Flagship Area 1:

FP1 MOTIONAL

European Rail Network and Mobility Management

Network management planning and control, Mobility Management in a multimodal environment and Digital Enablers

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HACON

San Sebastian, 23-24 October 2024

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Funded by the European Union

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Anti-Trust-Statement

While some activities among competitors are both legal and beneficial to the industry, group activities of competitors are inherently suspect under the antitrust/ competition laws of the countries in which our companies do business.

Agreements between or among competitors need not be formal to raise questions under antitrust laws. They may include any kind of understanding, formal or informal, secretive or public, under which each of the participants can reasonably expect that another will follow a particular course of action or conduct. Each of the participants in this initiative is responsible for seeing that topics which may give an appearance of an agreement that would violate the antitrust laws are not discussed. It is the responsibility of each participant in the first instance to avoid raising improper subjects for discussion, notably such as those identified below.

It is the sole purpose of any meeting of this initiative to provide a forum for expression of various points of view on topics

- (i) that are strictly related to the purpose or the execution of the initiative,
- (ii) that need to be discussed among the participants of the initiative,
- (iii) that are duly mentioned in the agenda of this meeting and
- (iv) that are extensively described in the minutes of the meeting.

Participants are strongly encouraged to adhere to the agenda. Under no circumstances shall this meeting be used as a means for competing companies to reach any understanding, expressed or implied, which restricts or tends to restrict competition, or in any way impairs or tends to impair the ability of members to exercise independent business judgment regarding matters affecting competition.

As a general rule, participants may not exchange any information about any business secret of their respective companies. In particular, participants must avoid any agreement or exchange of information on topics on the following non-exhaustive list:

1. Prices, including calculation methodologies, surcharges, fees, rebates, conditions, freight rates, marketing terms, and pricing policies in general;
2. any kind of market allocation, such as the allocation of territories, routes, product markets, customers, suppliers, and tenders;
3. production planning; marketing or investment plans; capacities; levels of production or sales; customer base; customer relationships; margins; costs in general; product development; specific R&D projects;
4. standards setting (when its purpose is to limit the availability and selection of products, limit competition, restrict entry into an industry, inhibit innovation or inhibit the ability of competitors to compete);
5. codes of ethics administered in a way that could inhibit or restrict competition;
6. group boycotts;
7. validity of patents;
8. ongoing litigations.

FP1 Motional Overview

Objective:

- Improve railway planning and operational management to make rail the preferred mode of transport in Europe.

Vision of the future European Railway System:

- Interoperable and resilient
- Adaptive capacity
- Integration of all services, including first/last mile operations
- Exploitation of digitalization opportunities

Current Challenges:

- National/regional management with legacy systems
- Poor digitalization and weak integration (between rail systems and with other modes)
- Networks complexity
- Demand for international trains

Project Goals:

- Develop functional requirements, specifications, and solutions
- Transform capacity planning and traffic management systems (increase automation)
- Make rail the backbone of a multimodal transport system
- Deliver Digital enablers

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Project Partners and details

COORDINATOR

HACON

BENEFICIARIES

adif, AZD, DB, etra, HITACHI, KNORR-BREMSE, ProRail, THALES, Metro, ALSTOM, CAF, DLR, Faiveley Transport, indra, ÖBB INFRA, TRAFIKVERKET, SJ, mermec, ceit, enyse, FERROVIE DELLO STATO ITALIANE, Jernbane-direktoratet, PKP, SNCF, voestalpine, FGC Ferrocarrils de la Generalitat de Catalunya

Call:	HORIZON-ER-JU-2022-01	**Max grant amount:**	37.875.973,46 €
Topic:	HORIZON-ER-JU-2022-FA1-TT-01 - Network management planning and control & Mobility Management in a multimodal environment and Digital Enablers	**Total project cost:**	92.600.000,00 €
		Project duration:	46 months
Linked actions:	FP2 , FP3 , FP4 , FP5 , FP6	**Number of partners:**	88

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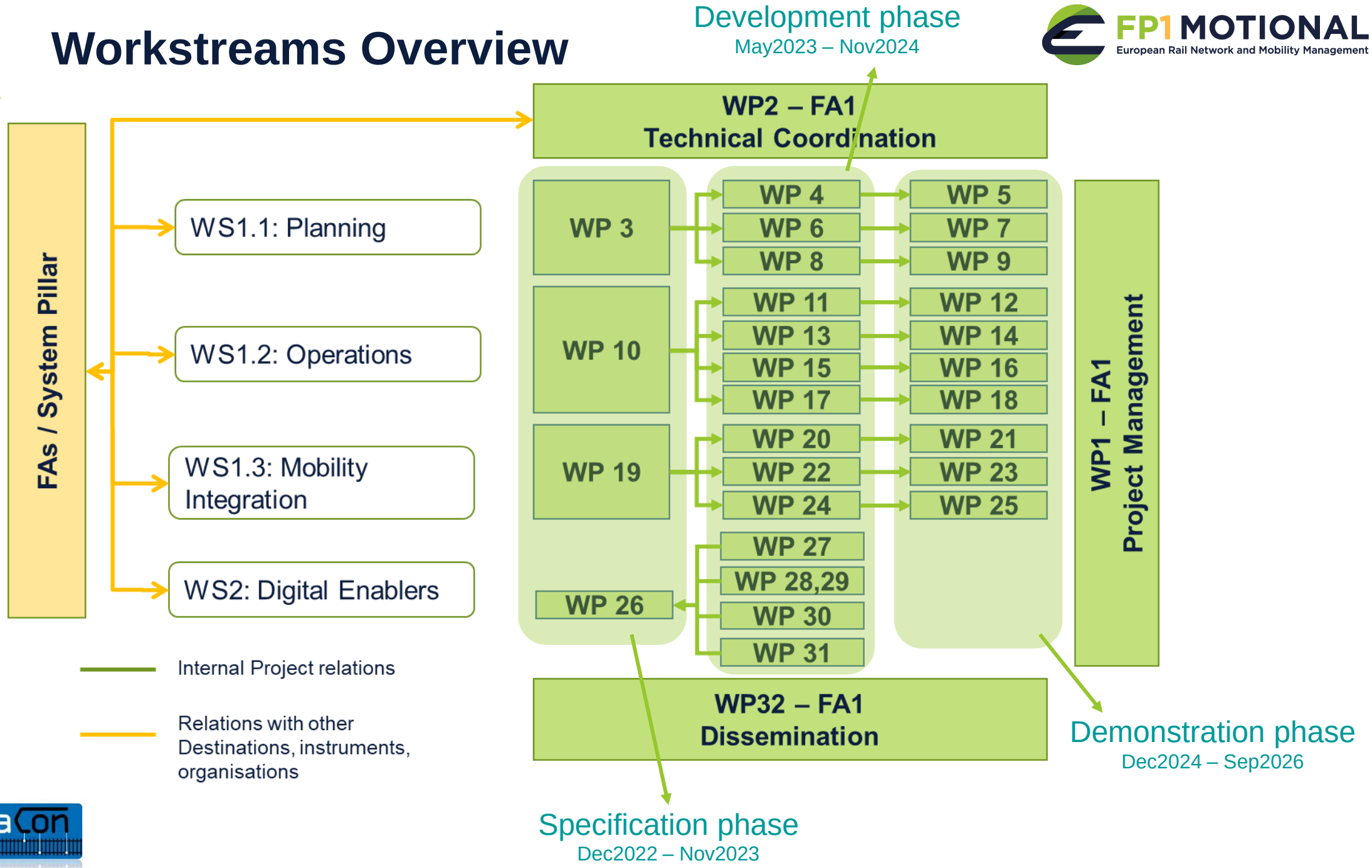
Workstreams Overview



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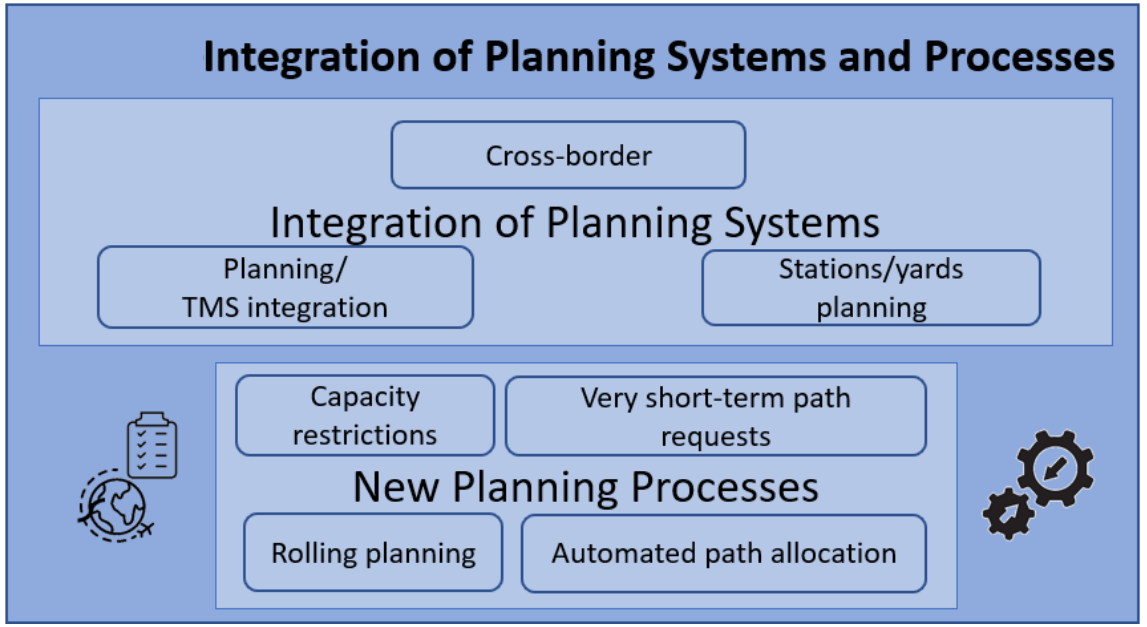
WS1.1 - Planning

WS1.1 – Planning | Context

Create the future railway planning processes and capacity management

- Planning systems Integration
- Cross-border traffic



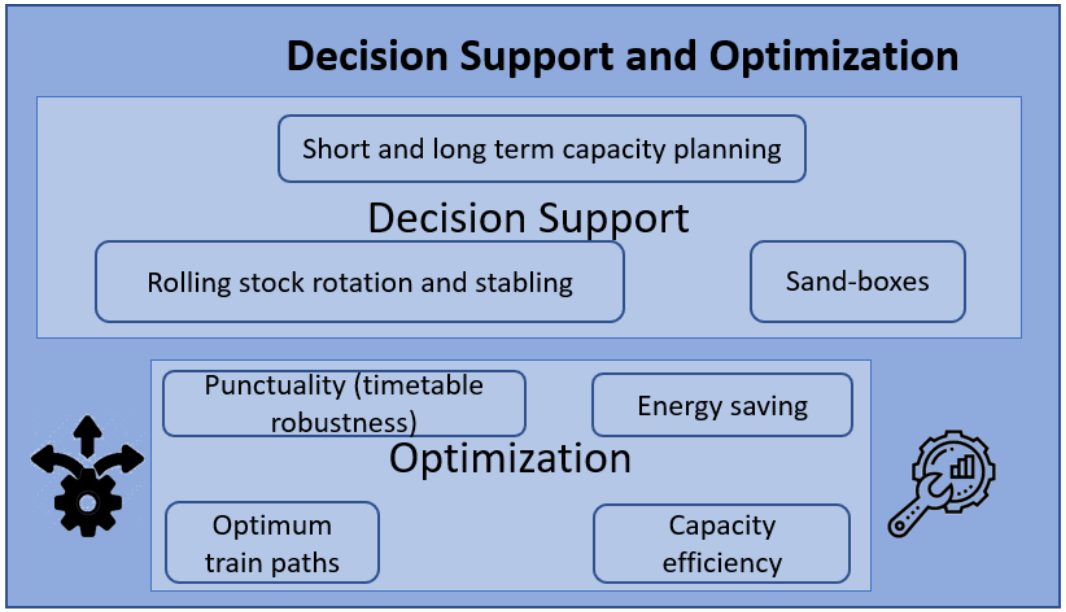
Detailed requirements and use cases for:

- Improved capacity allocation and new process
- Integration of traffic management system with network capacity planning
- Integration of network capacity planning with yard and station capacity planning
- Interfaces for interaction with external national or central planning applications

WS1.1 – Planning | Context

Optimise timetables and develop advanced algorithms.

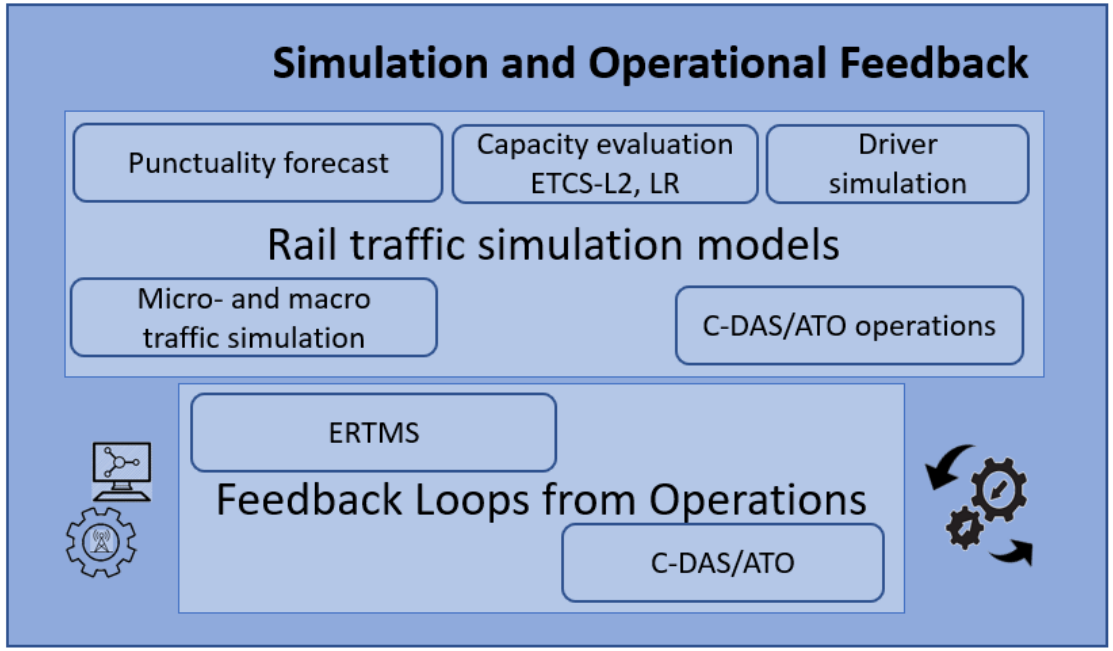
- Decision support modules and algorithms
- Solutions for optimisation: energy, punctuality, capacity, etc.



Defined demonstrations and Use cases for:

- Long term timetabling
- Short term timetabling
- Rolling stock planning

WS1.1 – Planning | Context



Simulate operational process

- C-DAS and ATO operations simulation
- Capacity simulation, evaluation and effects of New technologies

Developed simulation methods for Dato techniques (FP1-FP2 collaboration)

- ETCS Hybrid Train Detection System
- Next Generation-Brake System
- Centralized- Driver Advisory System, C-DAS
- Automatic Train Operation, ATO
- Traffic Management System, TMS

Developed methods and models for evaluating feedback loops between planning and operations

- Develop methods for analysing historical data from operations for evaluation of capacity
- Conclusions on historical data to produce primary delay distributions

WS1.1 – Planning | Challenges

- Develop supporting tools/modules for processes that are under development – SystemPillar, RNE and EU legislation
  - Activity - Close dialogue between FP1, SystemPillar and RNE

- Deliver TRL – demonstrations meets TRL level specified
  - Activity 1 – define how to evaluate TRL level for demo algorithm/functionality/method
  - Activity 2 – clear and well defined demonstrations and Technical enablers

- Succesful demonstrations
  - Activity 1 – define clear use cases for each demonstration
  - Activity 2 – Well defined activities, template and over all plan for demonstration phase (second phase of motional project 2025 and 2026)

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WS1.2 - Operation

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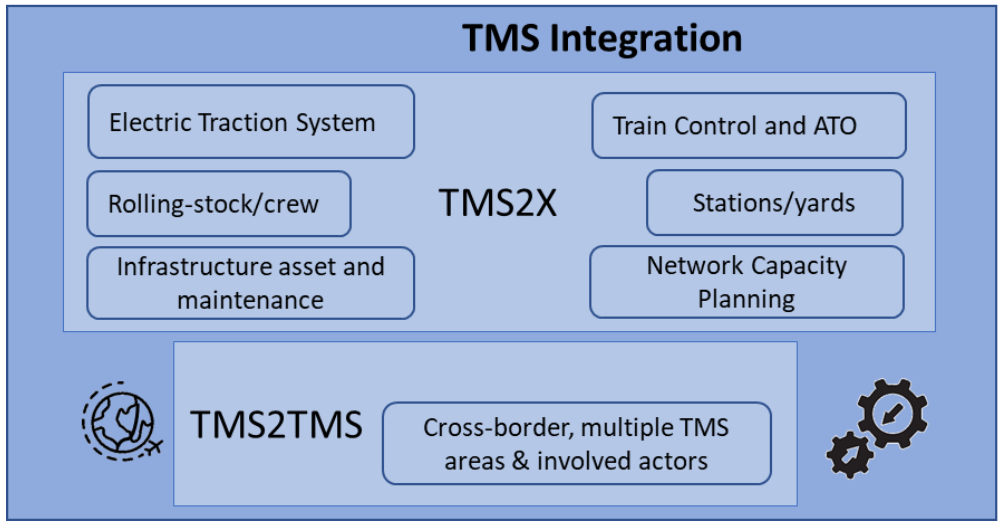
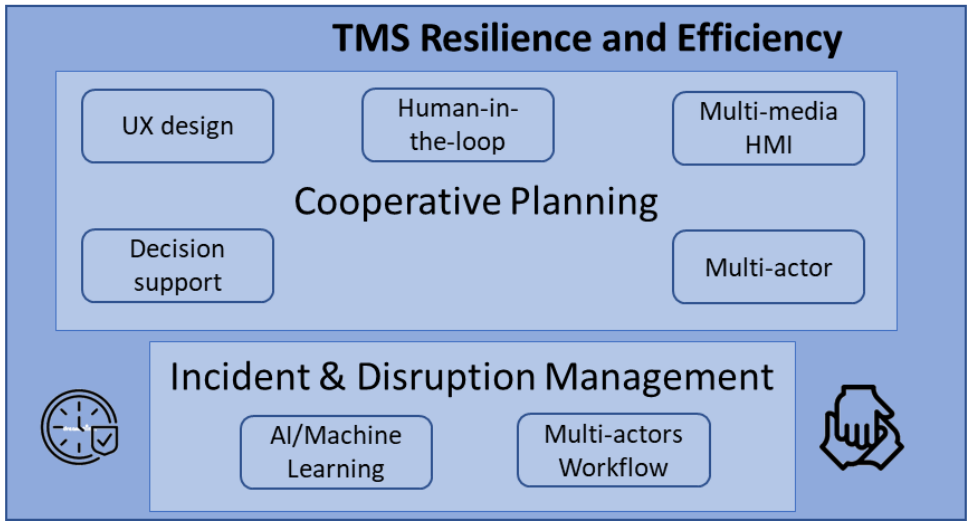
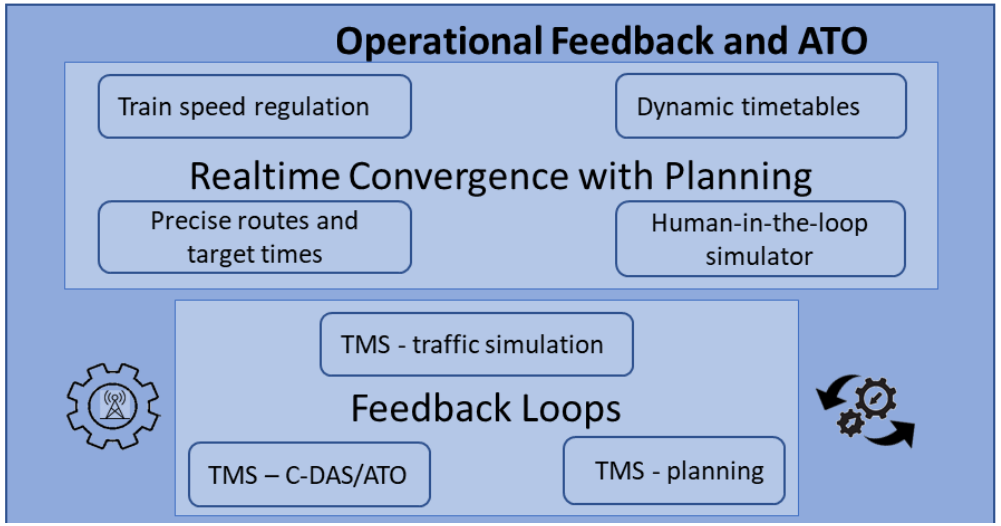
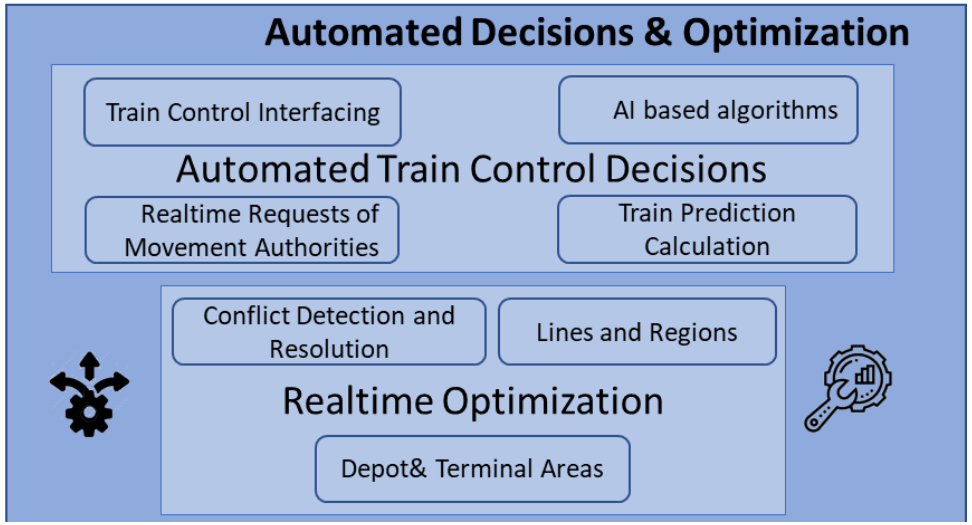
WS1.2 – Operations | Context

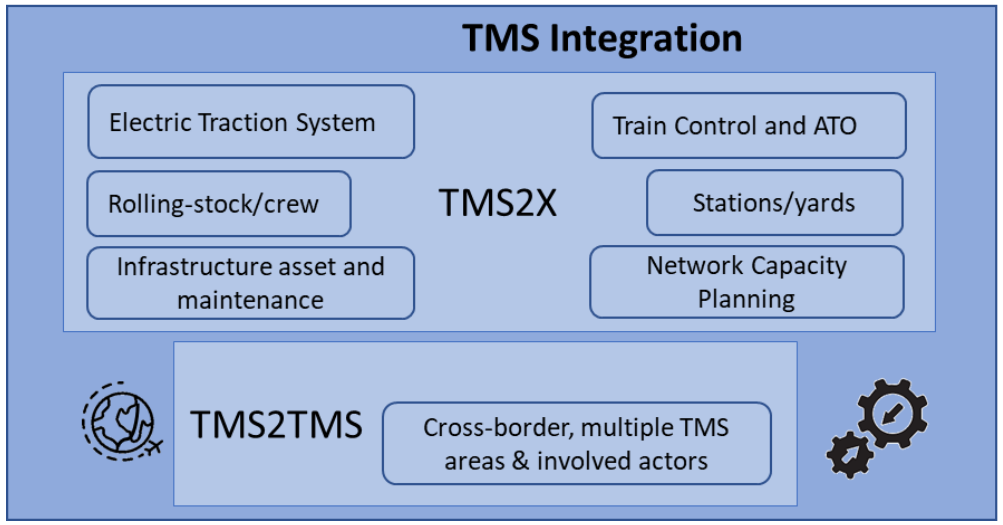








WS1.2 – Operations | Context



Technical Integration with external TMS and other actors or systems

- TMS2X integration
- TMS2TMS collaboration

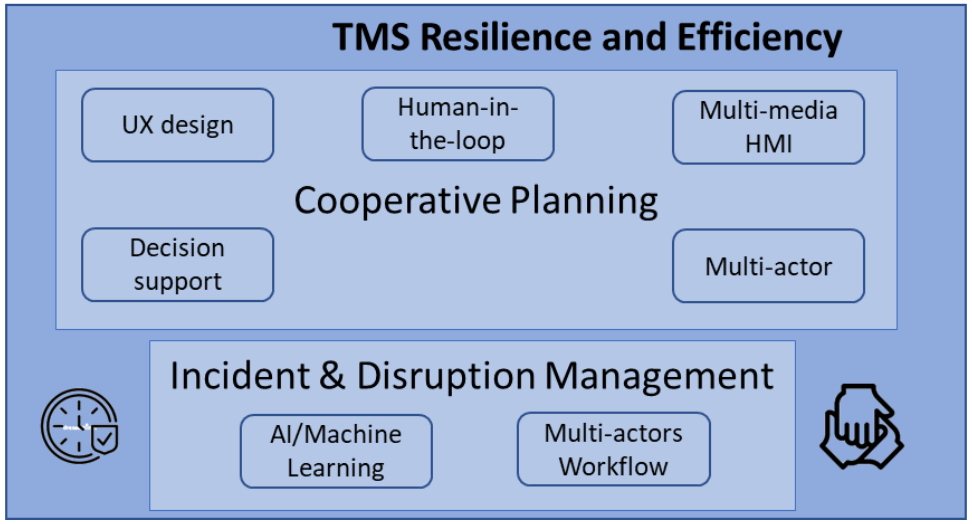
Developing processes and interfaces for higher integration of Traffic Management System (TMS) functions and decision processes:

- Creation of unified platforms for seamless communication and coordination between various TMS components across different regions and countries.
- Standardization of protocols and data exchange formats to break down silos and facilitate cohesive traffic management.

WS1.2 – Operations | Context

Improved resilience and efficiency

- DSS
- Human factors
- Disturbance/disruption management



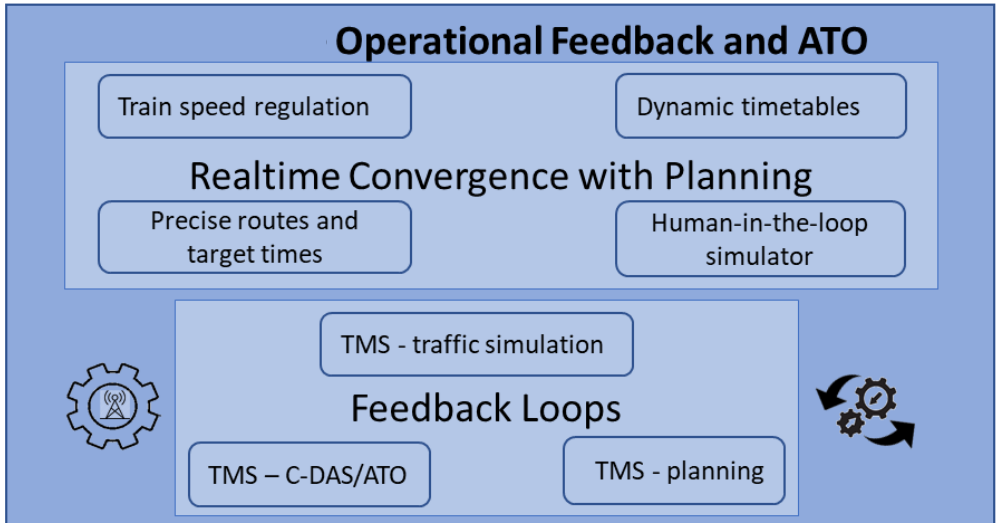
Creating modules for cooperative multi-actor optimization and decision support to enhance disruption management:

- Real-time collaboration between multiple stakeholders, including infrastructure managers, train operators, and emergency services.
- Integration of advanced analytics and predictive modelling to quickly identify potential disruptions, assess their impact, and coordinate effective responses.

WS1.2 – Operations | Context

Improved Automation

- Integration of traffic management system with network capacity planning
- C-DAS and ATO operation
- Energy and capacity optimisation



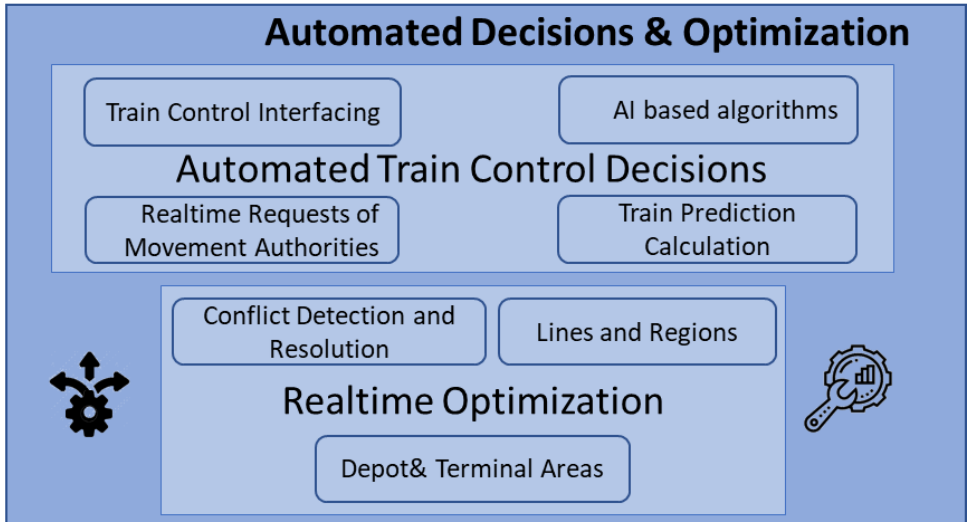
TMS and Automatic Train Operation (ATO)/Connected Driver Advisory System (C-DAS) integration:

- Increase network capacity, timetable robustness, energy efficiency, and punctuality
- Precise and adaptive control of train operations for smoother acceleration and braking, optimized speed profiles, and better adherence to schedules.
- Extensive testing and validation to ensure harmonious operation and delivery of intended benefits.

WS1.2 – Operations | Context

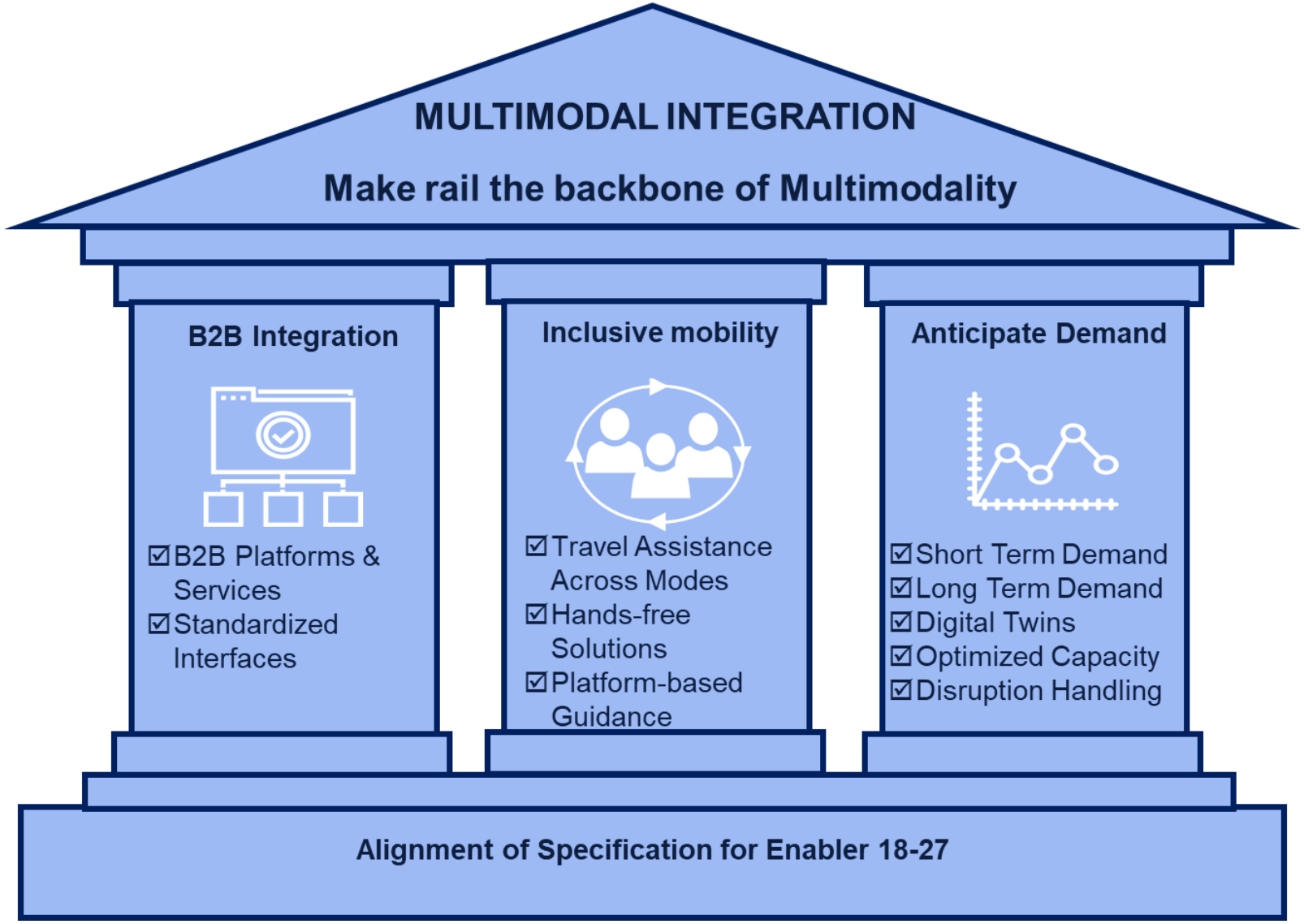
Automated Decisions and Optimization:
Developing algorithms and modules for future TMS to provide decision support and automate decisions for traffic management.

- Use of machine learning and artificial intelligence to analyze vast amounts of operational data, identify patterns, and make informed decisions in real-time.
- Reduction of reliance on manual intervention, leading to faster and more accurate traffic management decisions, improved capacity utilization, and enhanced overall network performance.



WS1.3 – Multimodal Integration

WS1.3 – Multimodal Integration | Context



Make Rail the Backbone of Multimodality

WS1.3 – Multimodal Integration | Achievements

Kick-off & Preparation

- Q4 2022. Preliminary project kick-off
- Q1 2023. Detailed analysis of the 9 enablers part of EU-RAIL Multi-Annual Working Plan from B2B Rail Integration to Travel Assistance, Demand Forecast, Capacity Optimization and Disruption Management
- Q2 2023. Review of Status Quo, baselines, knowledge transfer from previous projects. Definition of a shared engineering approach

Specification

- Q3 2023.
  - Delivery of use cases. A total of 54 use cases responding to the 9 enablers
  - Definition of system requirements, component architecture, data flows, interfaces
- Q4 2023. Delivery of WS1.3 specifications

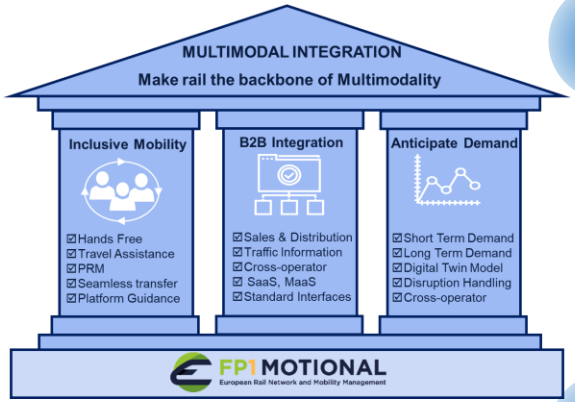
Development

- Q1 2024.Refinement of architecture, detailed design of components
- Q2, Q3 2024. Development of components (software, hardware, interfaces)
- Q3, Q4 2024. Iterative Integration and Testing including scenarios mapped to use cases and technical enablers
- Q4 2024. Early version of development reports (due delivery Date November 2024)

Demos

- 2023. Early vision of demonstrations, a total of 16 demonstrations in live areas (stations, mobility hubs).
- 2024. Framing of demonstration strategy, preparation of demonstration use cases, identification of data inputs, early demonstrations at INNOTRANS.
- Q1 2026 Demonstration execution

WS1.3 – Multimodal Integration | Challenges



Close developments. Finalize developments, especially for hardware parts deployed as part of the demos

Refine demo plans. Detail storyboards, participants, required data and timelines

Deliver TRL. Technical Readiness Level shall meet the ones specified for the enablers

Put in place interfaces. As part of the demos, between WS1.3 demos and other FP.

Deliver demonstration events. Includes live demos with end-users and results dessimination.

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WS2 – Digital Enablers

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What is a digital enabler?

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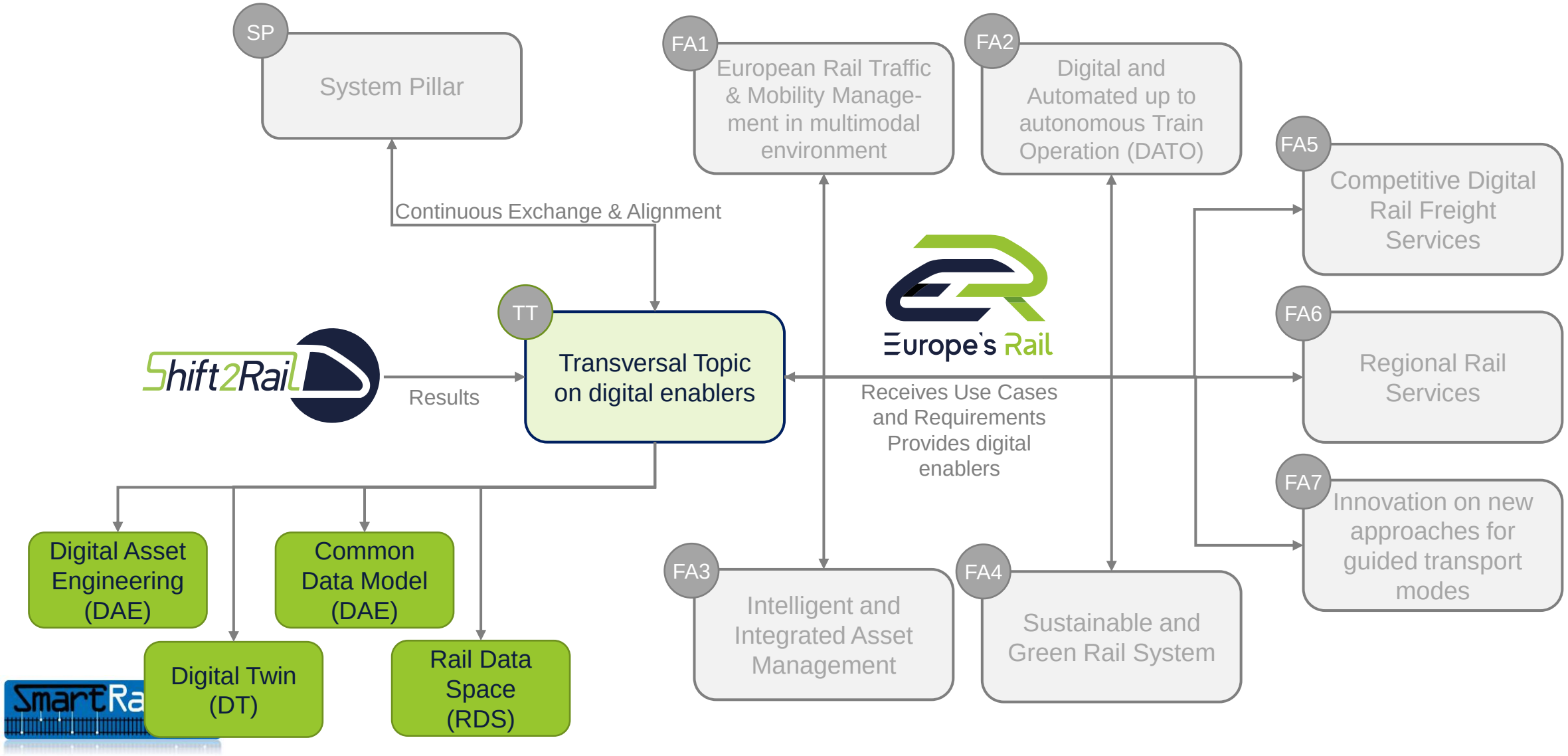
Digital Enablers Landscape in the Europe‘s Rail Joint Undertaking



Digital Asset Engineering (DAE)

OBJECTIVE: The Goal of DAE is to fully digitalize the Engineering process of railway assets (CCS, Stations, etc.) to ease engineering work, reduce costs of development and testing, and reduce time to deployment.

Challenges

- Paper-based design processes are prone to information loss
- Incomplete information delays the corrective maintenance process
- High cost of information exchange(non-standardized formats)

Benefits

- Increases economic benefits by reducing entrance barriers to new markets
- Increased operation efficiency(predictive maintenance/Monitoring through DT)
- Optimize rail operation and reduce energy consumption and emissions
- Automation saves time in design and construction phases.

Digital Twin (DT)

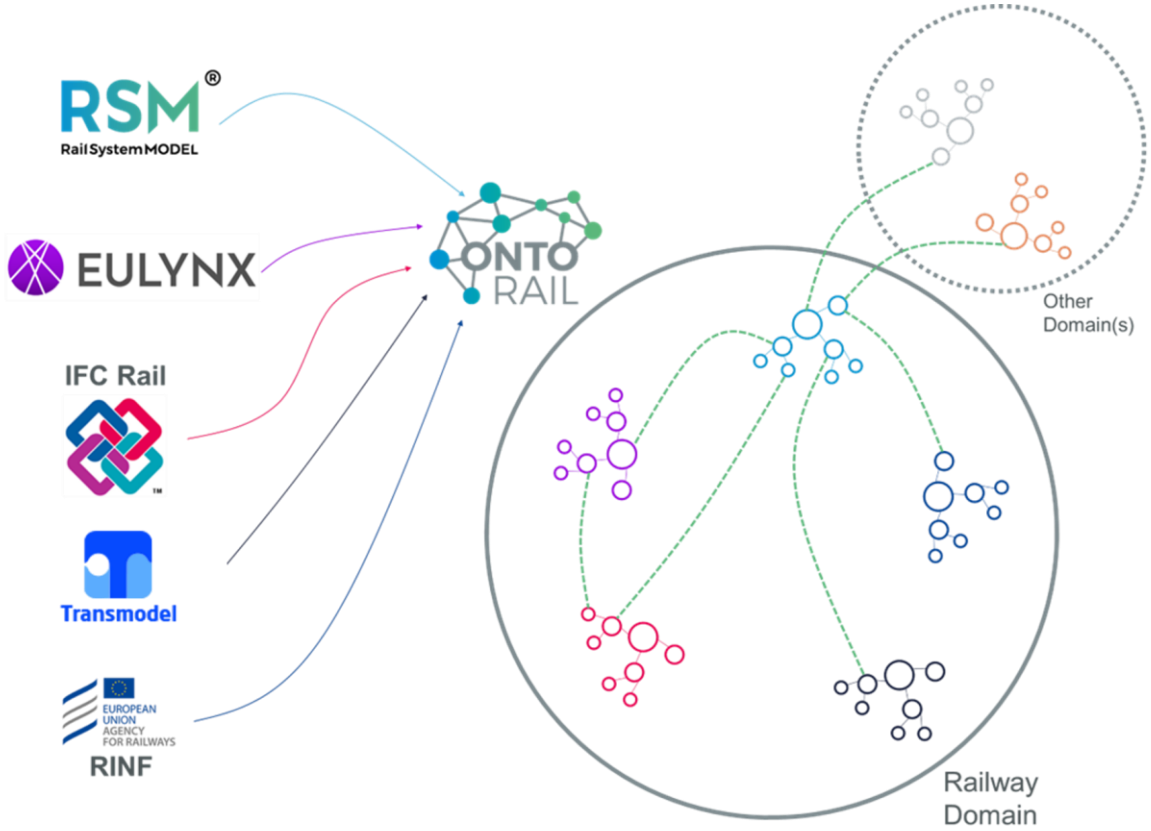
OBJECTIVE: The DT enabler aims to organise and support the assembly, verification, validation, testing and co-simulation of complex high-order Digital Twins. Modularity, interoperability and composability of the digital representation of the physical railway system are particularly in focus.

Benefits

- Increases Assets utilization and Sustainability
- Enables exchange of digital artefacts of railway assets
- Reduces operational cost through predictive maintenance
- New opportunities with AI

Conceptual Data Model (CDM)

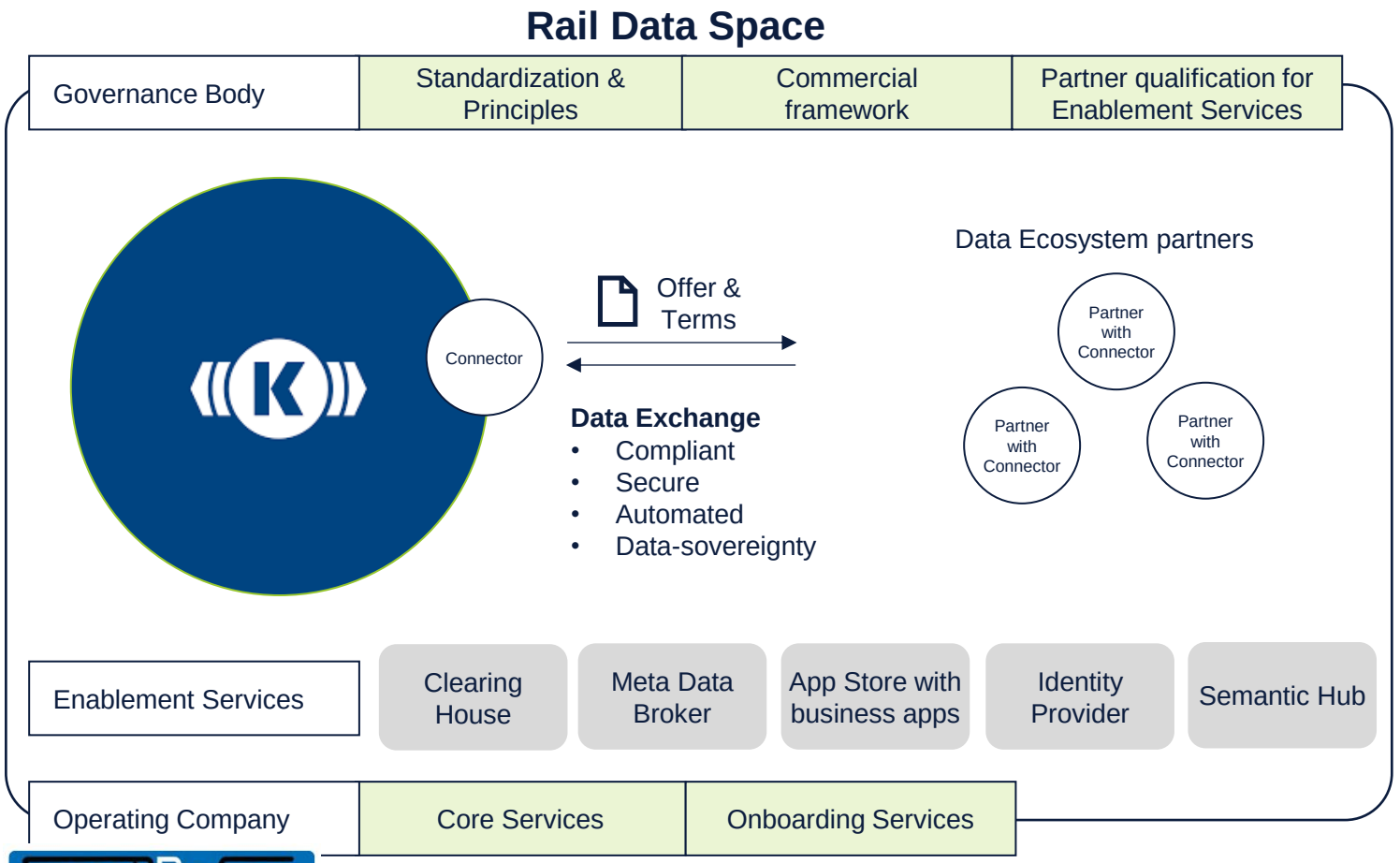
OBJECTIVE: The Conceptual Data Model aims at creating a common standardised ontology based machine-readable model of the rail system domain, formally describing syntactic and semantic data structures.



Benefits

- Enables interoperability among source models
- Source of Knowledge for domain users
- Fosters reuse and maintainability of the information systems

Decentralized, open and secure Rail Data Space (RDS) to drive Rail Innovations



Benefits

§ **Compliant with EU legislation** including EU Data Act

Maintain data ownership by defining who can access data and under what terms

Full transparency and verification of data transactions

Most efficient way to share data with multiple parties

Shared costs of scalable data space infrastructure

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Capacity Management

Traffic Management

Transforming the European rail system, making it more interoperable, resilient, capacity strong and connected to other modes !

Multimodal Integration

Digital Enablers

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