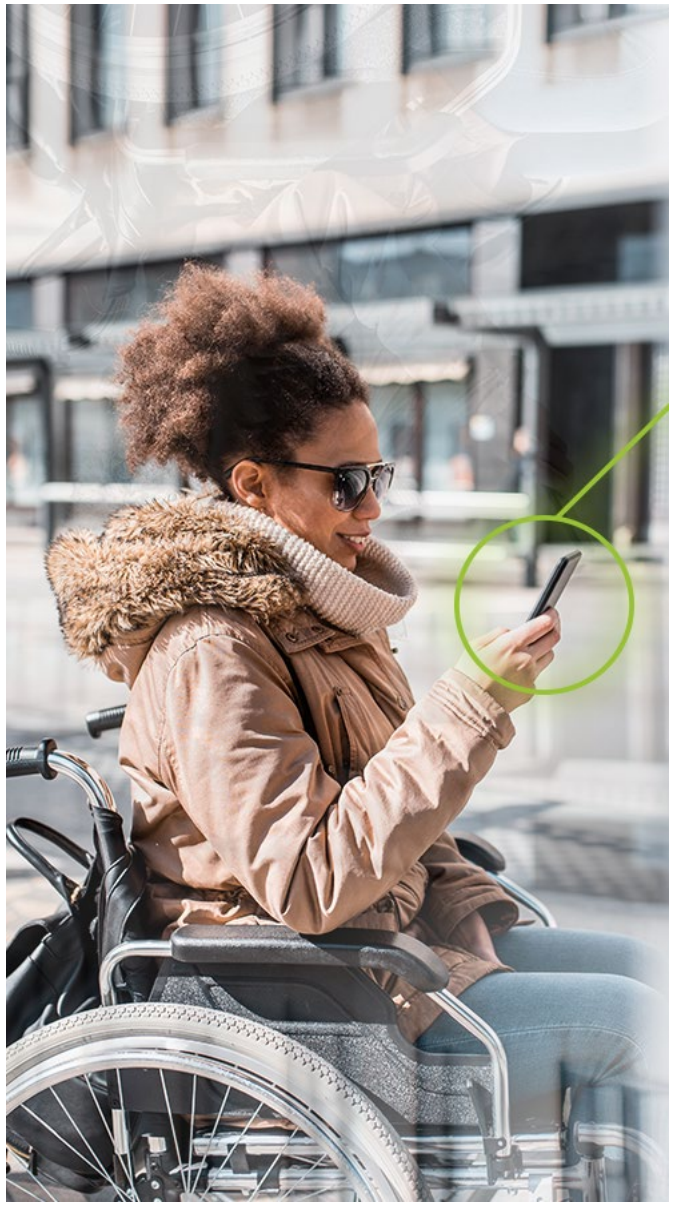
- Closing the first/last mile gap
- Availability check for DRT vehicles

Solution 1: Smart integration of Demand Responsive Transport



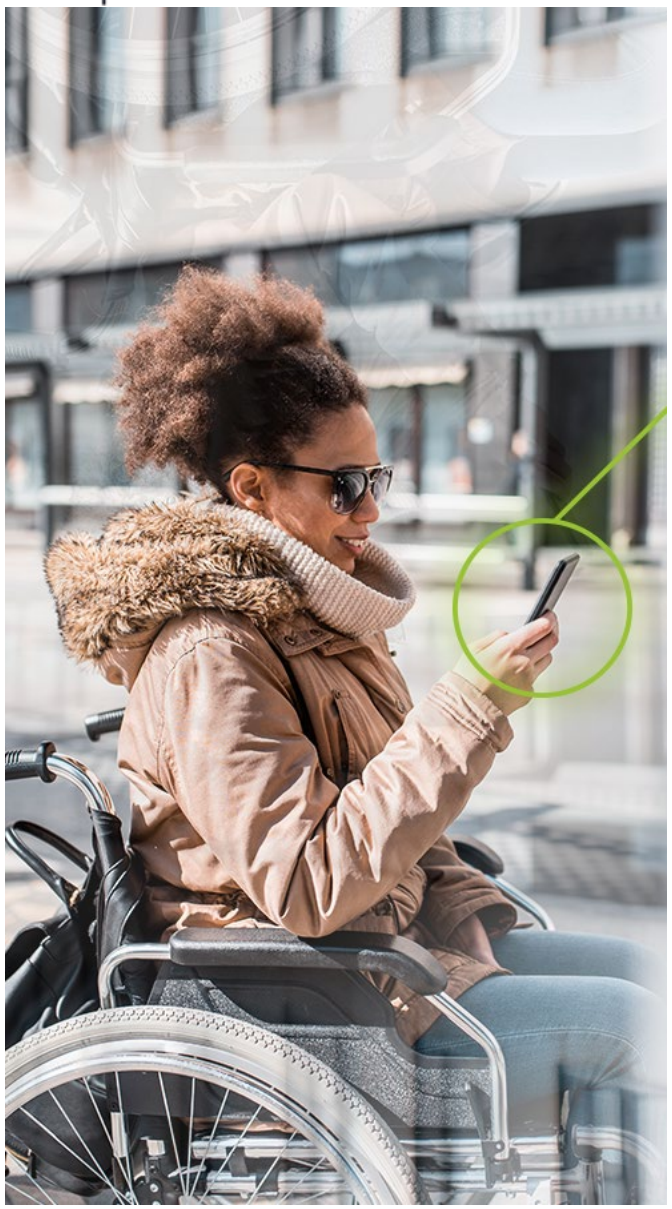
- Closing the first/last mile gap
- Availability check for DRT vehicles
- Considering competition between DRT and bus/rail

Problem 2: It is hard finding accessible routes



… for persons with reduced mobility (PRM)

Problem 2: It is hard finding accessible routes



… for persons with reduced mobility.

Everyone can be a PRM.





Solution 2: Profiles for persons with reduced mobility



Profiles for

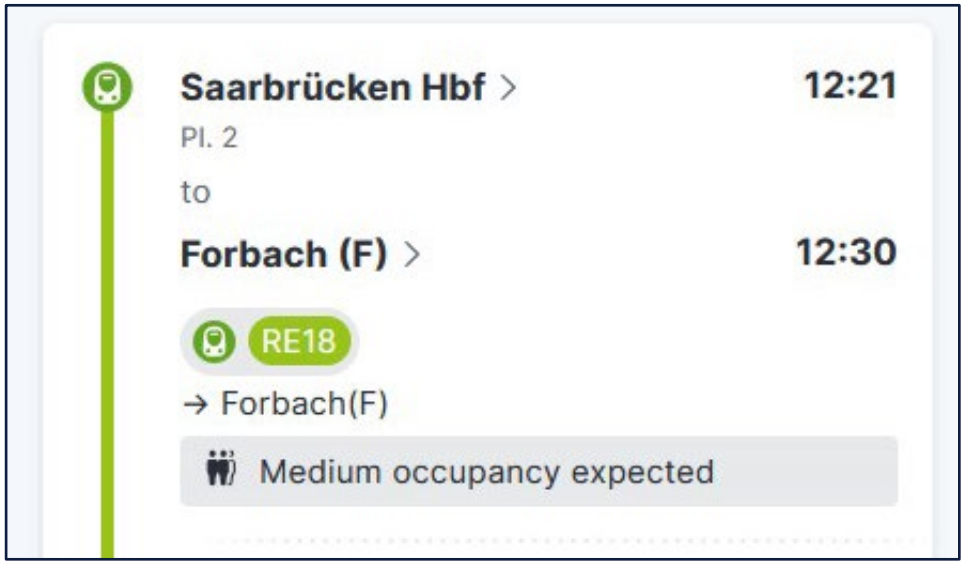
- Wheelchair user
- Wheelchair user with auxiliary person
- Walking impaired (e.g. rollator)
- Short walks

Problem 3: Travellers don‘t like crowded trains and buses





Solution 3: Make occupancy levels transparent



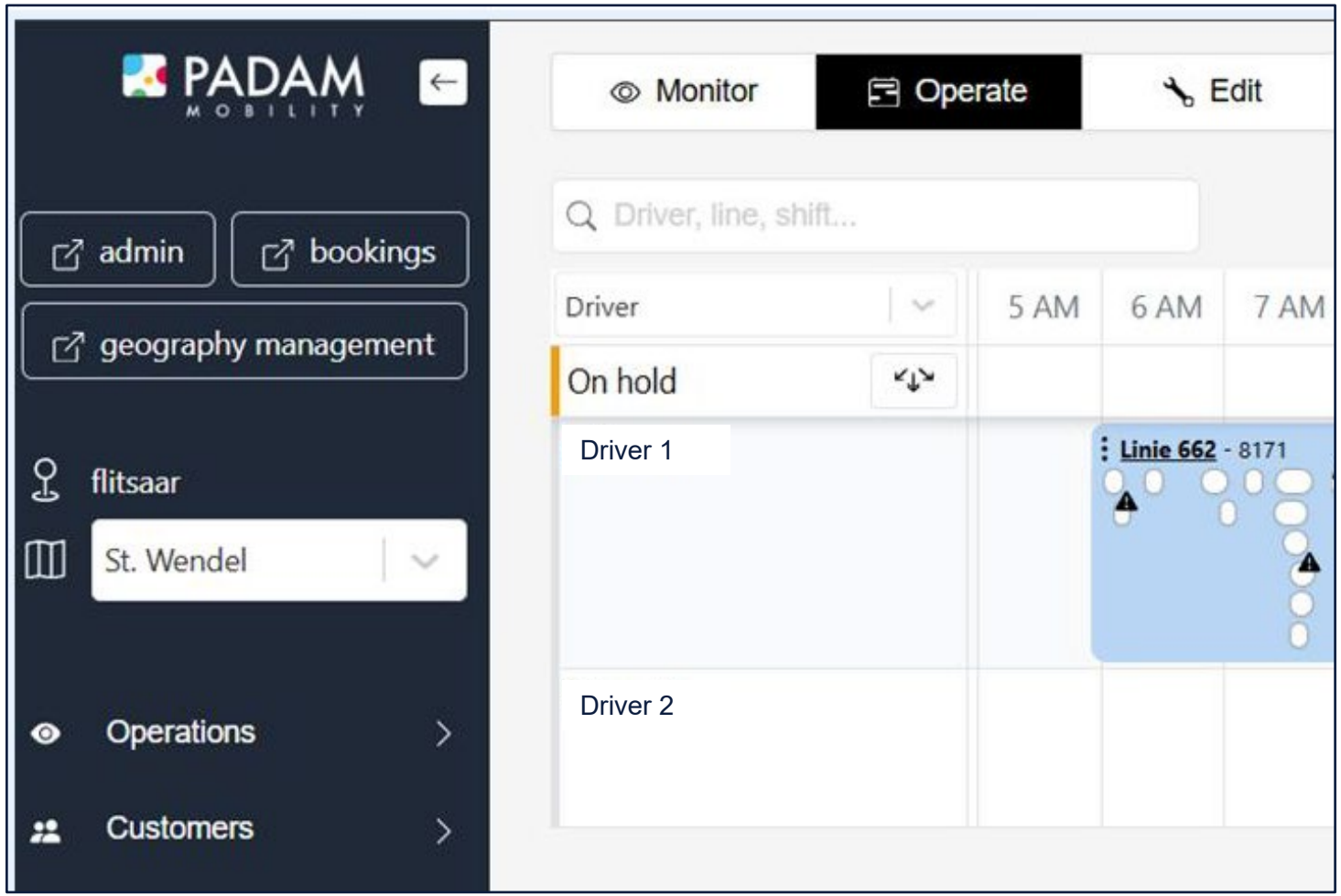
- Display occupancy forecast
- Forecast based on
  - trip search requests
  - counting data
  - capacity data
- Machine-learning approach

Problem 4: How many DRT vehicles for a new service area?





Solution 4: DRT simulation based on demand input from the PIS



- Input: Trip search responses
- First and last mile legs used to derive demand for DRT
- Derived demand is used for simulation runs with different number of vehicles

Demo 1: Passenger Information System

Demo workshop at regional transportation authority ZPS

- Demonstration of implemented solutions in front of experts
- Discussion of impact on costs and customer satisfaction

Four-week test phase with end users in Saarland area

- Support from ZPS in acquisition of test users including PRM
- Feedback via online questionnaires
- Overall positive perception of implemented features



Demo 1: Passenger Information System

Feedback from test users and experts

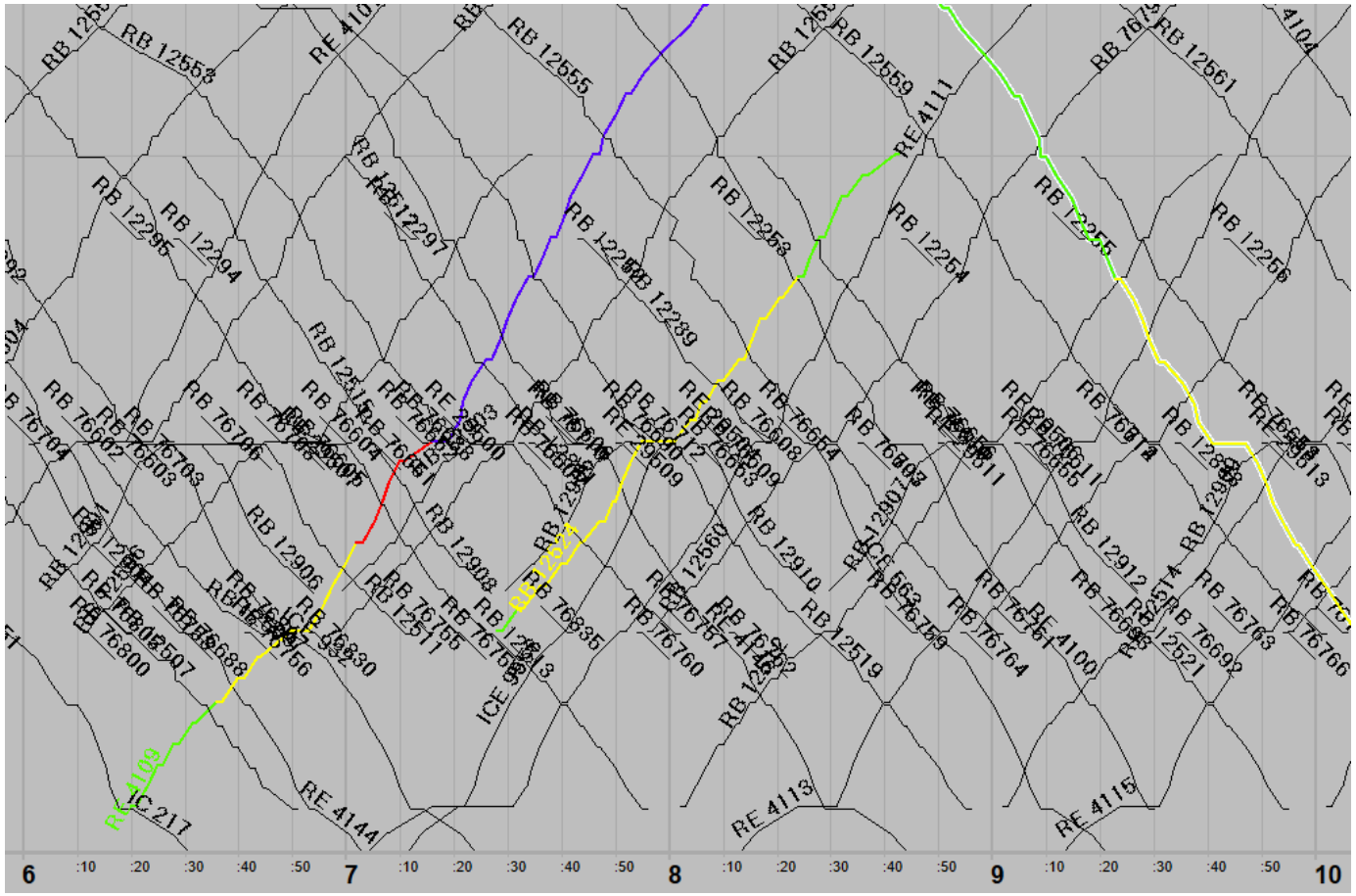
- DRT improves cost-benefit ratio in low-density rural areas; strict competition rules reduce overall required fleet size.
- Benefit in real-time alternative trip options in case of delays and disruptions
- Appreciation of barrier-free routing profiles for PRM
- Occupancy forecast helpful for traveller’s choice



Problem 5: TMS operators lack passenger demand data



Solution 5: Transfer of demand forecast data from PIS to TMS

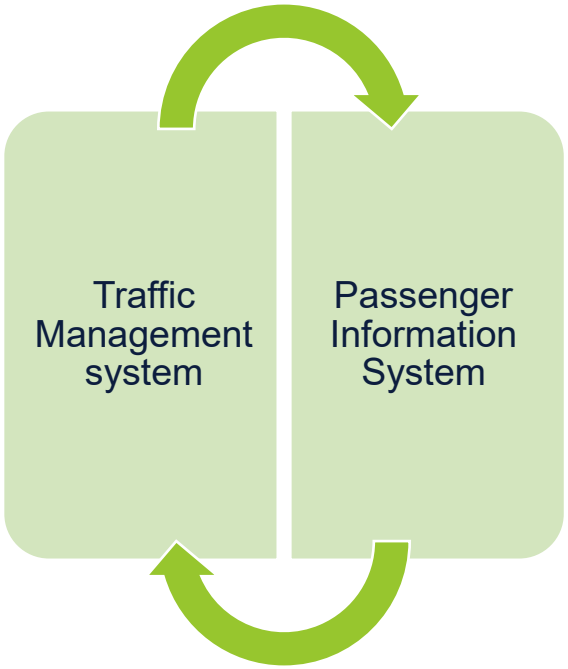


- PIS sends demand forecast to TMS
- Visualization within TMS, e.g. by a coloured train graph
- Changes are fed back to the PIS

Demo 2: TMS-PIS Bidirectional Exchange

Bidirectional operational and demand data exchange bridges the gap between dispatchers and passengers

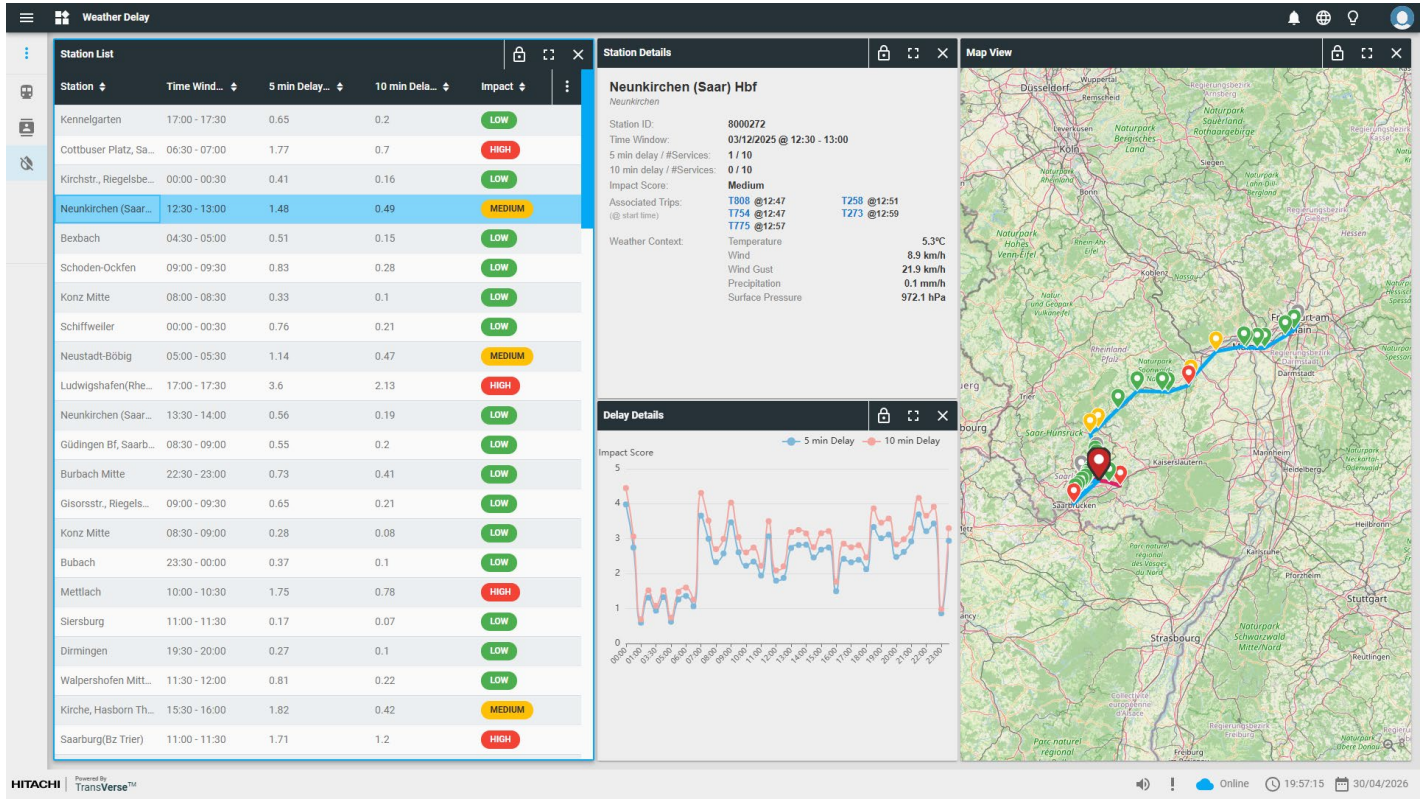
- Proven technical interoperability via exchange of operational forecasts (delays, cancellations) from TMS to PIS, and passenger demand forecasts from PIS to TMS.
- Establishes the digital backbone for demand-aware railway operations, enabling smarter capacity management, reduced energy/operating waste, and optimised crew/vehicle dispatching.
- Eliminates uncertainty during disruptions/delays by pushing accurate, up-to-the-minute operational forecasts directly to traveller apps, ensuring passengers can react instantly.



Problem 6: Weather-induced uncertainty causes network congestion



Solution 6: Weather forecasts to predict train delays and proactively adjust staff allocation.

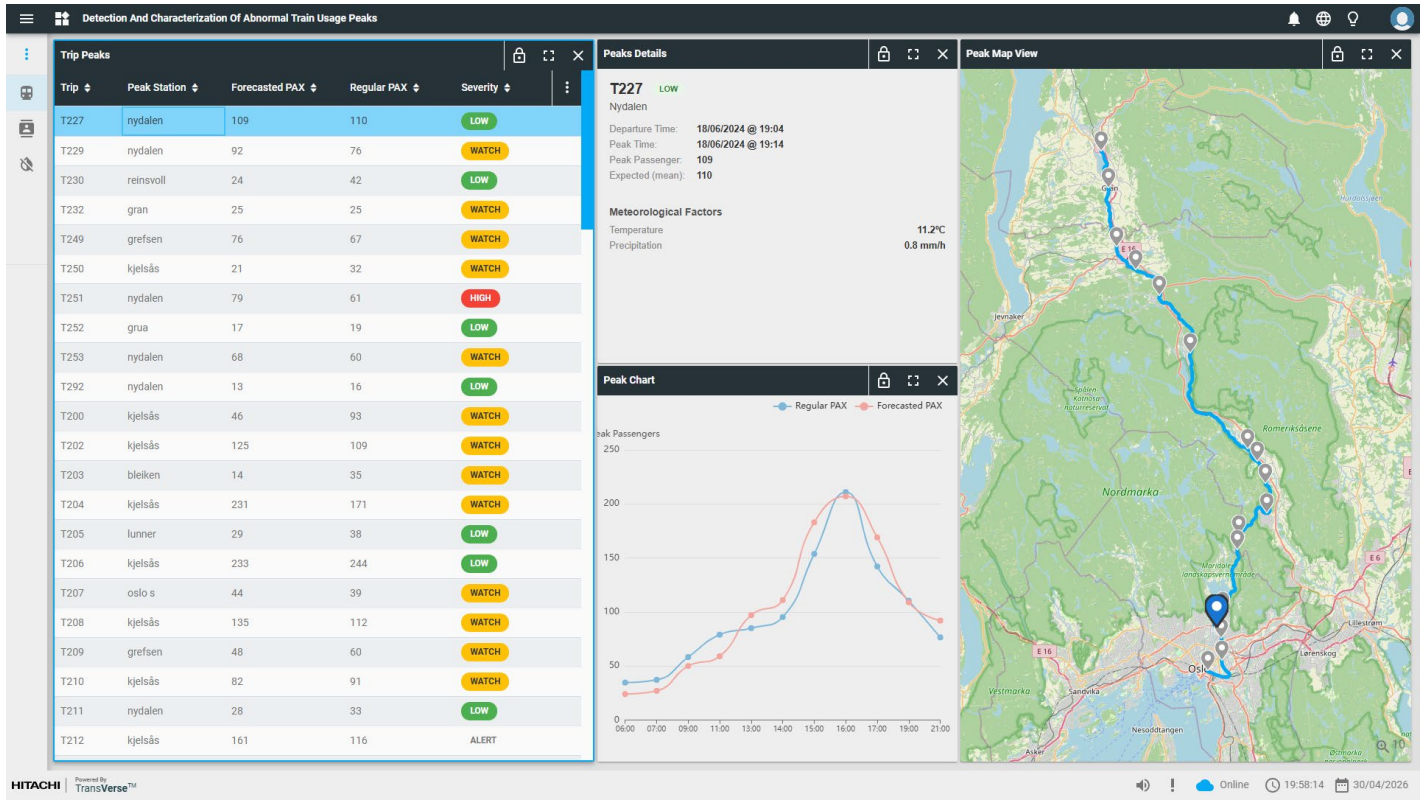


- Weather data: historical and forecast
- Train Timetable data: planned and observed
- AI model trained with specific data
- AI model applied to the current weather forecast data.

Problem 7: Unpredictable usage peaks may cause service congestion



Solution 7: Demand-based usage peak detection enables proactive staff allocation to reduce congestion.

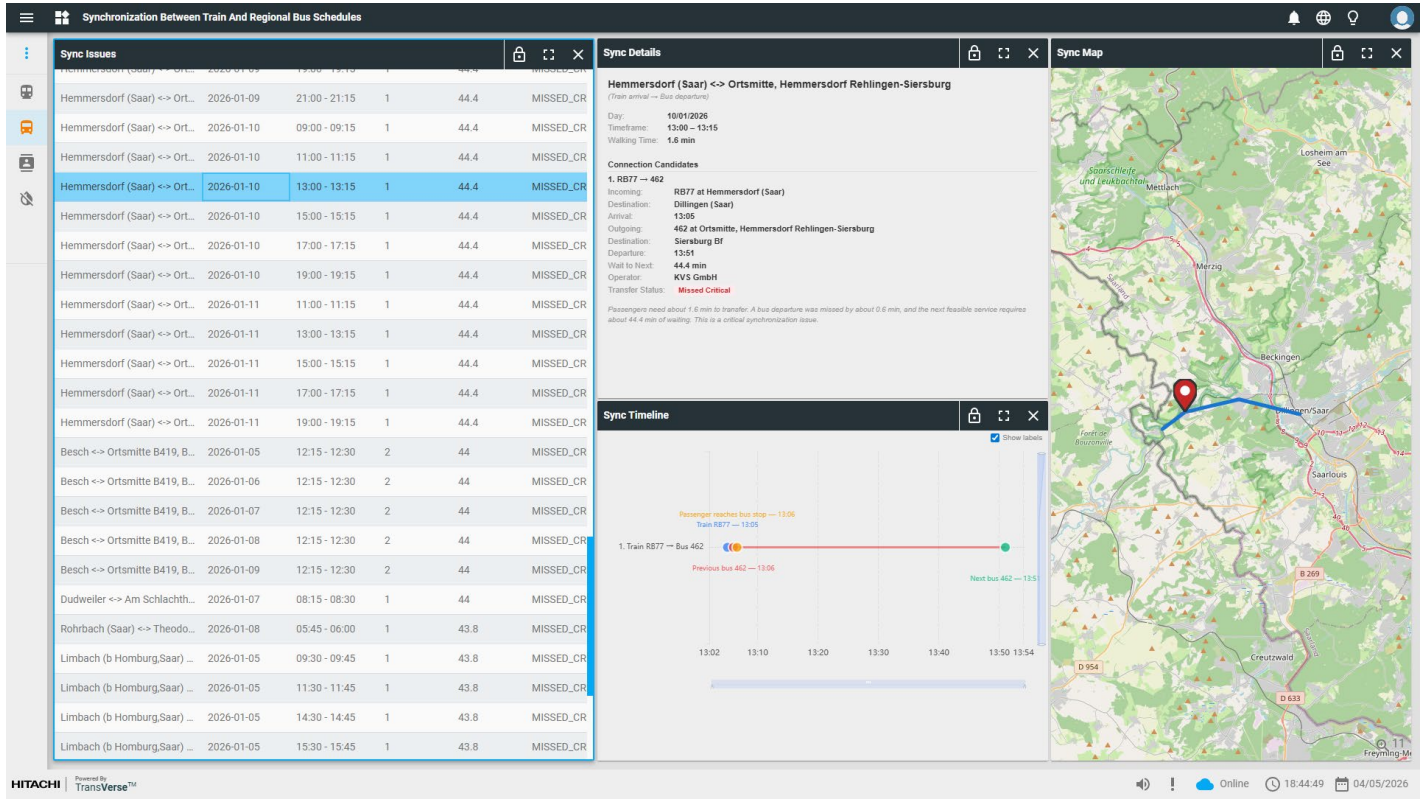


- Demand data: historical and forecast
- AI model trained with specific data
- AI model applied to the current demand forecast data.
- Identify abnormal usage peaks

Problem 8: Inefficient schedules hide optimisation opportunities



Solution 8: Schedule analysis identifies time slots suitable for optimisation

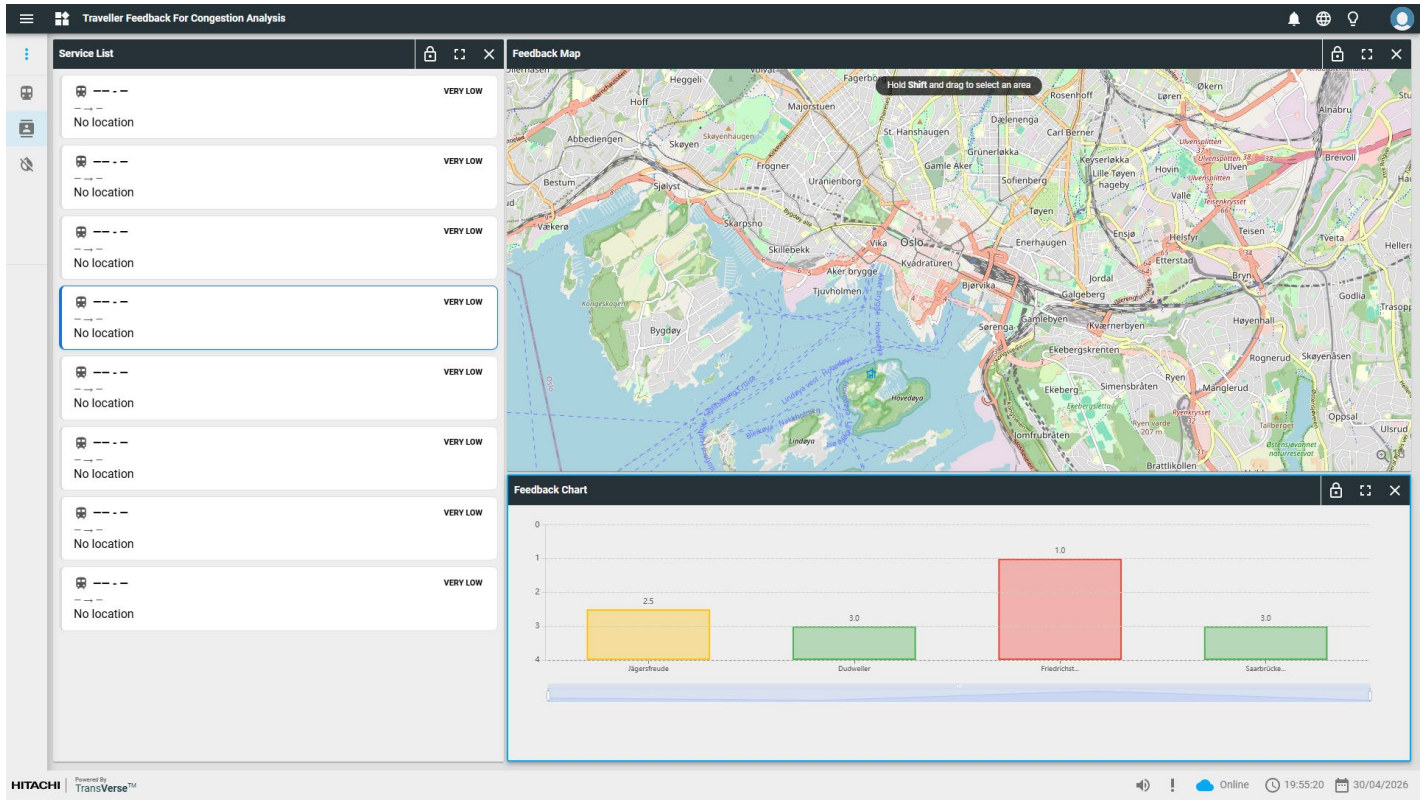


- Train and Bus timetables
- Algoritm to analyse the data and synchronization.
- Identify time slots where synchronization could be improved.

Problem 9: Limited visibility of real-time passenger congestion



Solution 9: Crowdsourced passenger data provides real-time network status



- Specific tool to collect data from passengers
- Algorithm to merge related feedbacks
- Network status presented in real-time.

Demo 3: Passenger Congestion Monitoring and Weather Impact Analysis

AI-driven peak detection and weather risk models transform reactive delays into proactive management

- Machine learning models successfully quantified weather delay risks (81.5% accuracy) and abnormal usage peaks, processing ~476k timetable records in 70 seconds.
- Empowers transport authorities and operators to preemptively adjust train-bus connections, mitigate bottleneck congestion, and optimize timetable synchronization.
- Empowers travellers with crowd-sourcing feedback tools and transparent congestion insights, helping them avoid overcrowded services and choose less congested alternatives.

Problem 10: Platform allocation affects passenger connections

At complex stations, assigning connecting trains to distant platforms can reduce the effective time available for passenger transfers.

OPERATIONAL FEASIBILITY
Each train must be assigned to a compatible and available platform.

PASSENGER CONNECTIONS
The distance between platforms affects the effective transfer time.

MULTIPLE INTERDEPENDENCIES
Timetable, station layout, passenger flows and operating constraints must be assessed together.



The challenge is to identify a feasible platform allocation that also supports passenger transfers.

Solution 10: Integrating passenger connections into platform allocation

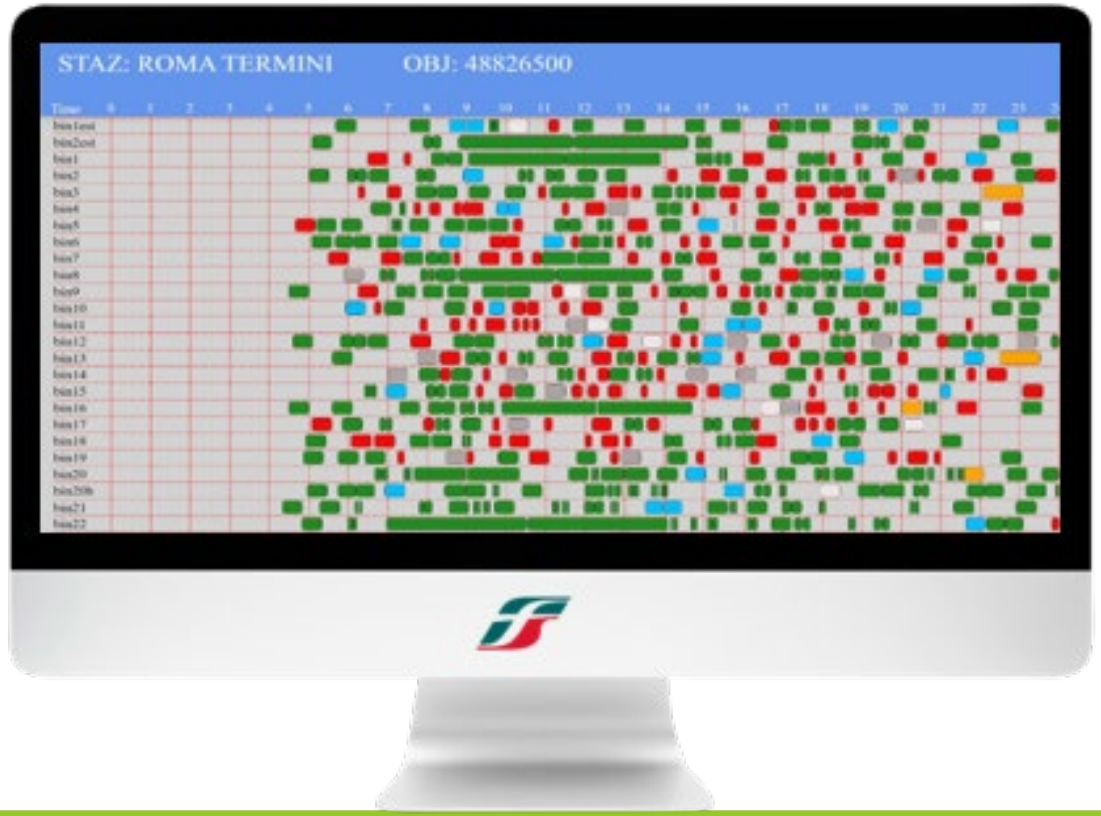


Train-to-platform assignments supporting passenger transfers while respecting operational constraints.

Demo 4: Train Platform Allocation

From data ingestion to decision-support views

The full workflow was exercised in a simulation environment using operationally relevant data.



1 **Acquire**
Timetable, platform, passenger-flow and operational data

2 **Optimise**
Run MILP-based platform allocation within a selected time window

3 **Inspect**
Review platform occupation, connections, flows and train details

TEST STATUS: PASSED

TRL 6

Reported evidence: data processed correctly, optimized track assignment generated, results displayed, and no illegal track overlaps detected.

TPP turns platform allocation into an evidence-based decision process that explicitly considers passenger transfers alongside operational feasibility.

What does this mean for Regional Rail

Digital integration unlocks a resilient, cost-efficient, and passenger-centric regional transport ecosystem

Unified operations: connects infrastructure systems and customer platforms into collaborative systems.

Optimised fleets: Solves low-density transport challenges via simulation, cutting unnecessary CAPEX/OPEX.

Seamless travel: Replaces fragmented journeys with a predictable, accessible multimodal service.

Way Forward

In the next phases of FA6, the developments will be further refined and taken up to higher TRLs.

A foundation for more passenger-oriented services

DEMONSTRATED

Beta software workflow
Operationally relevant data
TRL 6 evidence

NEXT STEP TOWARDS DEPLOYMENT

Further integration
Broader validation
Operational process alignment

LONG-TERM PERSPECTIVE

seamless, data-driven framework
for modern regional rail

Europe's Rail

Founding Members



adif

ALSTOM

mermec
AN ANGEL COMPANY

AŽD

CAF

ceit
IK4 Research Alliance

cd

DB

DLR

eSGR
European Smart Green Rail

Faiveley Transport
A Wabtec Company

FERROVIE DELLO STATO ITALIANE

HITACHI
Inspire the Next

indra
Talgo

Jernbane-direktoratet

KNORR-BREMSE

ÖBB

PKP
POLSKIE KOLEJE PAŃSTWOWE
Spółka Akcyjna

ProRail

SIEMENS
Ingenuity for life

SNCF

Strukton
Rail

THALES
Together • Safer • Everywhere

TRAFIKVERKET

RAILWAY SYSTEMS
by voestalpine

Pictures

- Mars Pathfinder: University of Washington, Department of Atmospheric Sciences Homehttps://www-k12.atmos.washington.edu/k12/mars/MPF_short_facts.html
- Haltestelle Saarbahn: Wikipedia, https://de.wikipedia.org/wiki/Datei:Walpershofen-Haltestelle-Ortsmitte1.jpg