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Brussels, 28 September 2026

NEXUS Presentation & Overall Progress



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TIME	DESCRIPTION	PRESENTER (S)
13:00 – 14:00	Welcome Lunch & Registration	
14:00 – 14:15	Welcome & Opening	ERTICO, UITP
14:15 – 14:30	EU-Rail's Vision and Outlook	EU-Rail JU Project Officer
14:30 – 14:45	NEXUS Overall presentation	STAM
14:45 – 15:15	Session 1: Future Train Control and Automation	SIEM
15:15 – 15:45	Session 2: Designing Passenger-Centric Metro Vehicles and Platforms	TUW, SIEM
15:45 – 16:05	Coffee Break	
16:05 – 16:35	Session 3: Artificial Intelligence & Cyber security for Smarter Metro Operations	VIF, AU, PT
16:35 – 17:20	Session 4: Digital Twins for Metro Planning and Operations	AU, UNIGE, STAM
17:20 – 17:50	Session 5: From Research to Deployment – Exploitation, Impact and Legacy	TIS
17:50 – 18:00	Closing remarks and acknowledgements	STAM, EU-RAIL



13

Partners



7

Countries



3

Workstreams



10

Work Packages



2

Use Cases



24

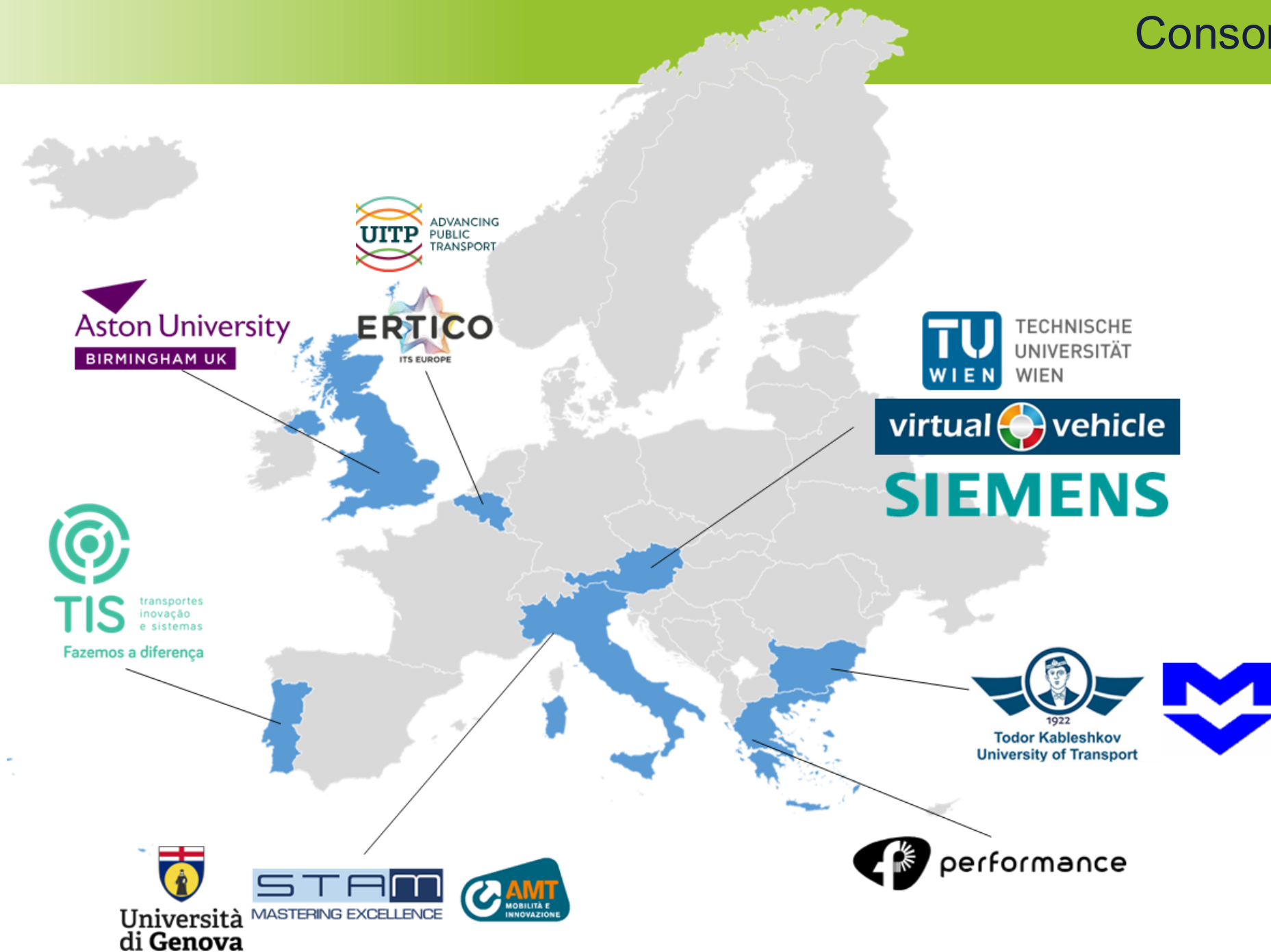
Months



3

Flagship Projects

“Next-gen technologies for enhanced metro operations”



Members and Activities



- Provision of expert opinion about ongoing project developments, feeding and enriching the project research
- Consultation at NEXUS different steps
- Support to project partners with ad hoc inputs on surveys/questionnaires, sharing them within their networks for enhancing project reach
- Validation of NEXUS intermediate and final results
- Participation in project workshops activities that may require their attention, providing expert support

NEXUS sets an innovation benchmark in urban transport, addressing key challenges and guiding European metro systems toward transformative futures.



WS1

Metro Adaptability

Enhancing adaptability to demand fluctuations using simulations and user-centred optimisation.



WS2

Future Train Control

Exploring future train control systems, emphasising automation, sustainability, and safety.



WS3

AI & Data Science

Applying AI and data science to optimise metro operations.



Models Supporting Metro Adaptability

OBJECTIVES

- Understanding of passenger behaviours using innovative modelling approaches for both regular and exceptional scenarios.
- Simulation models for metro stations, incorporating dynamic passenger profiles and what-if simulations — feeding a digital twin of the network.
- Study and optimisation of metro vehicle designs, emphasising accessibility & inclusivity.

5

Train Layouts
modelled

3×

Network Models
— AMT Genova

3×

Network Models
— MetroS Sofia

2+2

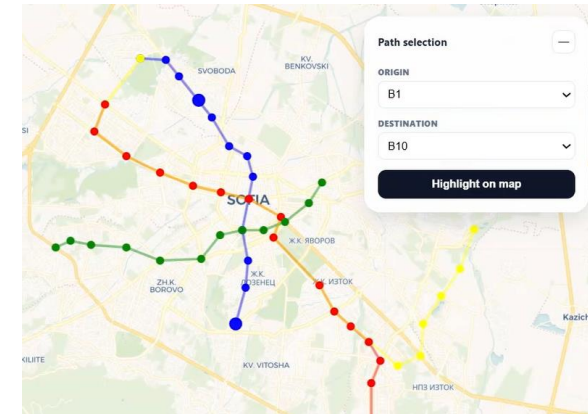
Model Stations
— AMT &
MetroS

SIMUL8

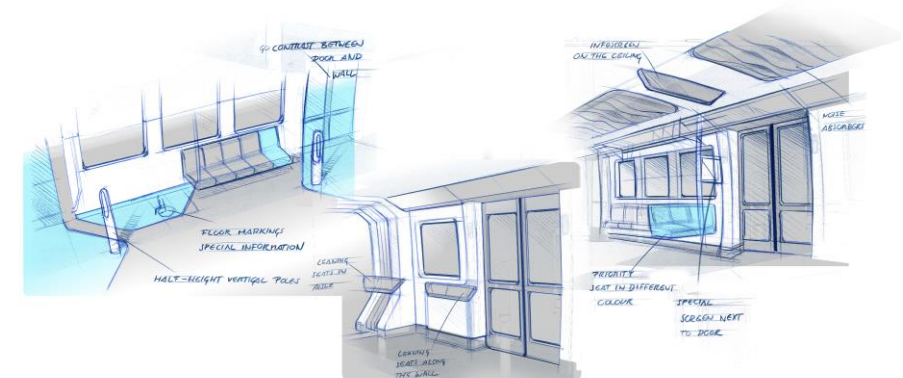
anylogic

extendSIM

MOBIUS



TrainOptimizer



Objectives

- Analysis of current urban train control systems (CBTC, TCMS) & their integration.
- Conduct a feasibility study on automated, fully digital control solutions, focusing on functionality, reliability, maintainability, and availability.
- Development of an architectural framework.
- Assessment of the feasibility and value of the future control systems by identifying both tangible and intangible benefits.

Key Findings



Future metro control systems must be modular, interoperable, and secure.



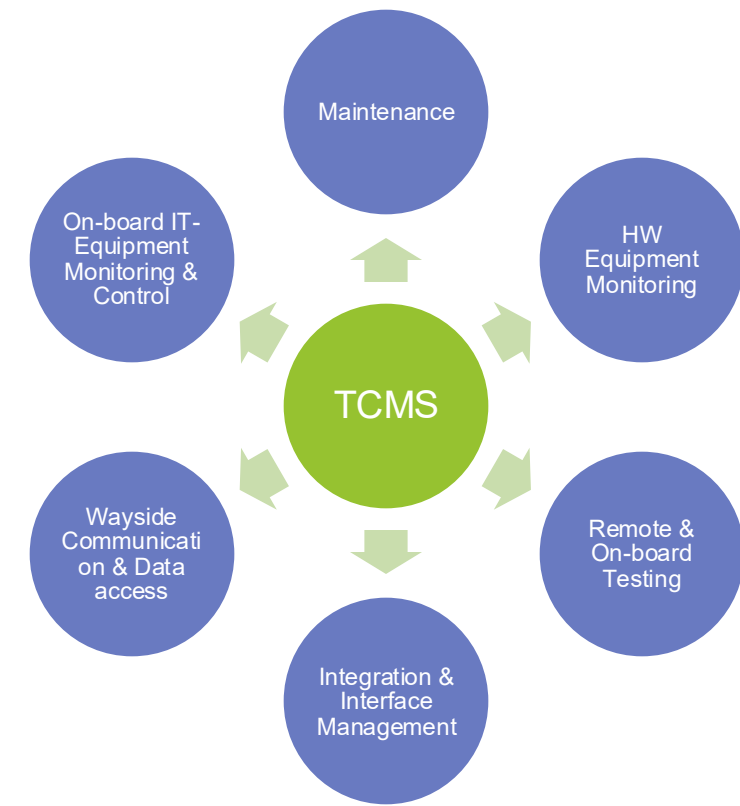
Integration of TCMS and CBTC is critical for automation and operational efficiency.



Operator and passenger needs drive requirements for flexibility, safety, and real-time data.



Strategic recommendations focus on hybrid architectures, open standards, and digitalisation.



Objectives

- To review IoT, Big Data, and AI applications in future metro operations, identify use cases for AI
- To optimize metro operations using data science and machine learning contributing to a responsive and financially optimized system
- To integrate AI for autonomous driving and train control, optimizing energy prediction, predictive maintenance and train2train communications
- To establish a proactive and comprehensive cybersecurity framework

Key points

1. Development of a model trained on 2024 passenger data. The model is used to extract demand scenarios used in the simulation models.
2. GTFS data can be used to optimize offering, predict passenger demand and for real-time information sharing between operator and passengers
3. 93% accuracy on Clean/Unclean classification in rail cars.
4. Log-Linear Regression model to forecast passenger demand.

4 USE CASES



Crowding prediction in metro stations



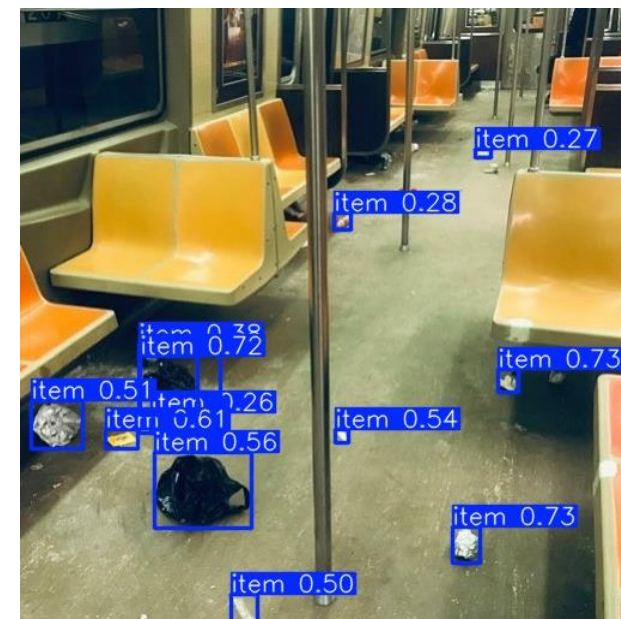
Timetable creation using GTFS feeds



Anomaly detection (vehicle soiling, obstacles)



Passenger demand forecasting — West Midlands Metro





Challenges/gaps for passengers and operators



Optimization of service based on flexible adaptation to travel demand.



Simulation models of metro networks, stations and train layouts



AI use cases for metros of the future.



Train Control Systems



Guidelines and recommendations

THANK YOU!

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 NEXUS Project

 nexus-heproject.eu

