Eu-Rail 1st General Assembly

1. WELCOME FROM THE GOVERNING BOARD CHAIR	14:00-14:10
2. JU ORGANISATION AND STATE OF PLAY FROM THE EXECUTIVE DIRECTOR	14:10-14:30
3. REPORT ON THE SHIFT2RAIL PROGRAMME IMPLEMENTATION STATUS AND TRANSFER OF KNOWLEDGE TO EU-RAIL JU PROGRAMME (JU Programme Managers with the support of IP Coordinators)	14:30-15:30
4. IMPLEMENTATION OF THE EU-RAIL PROGRAMME (intro JU Head of Programme) • SYSTEM PILLAR i. REPORT FROM SYSTEM PILLAR STEERING GROUP (European Commission) ii. STATUS OF LAUNCHED TASKS AND PLANNED ACTIVITIES (JU Head of SP with SP Core Group) • INNOVATION PILLAR i. PLANNED ACTIVITIES IN THE FIRST EU RAIL FLAGSHIP PROJECTS (FP Coordinators (10 mins))	15:30-17:10
5. ADVISORY BODIES (intro JU Executive Director) • STATES' REPRESENTATIVES GROUP • SCIENTIFIC COMMITTEE	17:10 – 17:40
6. COMMUNICATION AND DISSEMINATION STRATEGY (JU Chief communication)	17:40 – 17:55
7. CLOSING WORDS BY THE GOVERNING BOARD CHAIR	17:55 – 18:00

Rail Research and Innovation to Make Rail the Everyday Mobility

2. WELCOME FROM THE GOVERNING BOARD CHAIR

European Commission

Why we are here today

the Governing Board shall meet once a year in a general assembly and all participants to the research and innovation activities of the Europe's Rail Joint Undertaking shall be invited to attend. The assembly shall stimulate reflection on the overall direction of the activities of the Europe's Rail Joint Undertaking while conducting an open and transparent discussion on the progress of the Master Plan implementation.

Rail Research and Innovation to Make Rail the Everyday Mobility

2. JU ORGANISATION AND STATE OF PLAY FROM THE EXECUTIVE DIRECTOR

Carlo Borghini

Executive Director, Europe's Rail JU

EU-Rail vision

To deliver, via an integrated system approach, a high capacity, flexible, multi-modal, sustainable and reliable integrated European railway network by eliminating barriers to interoperability and providing solutions for full integration, for European citizens and cargo.

EU-Rail Mission Statement

Rail Research and Innovation to make rail the everyday mobility

EU-Rail general objectives (art. 85)*

(a) contribute towards the achievement of the Single European Railway Area;

(b) ensure a fast transition to more attractive, user-friendly, competitive, affordable, easy to maintain, efficient and sustainable European rail system, integrated into the wider mobility system;

(c) support the development of a strong and globally competitive European rail industry.

(*) SBA 19 Nov 2021

EU-Rail specific objectives (art. 85)*

(a) facilitate research and innovation activities to deliver an integrated European railway network by design […];

(b) deliver a sustainable and resilient rail system […];

(c) develop through its System Pillar a unified operational concept and a functional, safe and secure system architecture […];

(d) facilitate research and innovation activities related to rail freight and intermodal transport services […];

(e) develop demonstration projects in interested Member States;

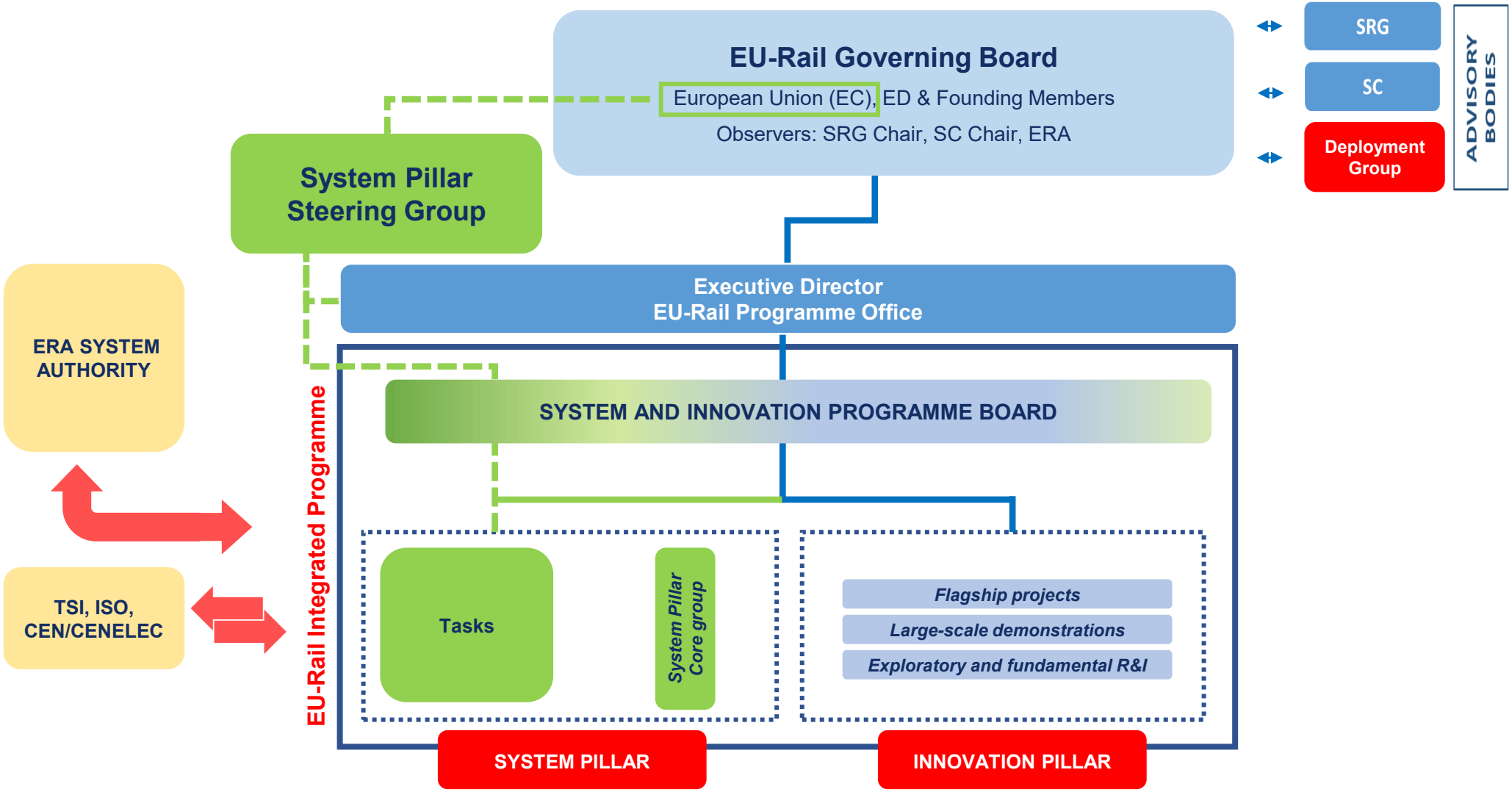
(f) contribute to the development of a strong and globally competitive European rail industry;

(g) enable, promote and exploit synergies with other Union policies, programmes, initiatives, instruments or funds in order to maximise its impact and added value.

+ EU-Rail is the legal and universal successor […] of the Shift2Rail joint undertaking […], which it shall replace and succeed (art. 174)

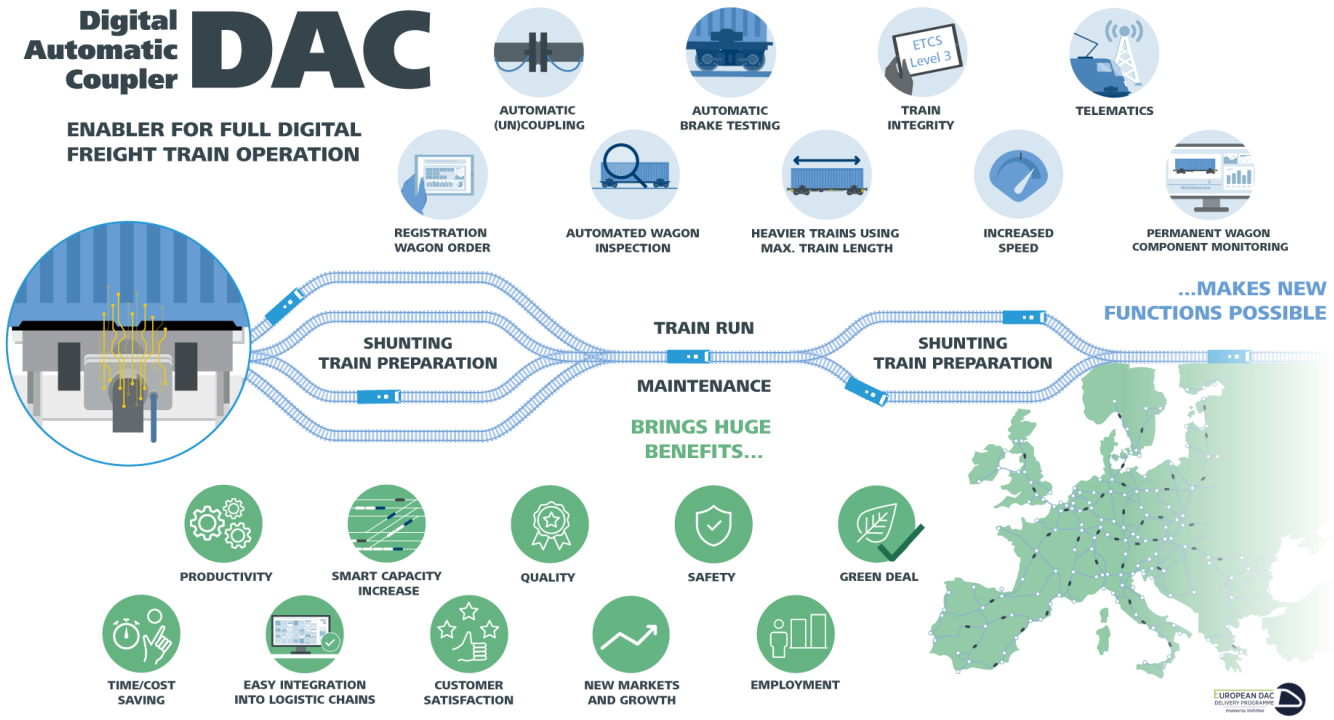
(*) SBA 19 Nov 2021

EU-Rail structure in accordance with SBA



European DAC delivery programme (EDDP):

An open platform for Full Digital Freight Train Operations



- DAC is **more than just a coupler**
- DAC is a key and unique **enabler for numerous applications**
- DAC is not a stand-alone technology but the backbone for **“full digital freight train operations”** to achieve the ambitious transformation in European rail freight
- This will allow the DAC to enable even more **use cases** and to **generate** a max. possible **benefit**

EUROPEAN DAC DELIVERY PROGRAMME
Enabled by Shift2Rail

‘Scharfenberg’ latch-type design selected for future Europe-wide Digital Automatic Coupling (DAC) standard coupler head

Source: Dellner & Voith

Membership (art. 87)*

- European Union
- Founding Members
- Associated Members

In addition

- contributing partner, any legal entity other than a member, or a constituent entity of a member or an affiliated entity of either that supports the objectives of a joint undertaking in its specific area of research

Financial contributions (art. 88, 89) *

- The Union financial contribution from the Horizon Europe Programme […] shall be up to EUR 600 000 000, including at least EUR 50 000 000 for the System Pillar […];
- The members of the Europe's Rail Joint Undertaking other than the Union shall make or arrange for their constituent or affiliated entities to make a total contribution of at least EUR 600 000 000 [...].

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

(*) SBA 19 Nov 2021

Bodies of the Europe's Rail JU*

Governing Board (art. 15, 16, 17)

- Is the decision-making body. With responsibility for the strategic orientation, coherence with relevant Union objectives and policies, and shall supervise the implementation of its activities.

Executive Director (art. 18, 19)

- Is the chief executive responsible for the day-to-day management of the JU in accordance with the decisions of the GB. He or she shall provide the GB with all information necessary for the performance of its functions.

States' Representative Group (art. 20)

- is consulted, reviews information and provides opinions (*more in today presentations*)

Scientific Committee (art. 21)

- provides independent scientific advice (*more in today presentations*)

Deployment Group (art.97)

- advises the Governing Board on the market uptake of rail innovation developed in the Europe's Rail JU and supports deployment of the innovative solutions

System Pillar Steering Group

- provides advice on System Pillar issues, chaired by the Commission

DELIVER AN **INTEGRATED EUROPEAN RAILWAY NETWORK** BY DESIGN

DEVELOP A **UNIFIED OPERATIONAL CONCEPT AND A FUNCTIONAL SYSTEM ARCHITECTURE** FOR INTEGRATED EUROPEAN RAIL TRAFFIC AND CCS/AUTOMATION

DELIVER A **SUSTAINABLE AND RESILIENT RAIL SYSTEM**

DELIVER A **COMPETITIVE, GREEN RAIL FREIGHT** FULLY INTEGRATED INTO THE LOGISTICS VALUE CHAIN

DEVELOP A **STRONG AND GLOBALLY COMPETITIVE EUROPEAN RAIL INDUSTRY**

EUROPE'S RAIL:

ONE INTEGRATED R&I PROGRAMME

Europe's Rail

SYSTEM PILLAR

OPERATIONAL CONCEPTS

FUNCTIONAL SYSTEM ARCHITECTURE

A SINGLE COORDINATING BODY FOR THE WHOLE SECTOR EVOLUTION

OPEN INTERFACES TO OTHER TRANSPORT MODES AND BUSINESSES

SYSTEM REQUIREMENT SPECIFICATIONS

INNOVATION PILLAR

TECHNOLOGICAL AND OPERATIONAL SOLUTIONS FOR SERVICES OF FUTURE

FLAGSHIP PROJECTS

LARGE-SCALE DEMONSTRATIONS

EXPLORATORY AND FUNDAMENTAL R&I

- **EUROPEAN RAIL TRAFFIC AND MOBILITY MANAGEMENT**
  - Manage and improve rail traffic at EU level
  - Adjust rail traffic management in function of the mobility demand
- **DIGITALISATION & AUTOMATION IN TRAIN OPERATIONS**
  - ATO implementation
  - Digital train operations
- **SUSTAINABLE AND DIGITAL ASSETS**
  - Integrated assets testing & life-cycle framework
  - Zero-emmission, silent rail system
- **COMPETITIVE, DIGITAL, GREEN RAIL FREIGHT**
  - New digital customer interaction & innovative rail freight services
  - Multimodal and rail freight innovation integration
- **REGIONAL RAIL SERVICES IN LOW DENSITY AREAS**
  - New system approach to regional rail services in low density areas

DEPLOYMENT GROUP

FUTURE SOLUTIONS DEPLOYED IN A COORDINATED AND CONSISTENT WAY AT EUROPEAN LEVEL, TAKING INTO ACCOUNT ALTERNATIVE ROLLOUT SCENARIOS, BEHAVIOURAL AND ORGANISATIONAL CHANGES, SYNERGIES WITH OTHER MODES OF TRANSPORT

On what EU-Rail is built upon

Shift2Rail R&I programme

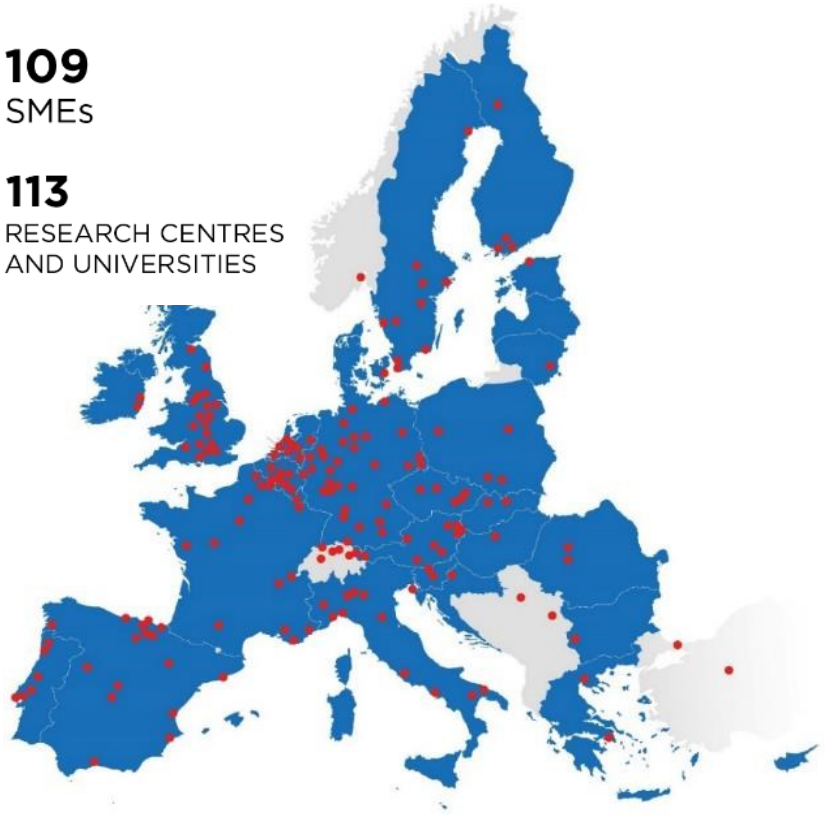
28 MEMBERS

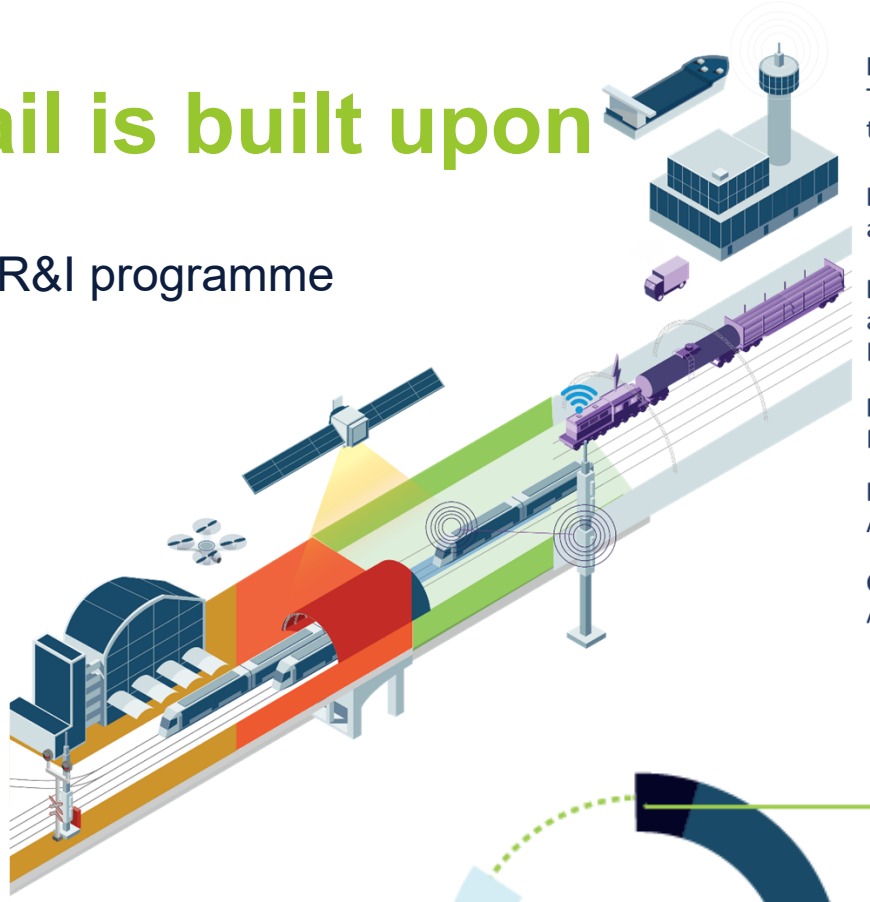
412 PARTICIPANTS

29 COUNTRIES

109 SMEs

113 RESEARCH CENTRES AND UNIVERSITIES





IP1 Cost-efficient and Reliable Trains, including high-capacity trains and high speed trains

IP2 Advanced Traffic Management and Control System

IP3 Cost-efficient, Sustainable and Reliable High Capacity Infrastructure

IP4 IT Solutions for Attractive Railways Services

IP5 Technology for Sustainable and Attractive European Rail Freight

CCA Cross Cutting Activities

2015 - € 52 M
SHIFT2RAIL INITIATIVE LIGHTHOUSE PROJECTS

2016 - € 168 M
27 PROJECTS

2017 - € 112 M
17 PROJECTS

2018 - € 153 M
19 PROJECTS & 3 TENDERS

2019 - € 150 M
17 PROJECTS & 4 TENDERS

2020 - € 152 M (yet to be awarded)
19 TOPICS, 3 TENDERS & 1 PRIZE

Rail Research and Innovation to Make Rail the Everyday Mobility

3. REPORT ON THE S2R PROGRAMME IMPLEMENTATION STATUS AND TRANSFER OF KNOWLEDGE TO EU-RAIL JU PROGRAMME

EU-Rail JU Senior Programme Managers and Programme Managers with the support of IP Coordinators

IP1 main achievements

TD1.1 – Traction system

- SiC traction system train tests on Tramways / Metro / Regional trains. Linked to KPIs

		LCC reduction						Reliability		Train Capacity				Line Capacity	
Train/application	Development partner	Cost		Energy Cost		Mainte-nance Cost		Reliability		Weight Reduction		Volume Reduction		Noise reduction	
Tramway	Siemens	0%	3	-10%	4	-2%	2	5%	2	-4%	2	-5%	2	Reduction of noise tonality	4
Metro	CAF	2%	4	-7%	3	-7%	3	6%	3	-25%	4	-25%	4	-3%	3
Sub-urban	BT	0%	3	-8%	3	-21%	2	31%	2	-10%	3	-20%	3	-10%	3
Regional	Alstom	2%	3	-13%	3	-14%	2	11%	2	-17%	4	-5%	4	-1%	2
High Speed	Talgo	2%	3	-4%	3	-5%	1	12%	3	-3%	3	-2%	3	0%	3
Application	Development partner	Cost		Energy Cost		Mainte-nance Cost		Reliability		Weight Reduction		Volume Reduction		Noise reduction	
HVAC - Regional	DB +	20%	4	-6%	3	20%	1	0%	1	15%	3	0%	3	0%	1

- Traction Virtual Validation and certification Methodology and Tools
- Reliability and life time prediction of power semiconductors. Methodology and Tools based on real physical tests

Pending

- Independent Wheel Traction Motor for HST test on train

IP1 main achievements

TD1.2 – Train control and monitoring systems (TCMS)

- Signal-based FDF with SIL2 certification up to TRL7
- Validation of Ethernet TSN features in laboratory
- New T2G services adapted to IEC 61375-2-6 Ed 2 (telemetry and file transfer services)
- FOC validation up to TRL 4 (HVAC, Doors)
- New wired SIL4 Inauguration concept validated up to TRL4
- Virtual Certification Framework for complete TCMS simulation in relevant laboratory environment

Pending

- Signal-based FDF with SIL4 architecture (not certified) up to TRL4
- Validation of Wireless Inauguration with radio devices
- Validation of Wireless Consist Network in train unit.
- Validation of T2G in train unit
- New T2G service to be included in IEC 61375-2-6 Ed 2 (video streaming service)
- New FOC profiles specification (traction, brakes, lighting, ATO)
- New Application Profiles specification (Fire Detection System, ATO, lighting)
- New wired SIL4 Inauguration concept validated up to TRL6
- Integration of Ethernet TSN configuration in a relevant laboratory demonstrator, system level validation

IP1 main achievements

TD1.3 – New generation of carbody shells

- Three demonstrators of structural carbodies sections and full carbody manufactured with composites materials and tested according to the loads defined of EN-12663
- Weight reduction ca. 30% which implies a substantial increase on the capacity and reduction of energy consumption and emission per passenger and kilometre
- Characterization of materials and processes for composites materials fulfilling fire, smoke and toxicity requirements of EN-45545 in the corresponding categories
- FMECA, economical and environmental studies performed to have a 360˚ view of the feasibility of introduction new material, specially composites, in railway structural application
- Transversal integration of composites material and railway knowledge between sectors and companies in the European framework
- All the activities performed on TD1.3 (and TD1.4) of Shift2Rail are the basement for the incoming standard entitled “Process Standard for the Introduction of New materials” on CEN TC 256/SC2/WG54 New Materials

IP1 main achievements

TD1.4 – Running gear

Sensor and health monitoring functionality

- Onboard solutions, an Acceleration Measurement System for Running Gear has been designed and integrated in the train
- IoT Platform on the Cloud has been designed with the purpose of taking into Production algorithms and rules for monitoring Health Status of Running Gear Components
- Prototype of wayside systems produced
- Health status models for primary suspension, flats and ovalisations have been developed and tested
- Track inspection system has been tested to determine the presence of corrugation in an operational way

Noise and Vibration reduction

- Study launched to investigate the effect of novel lightweight materials for controlling the structure-borne noise transmission through a transmission path
- Reduction of the rolling noise has been estimated, establishing a target of -2dB
- The test campaign has been delayed and that is the reason why no results can be shown yet

Optimised Materials

- The prototype of the composite frame for an independent rotating wheel running gear was produced
- The whole frame achieves a weight reduction of 46% for the whole frame
- Fatigue testing until 10 million cycles has been started
- The prototype of the composite frame for single axle bogie was produced
- Static test has been finished successfully with also a good correlation between model and reality
- NDT method like ultrasonic inspection has shown the potential for maintenance application for monolithic structures

IP1 main achievements

TD1.4 – Running gear

Optimised Materials

- Light-weight axle the weight reduced up to 26% with a long-time test started in August 2021 on the freight application
- 3D concept design for Metro application finished
- Metro wheelset manufacturing will be planned, and production started in 2022
- Bracket for a metro vehicle has been developed for additive manufacturing
- Demonstrator was produced by 3D print, mounted and static tested on an existing bogie: weight reduced by 60% VS the reference component and the number of parts to assemble was reduced from 17 to 2

Virtual certification

- Methods and guidelines (EN 14363:2016) currently used in the railway sector investigated
- Benchmark performed on existing different approaches around the world
- Influence parameters to validate a dynamic model of a vehicle have been explored
- Use of simulations with the aim of limiting over-speed tests or fault modes cases will be the next steps

Universal Cost model 2.0

- Technical modules updated, new modules investigated
- Track settlement model improved
- New method to calculate damage and costs for railway switches and crossings developed

IP1 main achievements

TD1.5 – New braking systems

SIL3/4 compliant electronic platform for brake control functions

- General specification regarding implementation and validation of high SIL braking functionality is developed
- First laboratory trials on test bench simulating EUSKOTREN train validated the performance of high SIL electronics against the performance of conventional braking control electronics
- Preliminary work on Brake Application Profile such as definition of use cases and equipment vehicle class is done
- SIL3/4 electronic solutions for brake control TRL7 on-field demonstrator on EUSKOTREN train is successfully completed

Innovative friction pair solutions to reduce noise and dust emissions

- Two new concepts for eco-friendly pairing showed promising: a specific surface treatment and dedicated geometry
- A series of dynamometer test has been carried out to investigate features such as braking performance under different test conditions, wear of the brake and pad, noise and dust emissions level
- TRL7 on-field demonstrator (TRENORD train) is completed
- Preliminary results confirm that reduction of brake noise and dust emissions are achieved

Improved adhesion management systems

- Multiple measurement campaigns took place on test rigs (1:1 scale roller rig ATLAS) and test trains (DB VT605 Advanced Train Lab) to investigate the effect of sanding on brake performance on leaves
- Adhesion catalogue was published. Novel adhesion management system was tested on an EUSKOTREN train in the field (TRL7)
- Novel adhesion management system was tested on cooperation of KB and DB (TRL6)
- Adhesion consideration in ATO/ETCS (use cases, norms and standards and determination of wheel/rail adhesion) have taken place

IP1 main achievements

TD1.5 – New braking systems

Electro-mechanic braking system

- The functional and performance requirements on electro-mechanical brake were collected
- The brake calculation for the electro-mechanical brake was conducted and a comparison with conventional pneumatic brake is provided
- Description of functionality, wiring and diagnostics, safety analysis and test bench design has been provided
- TRL6 on-field demonstrator is successfully completed
- By the end of S2R the results of the measurement campaign will be analyzed and published

Methods and tools for virtual validation and certification of braking system

- A detailed concept for virtual validation and certification of braking system is developed
- Proof of concept on Wheel Slide Protection confirmed the validity of approach
- Supported by extensive dialogue with DAkks, NBRail and ERA, specification for virtual validation and certification process and simulator have been developed
- CSM Risk Analysis is completed
- By the end of S2R the developed simulator will be validated with real-life authorization and /or commissioning data

IP1 main achievements

TD1.6 – Innovative doors

- One new mock-up of single sliding plug door configurable with high load swinging arm or vertical bars for testing in laboratory has been assembled. The tests are on-going
- One door equipped with metallic door leaves, high load swinging arm is mounted on a static AGC train of SNCF. The metallic door leaves include the solution for thermal insulation and the solution for acoustic insulation. This door will be used for demo and tests. The adjustment of the door is done and the tests are planned in December 2022
- Additional metallic door leaves will be mechanically tested in the laboratory in December 2022
- 4 door leaves for acoustic testing with 4 different configurations covering the markets needs are assembled. These door leaves includes the solution for thermal insulation and different level of acoustic insulation. The tests are planned in December 2022
- The manufacturing of the composite door leaves is facing difficulties and an improvement of the mold for press molding process has been done. An investigation to find a stronger press is launched to solve the remaining issues. The delivery of the door leaves for laboratory tests and for the AGC train is postponed to 2023
- The tests of the bridging plate improved for cost are finished (see deliverable D13.3)
- The eco-design study is finished with recommendations and detection of the key factors regarding the main indicators (use of recycled aluminium, use of carbon fiber for composite, weight…)
- The on-line tests on Euskotren vehicle continue. The video collect is not launched due to difficulties in the implementation of RGPD regulation and the tests of obstacle detection with laser sensors requires improvements.

IP1 main achievements

TD1.7 – Train modularity in use

- One new mock-up of single sliding plug door configurable with high load swinging arm or vertical bars for testing in laboratory has been assembled. The tests are on-going
- One door equipped with metallic door leaves, high load swinging arm is mounted on a static AGC train of SNCF. The metallic door leaves include the solution for thermal insulation and the solution for acoustic insulation. This door will be used for demo and tests. The adjustment of the door is done and the tests are planned in December 2022
- Additional metallic door leaves will be mechanically tested in the laboratory in December 2022
- Four door leaves for acoustic testing with 4 different configurations covering the markets needs are assembled. These door leaves includes the solution for thermal insulation and different level of acoustic insulation. The tests are planned in December 2022

Pending

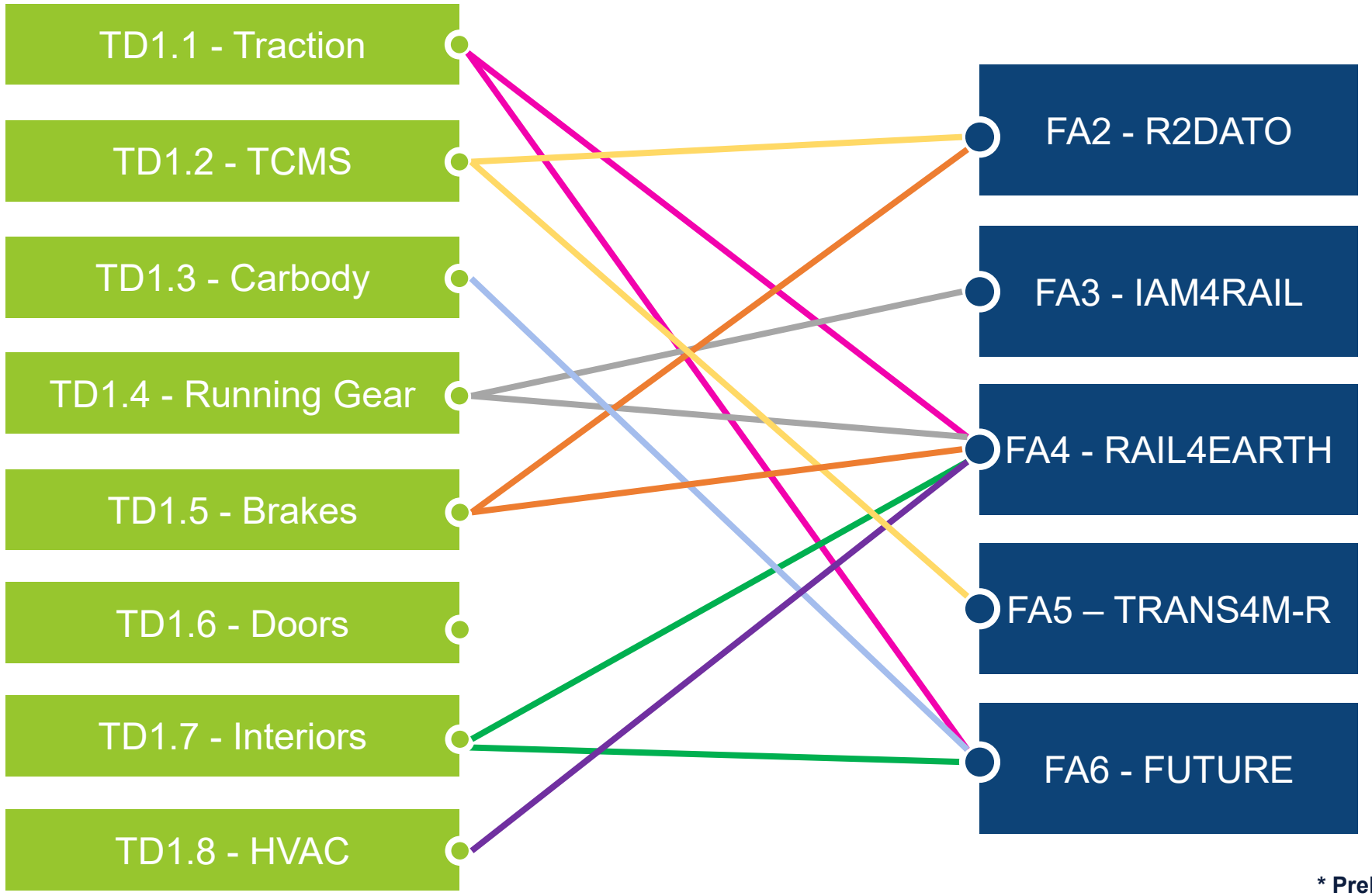
- The manufacturing of the composite door leaves is facing difficulties and an improvement of the mold for press molding process has been done. An investigation to find a stronger press is launched to solve the remaining issues. Laboratory tests remaining

IP1 main achievements

TD1.8 - Heating, Ventilation, Air conditioning and Cooling (HVAC) systems

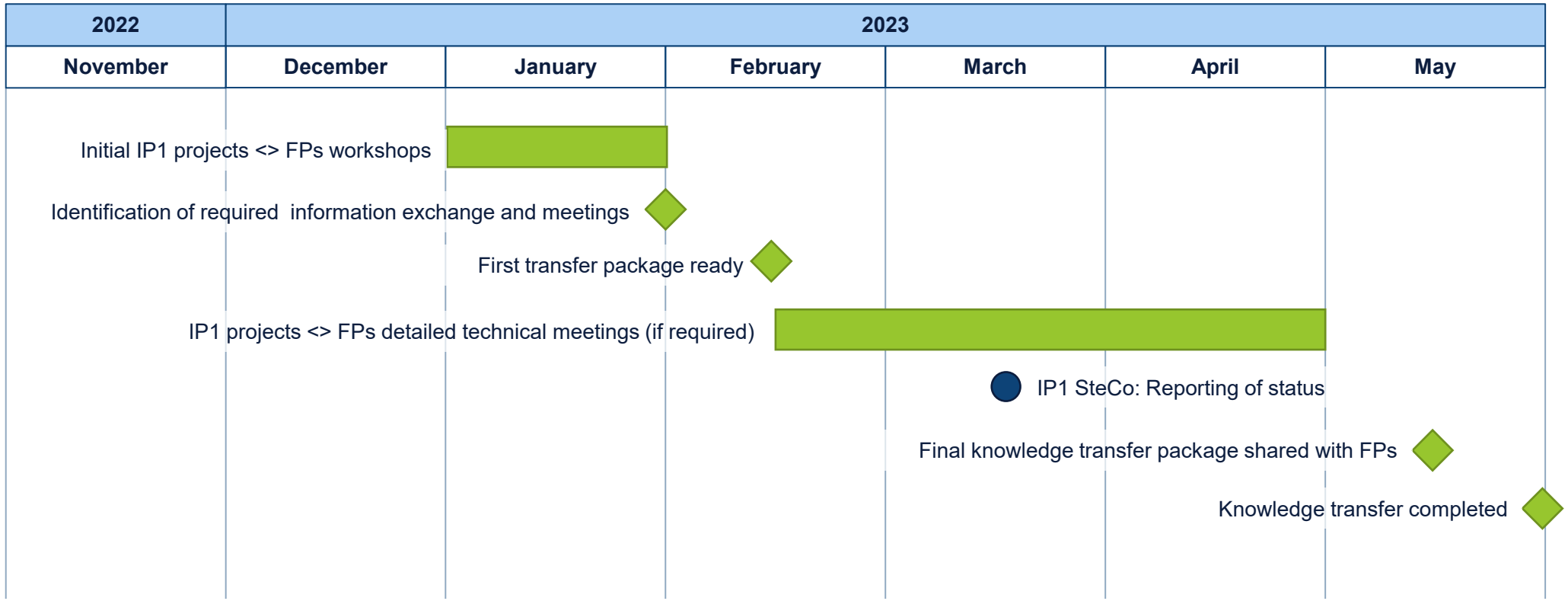
- Two HVAC units with the natural refrigerant CO2 were developed and tested in laboratory and in commercial operation
- The units have been working well, although not tested during the high summer temperatures
- The CO2-Technology is suitable for climate zone 1 and 2, but not for climate zone 3 (south Europe)
- The energy consumption is reduced due to the integration of a heat pump although there is still potential for improving the control strategy for switching between heat pump and electrical heating
- Suggestions for standardization of electrical interfaces are ready for integration into European standards and should be applied for new HVAC units
- First ideas for standardization of mechanical interfaces have been developed
- Concerning control interfaces input was given for the HVAC application profile developed in CONNECTA
- The results will serve as an input for FP4 Rail4EARTH workstream 4.2 HVAC

Transfer of knowledge: Expected Interfaces*



* Preliminary analysis

Proposed process and timeline



*** Preliminary analysis**

IP2 highlights – main achievements

- TD 2.1 – Adaptable Communication System
  - Successful field tests was provided for Urban/suburban and Mainline/ Highspeed demonstrators
- TD 2.2 – Automatic Train Operation
  - GoA3/4 - Capella model and System Requirement Specification - Complete the ATO GoA3/4 specification and model by 12/2023.
- TD 2.3 – Moving Block
  - All three X2Rail-5 Moving Block Technical Demonstrators have been shown to members of X2Rail-5 WP4: Siemens on 20-Oct, in SMO Madrid; Hitachi on 09-Nov, in STS Genoa; Thales on 23-Nov, in TD Berlin.
- TD 2.4 – Train Positioning
  - Roadmap and Migration Strategy: Functions of both Streams defined, analysis of ETCS integration ongoing. Complete finalization is foreseen in Q4 2023.

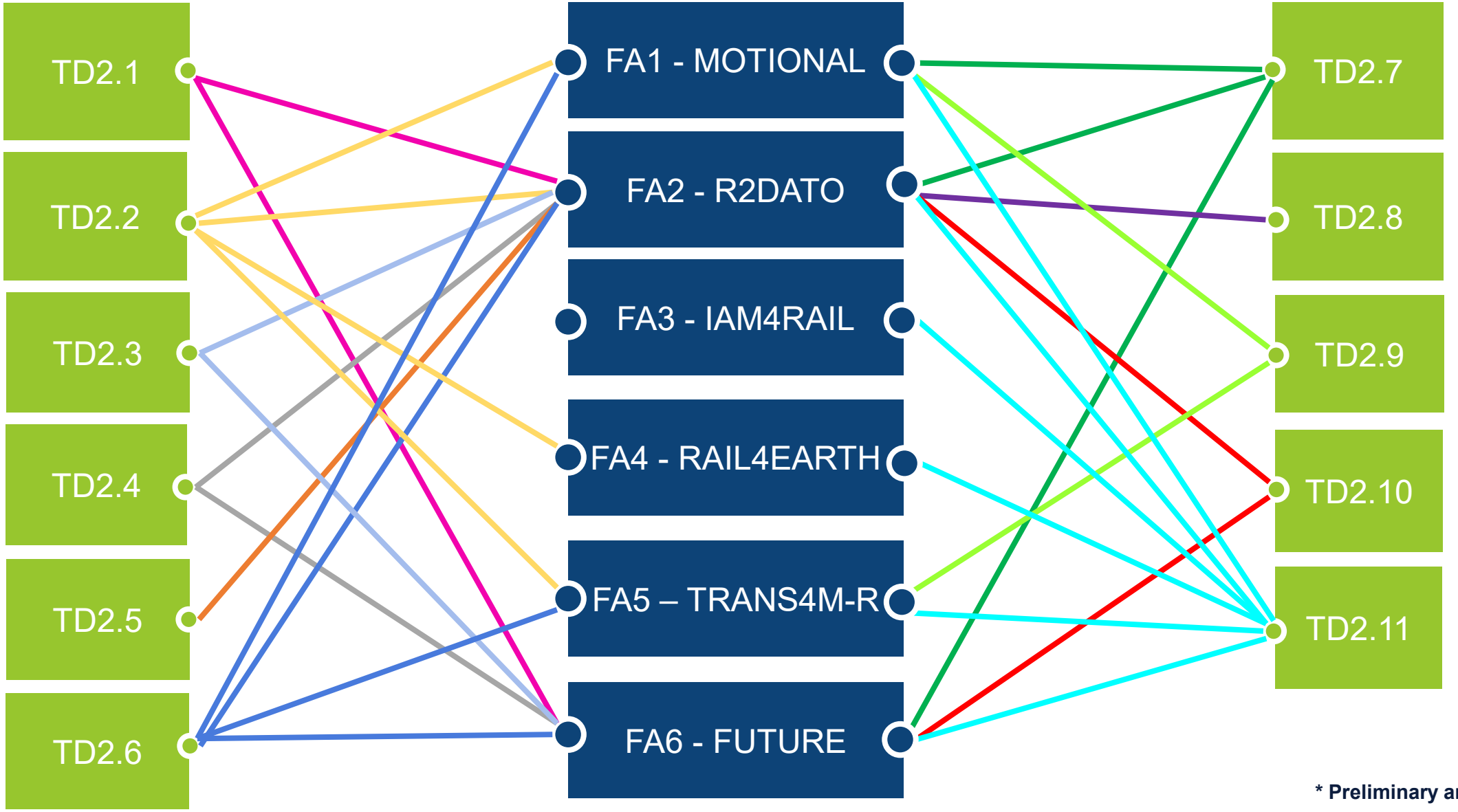
IP2 highlights – main achievements

- TD 2.5 – Train Integrity
  - On-field testing with demonstrator for Product Class 1 in Czech Republic, for Product Class 2 in Italy and for Product Class 3 in UK
- TD 2.6 – Zero On-Site Testing
  - ZOST definition determined, possible Use Cases incl. timeline; Demonstration of additional Test Environment Capabilities: Demonstrator and Prototype Enhancements for the other TDs
- TD 2.7 – Formal Methods
  - Formal Methods Guidebook - Guidebook for use of FMs to enable increased efficiency, automation and use of standards; Two lab-based demonstrators both to complete in 2023
- TD 2.8 – Virtual Coupling
  - Already concluded

IP2 highlights – main achievements

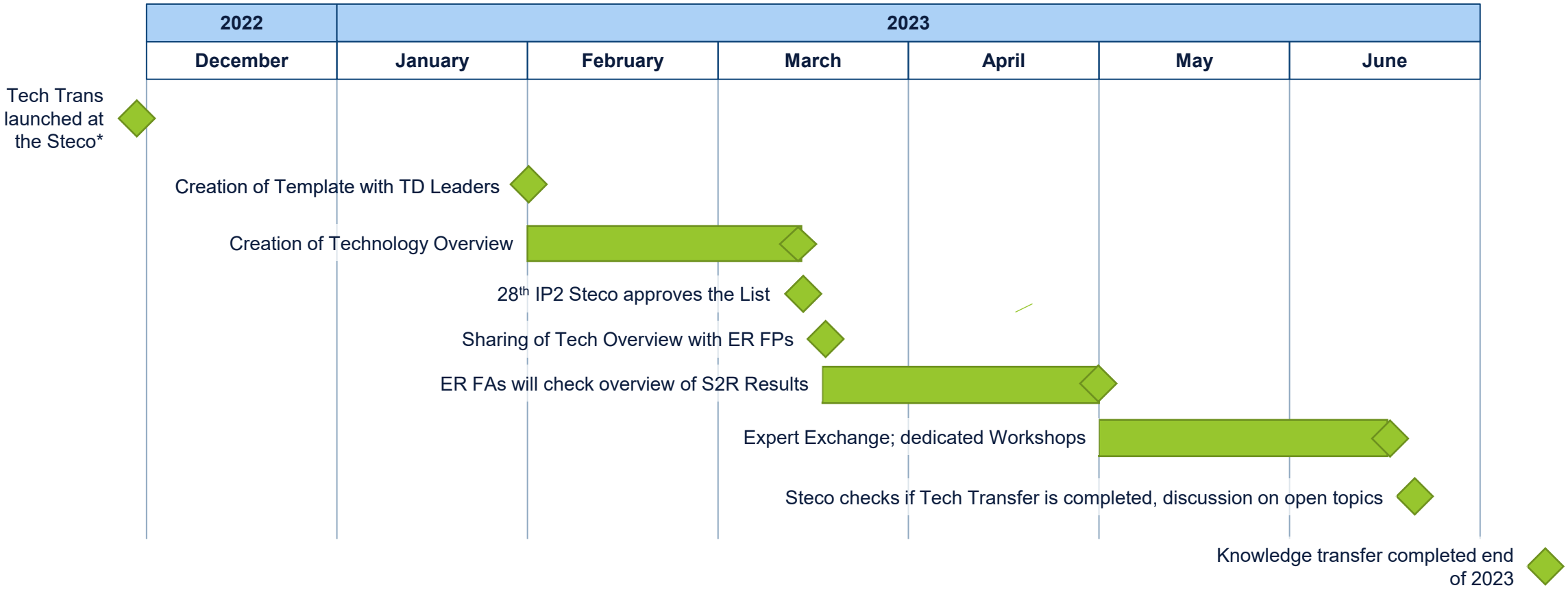
- TD 2.9 – Traffic Management Evolution
  - Demonstrators (TRL6) are in final Test phase
- TD 2.10 – Smart Radio Connected All-in-all Wayside Objects
  - Eight prototypes have been defined in order to cover a large spectrum of suitable scenarios, with the intention of being able to test, in greater detail and precision, each of the functionality/features to be covered by the SWOC.
- TD 2.11 - Cybersecurity
  - Specification & development of Demonstrator for cybersecurity framework assessment; Analysis of railway systems' cyber resilience : Threat space analysis performed; ISAC prototype completed
- ITD
  - Within Shift2Rail three individual workstreams have been developing specifications, prototyping solutions and undertaking individual demonstrations: Moving Block, TMS and ACS. ITD testing was completed successfully in June 2022.

Expected interfaces *



* Preliminary analysis

Technology Transfer - Timeline for IP2



*** Discussed on the 27th IP2 SteCo meeting**

IP3 highlights – main achievements

- TD3.1 Enhanced Switch & Crossing System Demonstrator -> Dec 2023
  - Validation of the Whole system modelling for S&C
  - Enhanced manganese crossing / Enhanced switch and crossing (including condition monitoring).

- TD3.2 Next Generations Switch & Crossing System Demonstrator -> Dec 2023
  - Concepts, radical new components, autonomous inspection and repair

- TD3.3 Optimized Track System-> Dec 2023
  - Innovative Slab track solution
  - Urban oscillating grinding machine
  - New bainitic rail solution for higher performance

- TD3.4 Next Generation Track System -> Dec 2023
  - Automated inspection and repair solutions
  - Smart Material for transition zones

- TD3.5 Next Generation Track System -> Dec 2023
  - Various technologies for tunnel/bridge inspections/monitoring and innovative technics repair
  - Bridge dynamics

IP3 highlights – main achievements

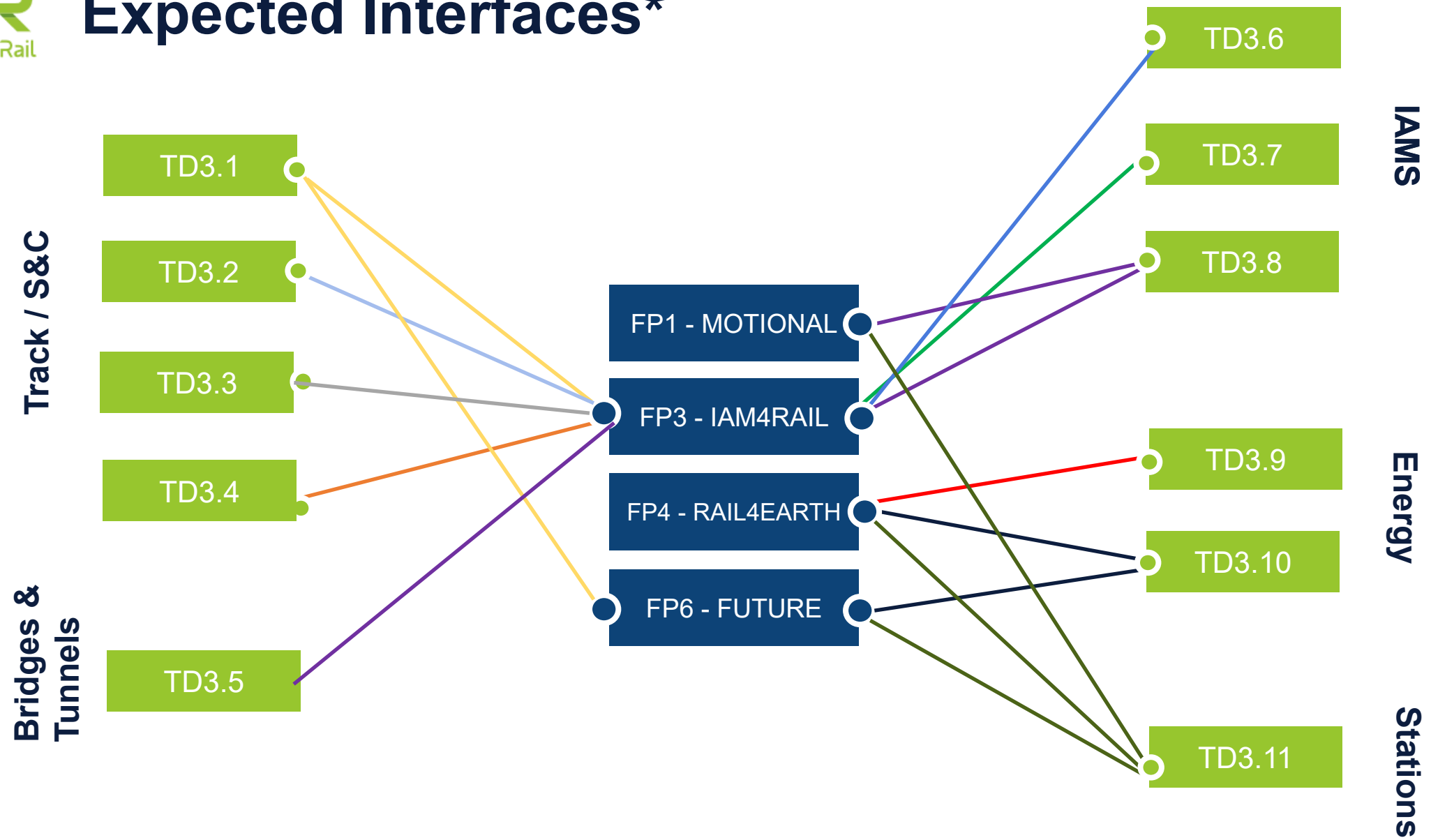
- TD3.6 to 3.8 Intelligent Assets Management Systems -> Mai 2023
  - Demonstration in different Use Cases of IAMS solution (e.g. Anomaly detection for rail fastener systems, track geometry monitoring system)
  - Maintenance execution, e.g. exoskeleton / autonomous maintenance platform

- TD3.9 Smart Power Supply Demonstrator -> March 2023
  - smart control and protection demonstrator
  - FACTS demonstrator

- TD3.10 Smart Metering for Railway Distributed Energy Resource Management System Demonstrator- completed
  - Smart metering solutions implemented in 3 Uses Cases

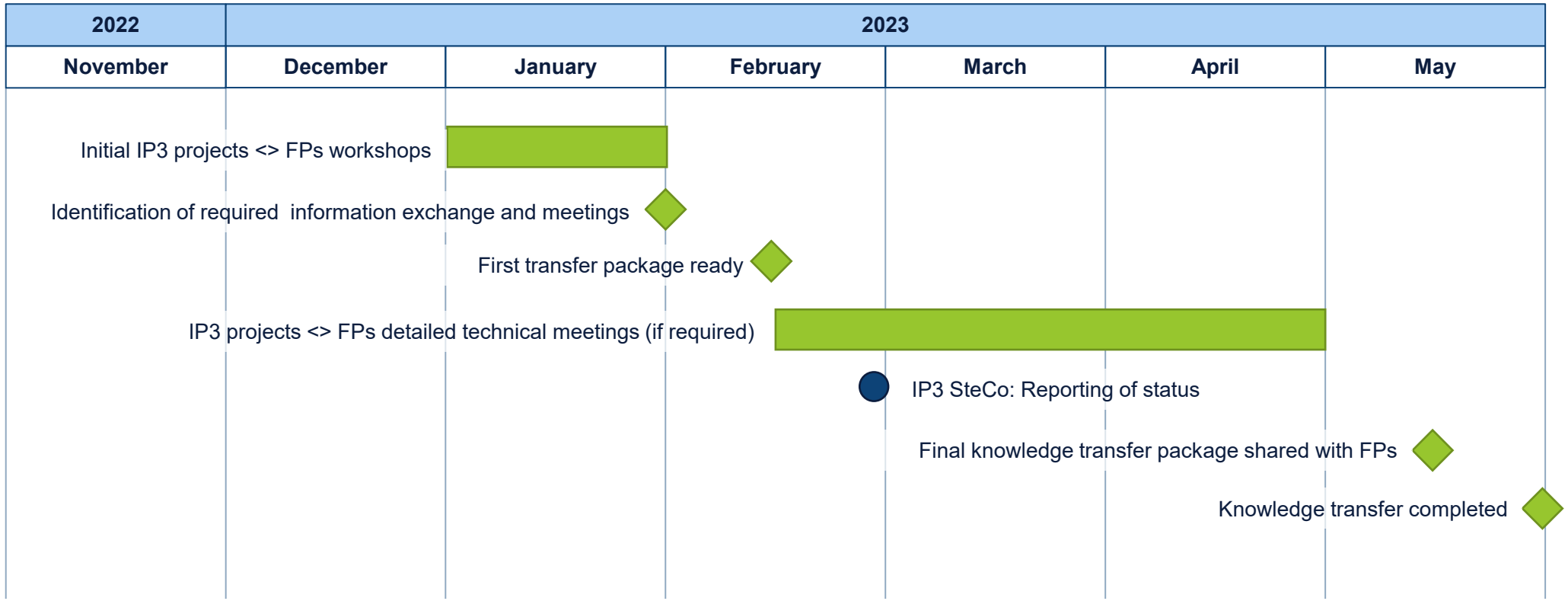
- TD3.11 Future Stations -> March 2023
  - Crowd management solutions

Expected Interfaces*



* Preliminary analysis

Proposed process and timeline

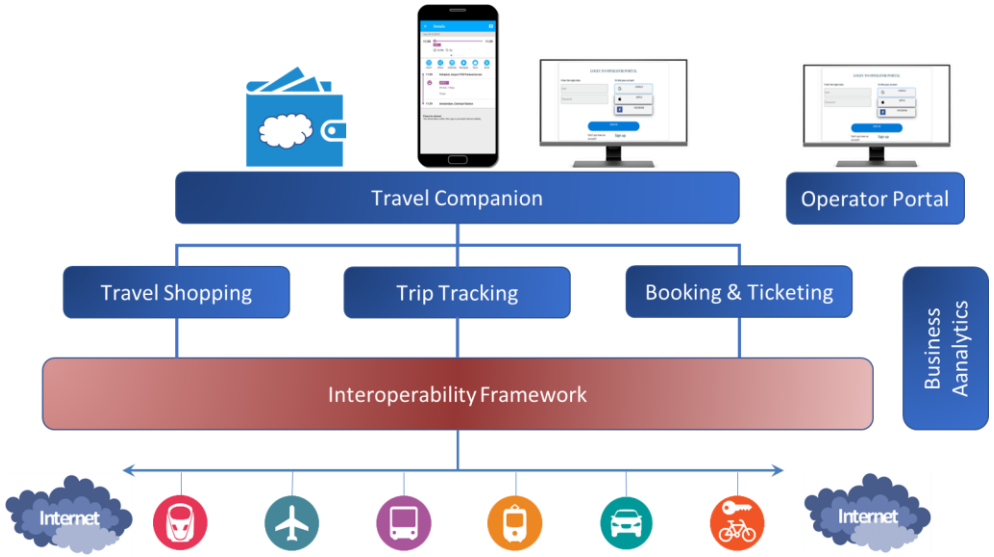


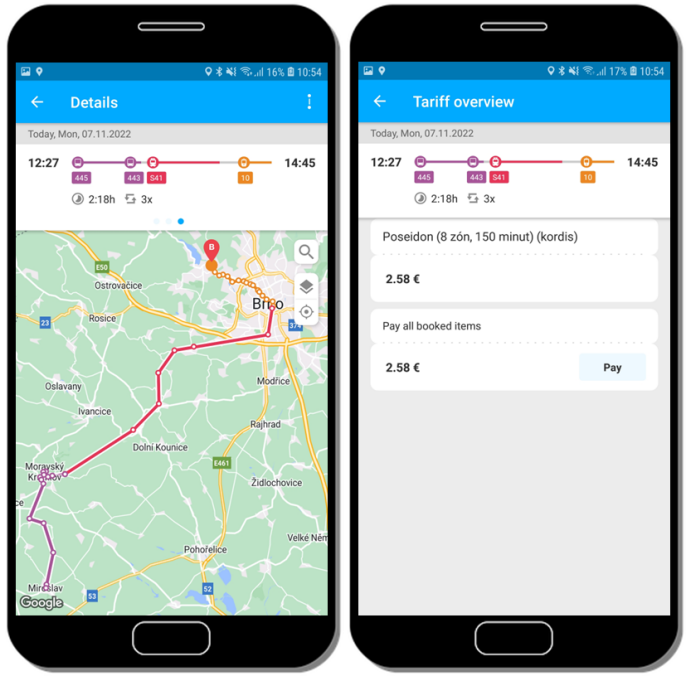
*** Preliminary analysis**

IP4 highlights – main achievements

IP4 has developed an interoperable multimodal platform for passengers and operators, putting public transport at the heart of the MaaS approach, and has demonstrated it on many pilots up to TRL6-7

1. Attractive for passengers – **Travel Companion app** - for multimodal travel, cross border and EU wide, with guidance support in the stations
2. operator portal to help **Transport Service Providers** to join the ecosystem, to define mobility packages and manage their customers
3. Framework for Multimodal travel services orchestration and data analysis





TD4.1:Interoperability Framework **providing easy connection of travel offers**

TD4.2: Travel Shopping providing a two steps approach to reduce calculation time

TD4.3: Booking & Ticketing to enable purchase of “inter-modal” tickets

TD4.4: Trip Tracking to support travellers in case of disruption during their trip

TD4.5: Travel Companion hiding complexity of trip planning from travellers

TD4.6: Business Analytics to analyse the passengers demand and anticipate the traffic

all elements demonstrated in various Pilots thanks to TD4.7

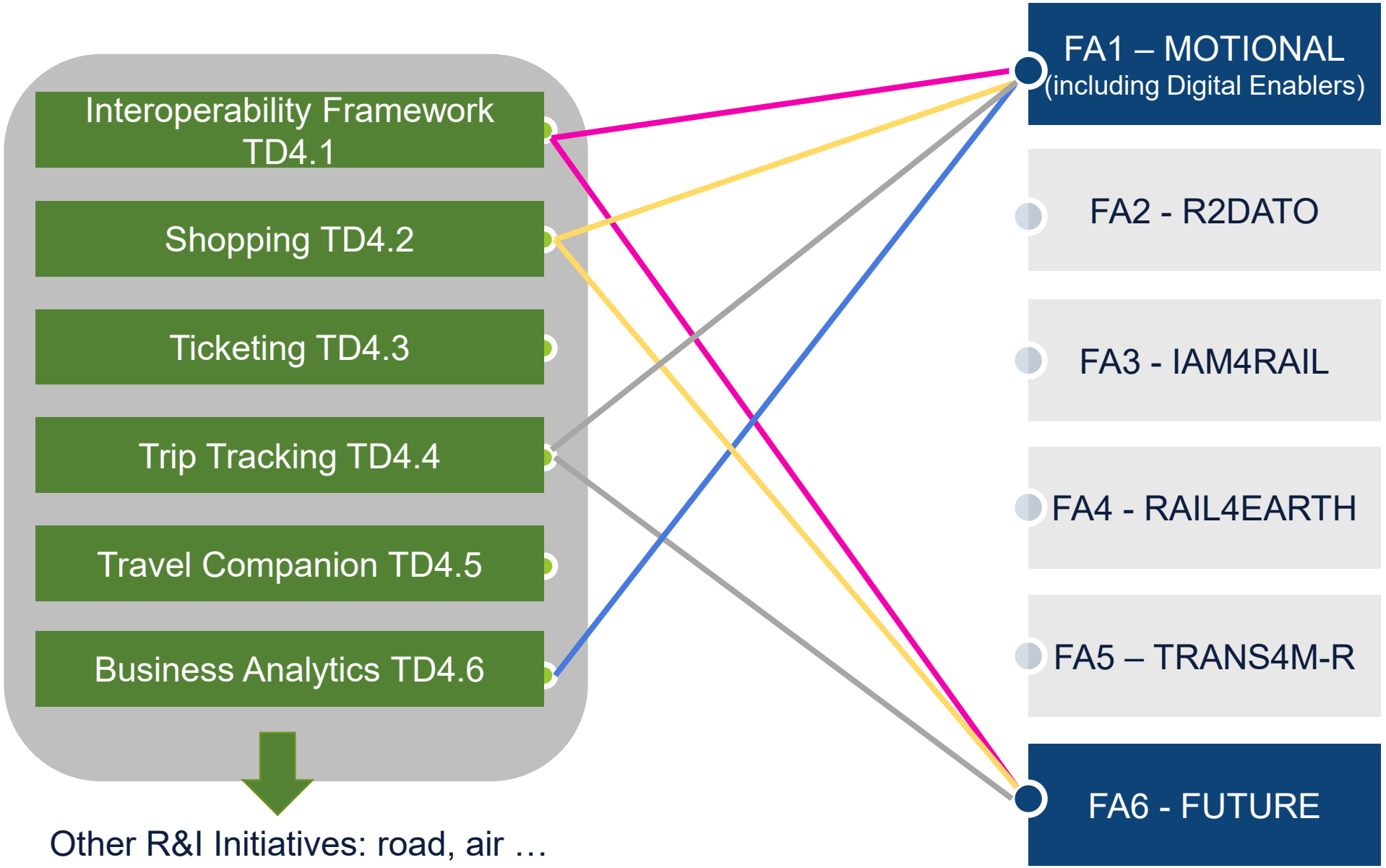
IP4 highlights – Pilots up to TRL7 in many cities

1. Many **Public transport operators** involved, thanks to the active support of UITP in the open calls
2. Several modes connected (bus, train, air transport, bike & car sharing, on-demand transport…)
3. Most of the functionalities developed in IP4 have been tested and demonstrated in real situation
4. Up to 400 users in some PILOTS

- **Lisbon,**
- **Málaga,**
- **Brno – Frankfurt,**
- **Athens,**
- **Helsinki,**
- **Padua (Italy)**
- **Barcelona (Spain)**
- **Osijek (Croatia)**
- **Warsaw (Poland)**
- **Liberec (Czech Republic)**

(Train, Bus, Tram, Metro, Bikes, Park, Coach, Ride sharing….)

Expected Interfaces with ERJU

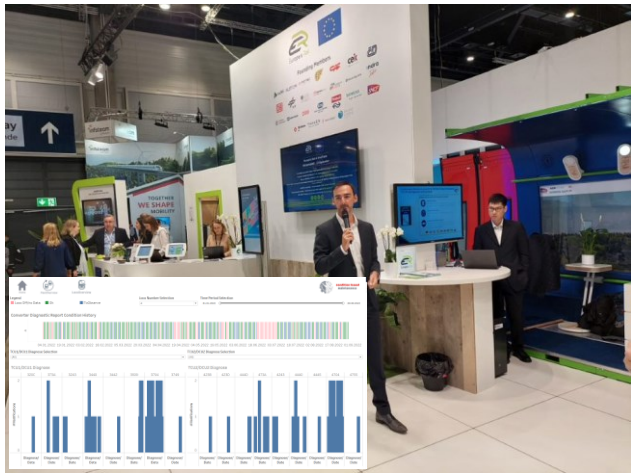


IP4 knowledge transfer

- IP4/S2R results are **only partially** relevant to Europe's Rail,
  - Only a few outcomes, related to the data management (ontologies, interoperability framework and business analytics) can be easily transferred.
  - In addition, some partners will use their own IP4 foreground for the FP6 demos.
- STEPS :
  - The list of documents shared with ERJU will be proposed by the IP4 projects, after assessment of the confidentiality aspect.
  - Project Coordinators will prepare a first package(s) for the ERJU projects
  - Along March 2023, meetings involving TMT of the concerned projects could be held with FPs
    - General presentation of projects
    - Description of the knowledge transfer package content
    - Detailed technical workshops when needed
  - During the IP4 SteCo in March 2023 reporting on the status of the knowledge transfer could already be given
  - By June 2023 the last open items could be transferred and declare the process completed

IP5 achieves various technological highlights in 22

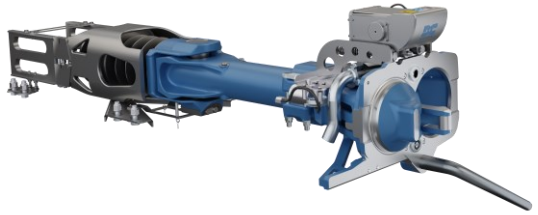
Examples: IP5 Highlight



Condition Based Maintenance

Extended Market Wagon

Digital Automatic Coupler



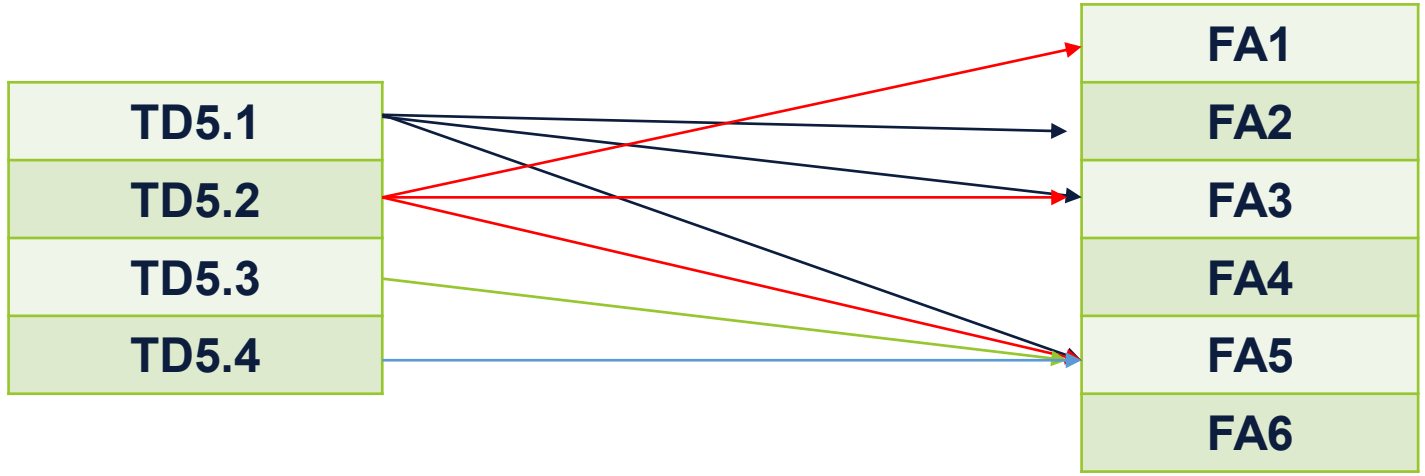
Core Market Wagon

Intelligent Video Gates

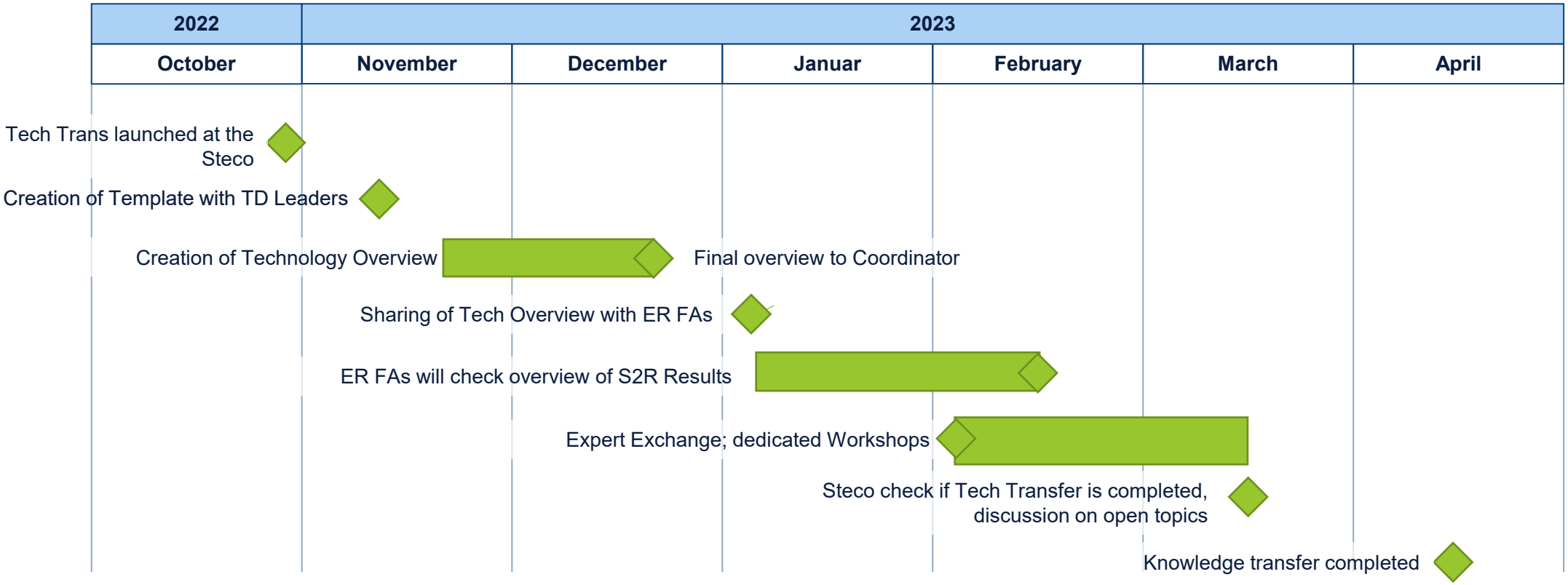
IP5 highlights – main achievements

- TD5.1 Fleet Digitalization and Automation -> Dec 2023
  - CBM
  - ATO Freight
  - DAC
- TD5.2 Digital Transport management -> Dec 2023
  - Intelligent Video Gates
- TD5.3 Smart Freight Wagon Concepts -> Dec 2023
  - Common Market Wagon
  - Extended Market Wagon
  - WOBU Telematics for Freight
- TD5.4 New Freight Propulsion Concepts -> Dec 2023
  - Long Trains / Distributed Traction for Freight
  - Last mile battery

IP5 Expected Interfaces



Timeline Technology Transfer



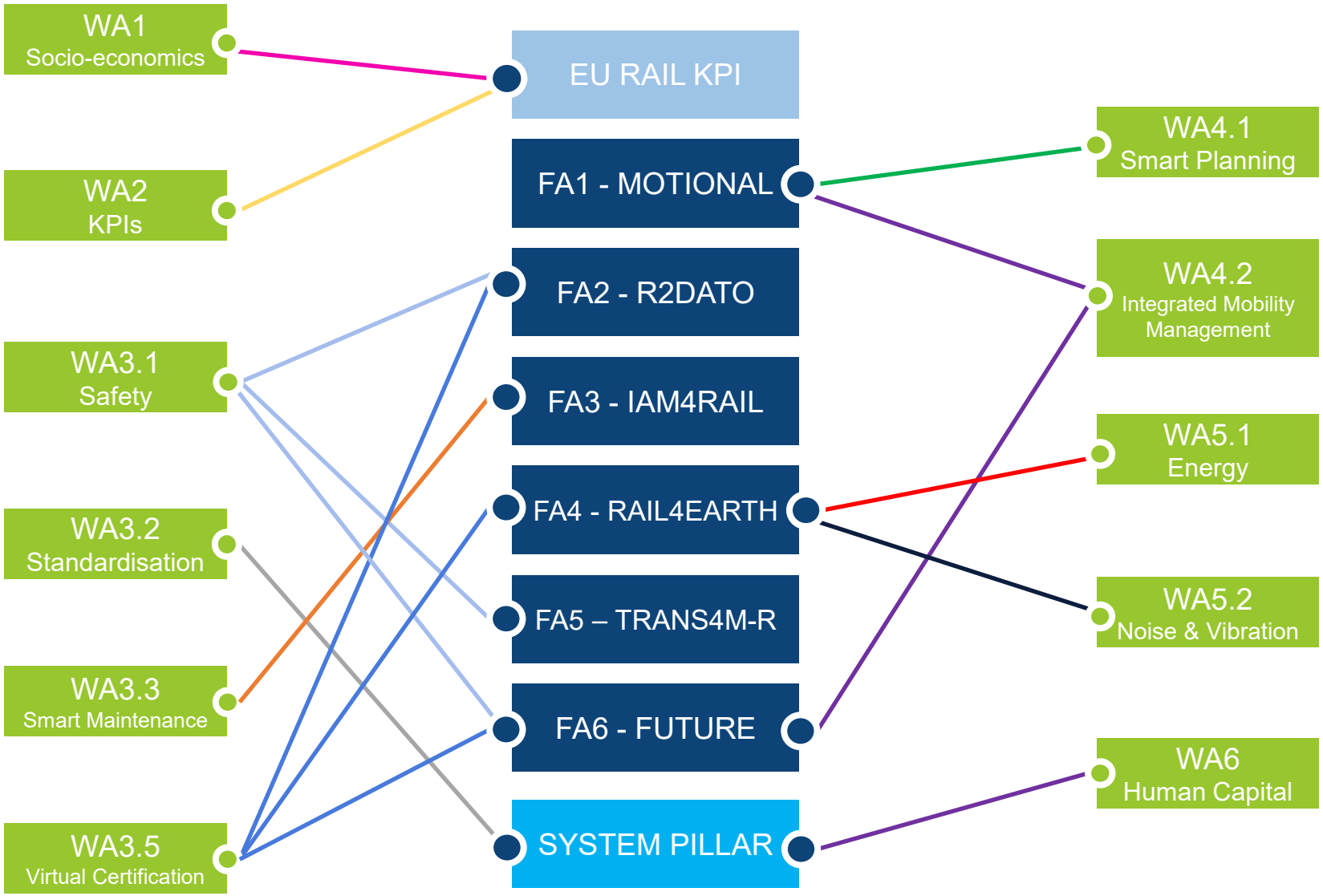
CCA highlights – main achievements

- WA1 Long-term needs and socio-economic research
  - Definition of the system platform demonstrators (High Speed, regional, urban and freight)
  - cost benefit analysis and socioeconomic impact of the S2R innovations on the European network
- WA2 Integrated Assessment of Key Performance Indicators
  - KPI model development + quantification of assessment of the S2R high level KPIs
- WA3.1 Safety
  - Decision Support model for safety for day-to day operation including an assessment of human reliability
  - Development of a safety monitoring system such as Object detection system based on pattern recognition, landslide detection system based on micro-seismic sensors
- WA3.2 Standardisation
  - Standardisation Rolling Development Plan: Map, collect and monitor the standardisation potential of Shift2Rail outcomes
  - Innovative and optimised standardisation processes to engage with the standardisation stakeholders
- WA3.3 Smart Maintenance
  - Common maintenance concept for rolling stock, infrastructure and control command and signalling assets
  - Condition Based Maintenance data structures
- WA3.5 Virtual Certification
  - Generic methodology for virtual certification (tested in PINTA-3 and PIVOT2 and input to CEN WG)

CCA highlights - main achievements

- WA4.1 Smart Planning
  - Smart Planning simulation tool PROTON for short term timetable planning (tested in FR8RAIL II and III)
- WA4.2 Integrated Mobility Management
  - Integrated status data exchange between traffic management, asset management and freight management systems
  - new advanced business service software modules will allow a high-precision ETA forecast
- WA5.1 Energy
  - Assess the overall energy reduction potentials for the S2R technologies and develop the energy baseline
  - Enhanced Energy Simulation Tool
- WA5.2 Noise and Vibration
  - Tools and methods to improve prediction of noise from different sources on a system level and to rank railway noise mitigation options together with assessment of their cost-effectiveness
  - Auralisation and visualisation technology e.g. shown at InnoTrans
- WA6 Human Capital
  - Change in job profiles/skills and qualifications in rail job categories as a results of the introduction of S2R innovations – detailed assessment on maintenance of infrastructure
  - Proposal of an alternative model of agile organization for Crisis Management teams

Expected Interfaces*



*** Preliminary analysis**

CCA Knowledge transfer

- Most of the results of the CCA activities are publicly available and they are already accessible exceptions are linked to the Smart Planning and Integrated Mobility Management Work Areas

- Steps:
  - The WA leaders will identify the relevant deliverables including the assessment of its confidential nature.
  - The list of deliverables which are publicly available will be shared with the FPs 1Q of 2023
  - The deliverables with confidential nature will be assessed and the concerned projects will be contacted for assessing their accessibility to the FP projects.
  - During the CCA SteCo in March 2023 reporting on the status of the knowledge transfer could already be given
  - By June 2023 the last open items could be transferred and declare the process completed

Rail Research and Innovation to Make Rail the Everyday Mobility

4. IMPLEMENTATION OF THE EU-RAIL PROGRAMME

Giorgio Travaini

Head of Programme, Europe's Rail JU

Multi-Annual Programme Implementation

System Pillar activities: the implementation via framework contract (procurement).

Innovation Pillar activities: This constitutes the core of the Programme, where the private Members are expected to provide their contribution up to EUR 576 million.

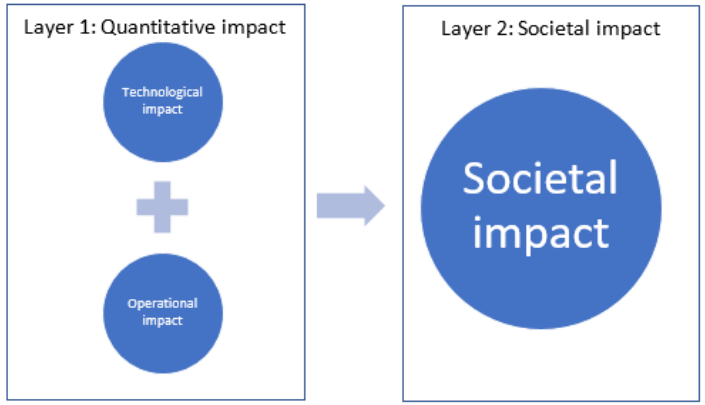
1. Call 2022-1, to cover up to 50% of the research and innovation activities value of 6 Flagship Areas+TT
2. Call 2025/2026, expected to cover around 30% of the research and innovation activities of 6 Flagship Areas+TT
3. Call 2027 expected to cover the remaining part of 6 Flagship Areas+TT activities to be performed until 2031

In addition, EU-Rail will launch on a regular basis calls for proposals to explore new areas of rail research and innovation or perform studies and any other relevant activities that would contribute to the achievement of its Programme

Deployment Group activities: to bridge research and innovation to the future coordinated deployment and they will be defined in line with the evolution of the Programme.

Multi-Annual Programme implementation

- **In addition to the normal Grant and Tender monitoring processes in accordance with the HE and EU Financial rules, as defined in the EU-Rail Governance and process handbook:**
  - Working with ERA in the SP and IP;
  - Synergies with other JUs/Programmes;
  - Change management with the ED-SIPB at its core for the integrated Programme;
  - Corporate programme management tools and communication/dissemination approach;
  - Maturity checkpoints :
    - Activities target a given maturity for a solution/R&I challenge,
    - Before validating a solution, checkpoints organised with external entities having an interest, as needed (e.g. other Flagship Project, SP…) for a validation and assessment (e.g. with external technical experts, ERA…)
    - Checkpoints will allow for alignment, typically on requirements, architecture, achievable performance and for successfully concluding (part of) project activities.
  - EU-Rail KPIs and impacts



Source EU RAIL Master Plan

Europe's Rail

Rail Research and Innovation to Make Rail the Everyday Mobility

4. IMPLEMENTATION OF THE EU-RAIL PROGRAMME

- REPORT FROM SYSTEM PILLAR STEERING GROUP

European Commission

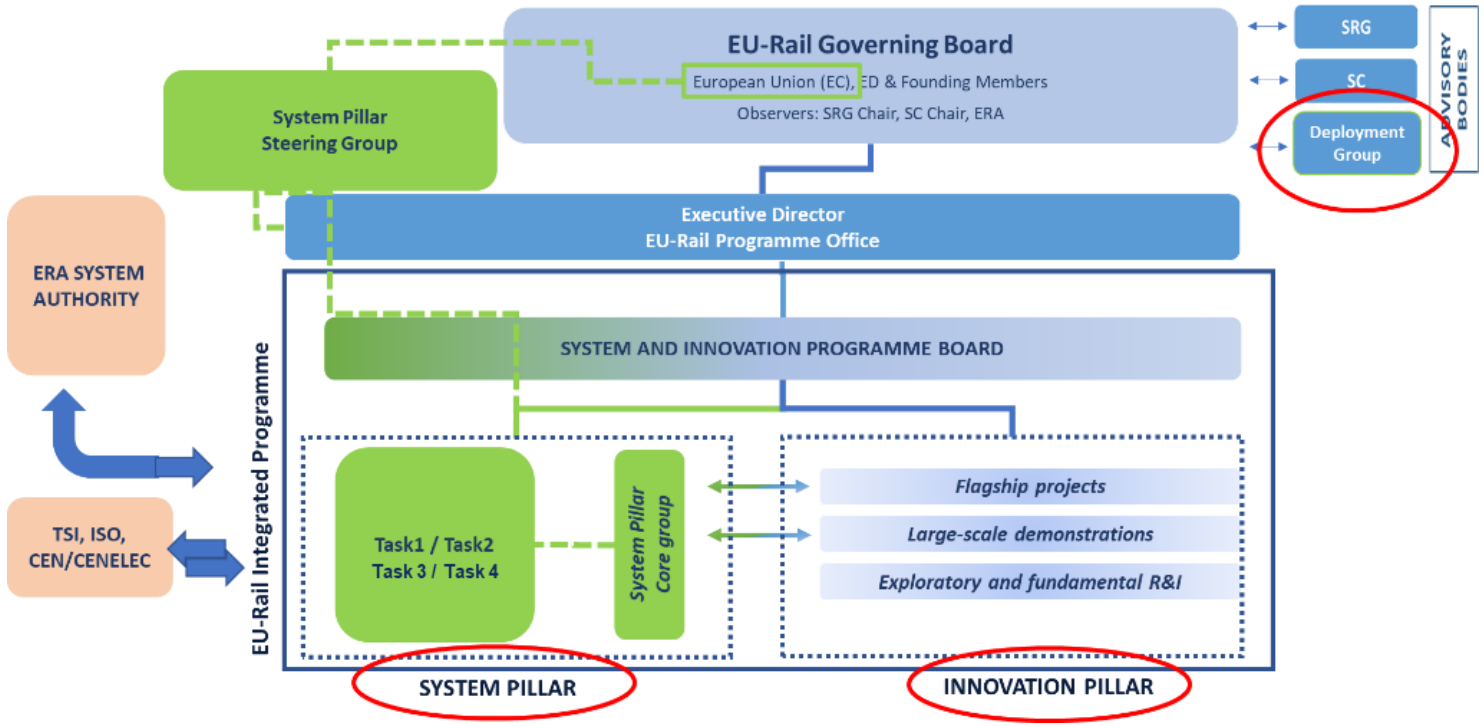
System Pillar Steering Group

Article 93: Single Basic Act

System Pillar Steering Group shall be composed of representatives of the Commission, representatives of the rail and mobility sector and of relevant organisations, the Executive Director of the Europe's Rail Joint Undertaking and representatives of the European Union Agency for Railways….

The System Pillar Steering Group shall be responsible for providing advice to the Executive Director and Governing Board on any of the following:

- The approach to operational harmonisation and the development of system architecture, including on the relevant part of the Master Plan
- Delivering on the specific objective set out in point (c) of Article 83(2);
- carrying out the task set out in point (a) of Article 84(5);
- the detailed annual implementation plan for the System Pillar in line with the work programmes adopted by the Governing Board in accordance with point (b) of Article 92.



⇒ **SP-STG is the body where the sector/suppliers/ERA/MOVE monitor and control the work of the SP**

System Pillar Steering Group: Comments of the Chair

- MOVE sees the System Pillar as central to improving the system – increasing speed and transparency of the specification development; more ambitious harmonisation

- So far:
  - SP-STG 1: Terms of Reference and Governance and Working Arrangements (including set up and task definition)
  - SP STG 2: Common Business Objectives; CCS and TMS vision
  - SP STG 3: System Engineering Management Plan

⇒ Ingredients in place for the SP work to fully begin; ambitious plans for the coming years

Rail Research and Innovation to Make Rail the Everyday Mobility

4. IMPLEMENTATION OF THE EU-RAIL PROGRAMME

- System Pillar: STATUS OF LAUNCHED TASKS AND PLANNED ACTIVITIES

Ian Conlon

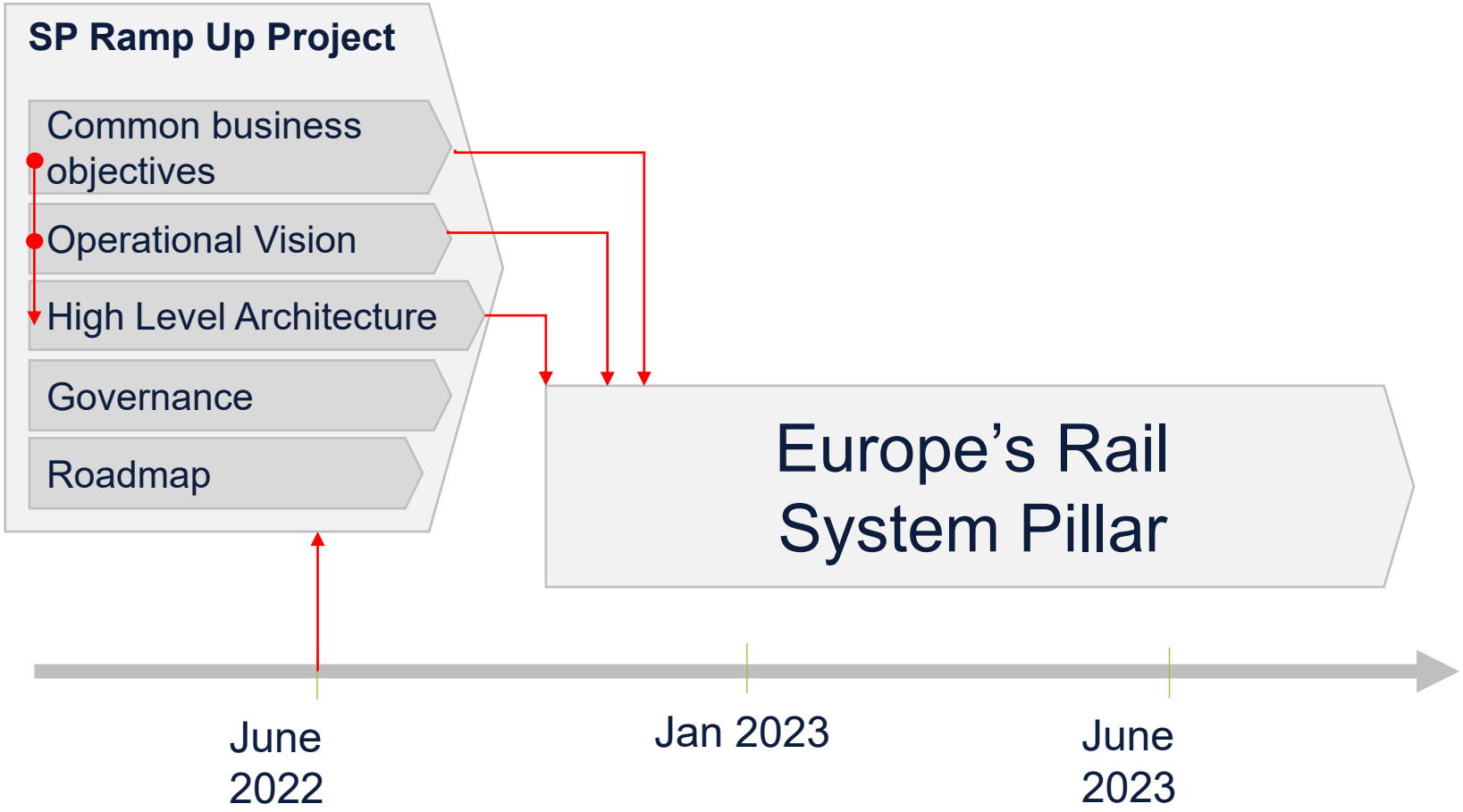
Head of System Pillar, Europe's Rail JU

+

SP Core Group members

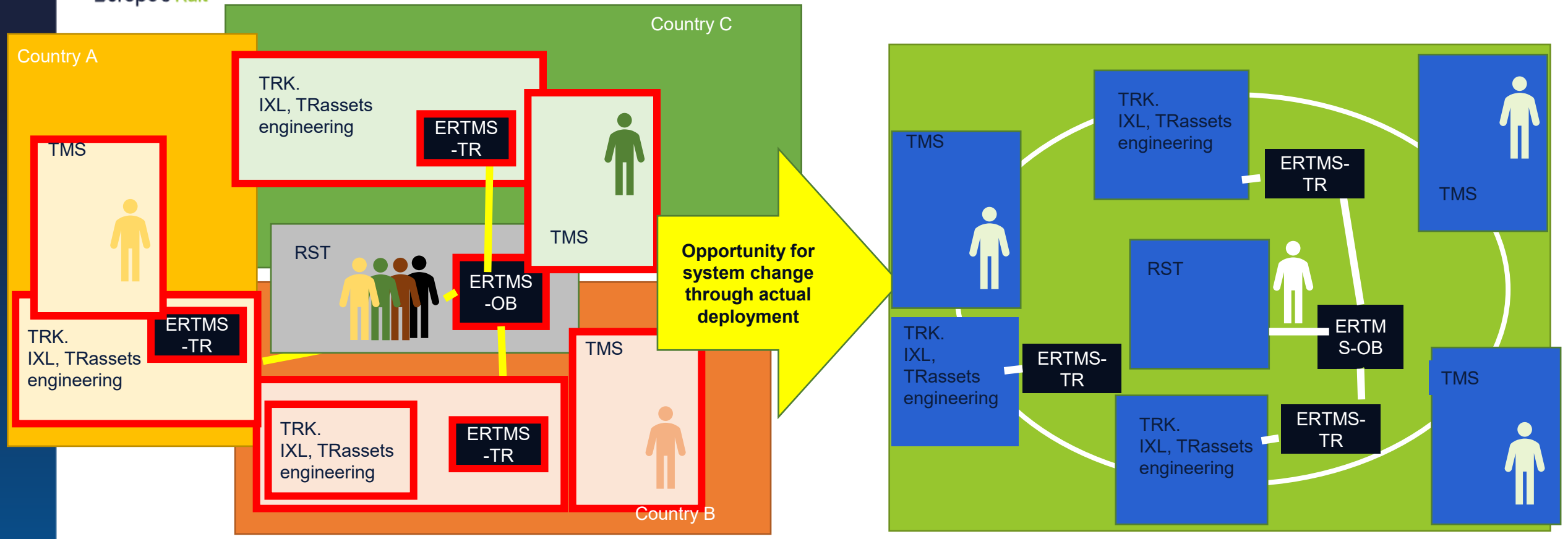
CONTEXT

We are here…..



Planning since the beginning of 2022 has been for the SP to be resourced from October 2022.
⇒ This target has been met

System Pillar: The opportunity



System view:

- Harmonized operations and engineering – beyond strict interoperability
- Best practice architecture approaches supporting adaptable systems
- Specifications and standard evolution supporting a strategic view on system change

System Pillar is the opportunity for the sector to converge on the evolution of the Railway system - operational concept and system architecture

System Pillar: Impact

EU-Rail, through the System Pillar, provides governance and resources to allow the sector to coordinate and converge on the evolution of the system to:

- Define the fundamental design principles and a functional architecture for rail as a system
- Harmonise this system architecture approach at European level, including standardisation of interfaces, communications and data exchange.
- Consider the migration path from current systems to the future system.
- Ensure that the long-term system view can be reflected in a predictable regulatory framework, while modularity ensures the necessary flexibility to innovate.

Successful implementation will:

- facilitate rail as integral part of mobility services and intermodal transport
- increase the overall performance of the rail system, and strengthen interoperability
- deliver cost efficiency in integration, maintenance and evolution of the system
- strengthen the market with large scale and faster deployment of leading-edge developments

System Pilar Expected Outcomes

Technical Specifications for Interoperability and Standards

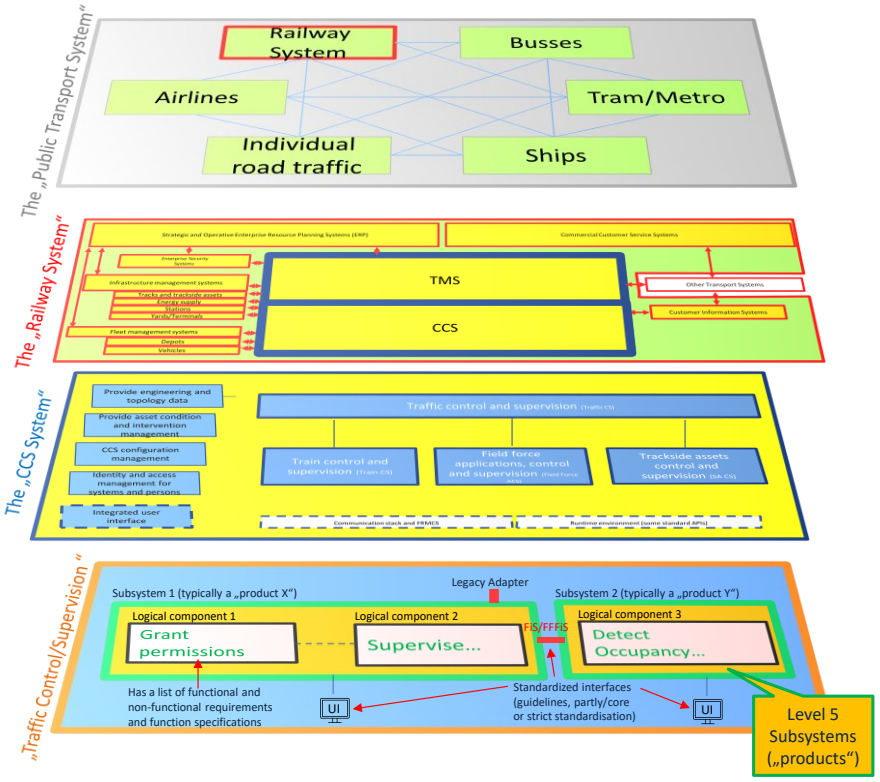
The central tasks of the System Pillar are:

1. Define target system architectures and operational concepts.
2. Coordinate and deliver the means for implementation through inputs to Technical Specifications for Interoperability and harmonized standards.

This tasks are to be aligned and coordinated with the Innovation Pillar flagship projects.

The System Pillar will be the focus for coordination, specification and sector agreement for EU-Rail activities on TSIs and standards which will support interoperability, harmonization and implementation of the Single European Rail Area.

Technical Specifications for Interoperability and Standards will be outcomes from the Model Based System Engineering process to be applied.



SYSTEM PILLAR SET UP

System Pillar Set up

- The basis for the activities
  - Governance and working arrangements
  - Development of the Common Business Objectives
  - Development of the CCS and TMS/CMS Operational Vision
  - Consolidation of CCS architecture

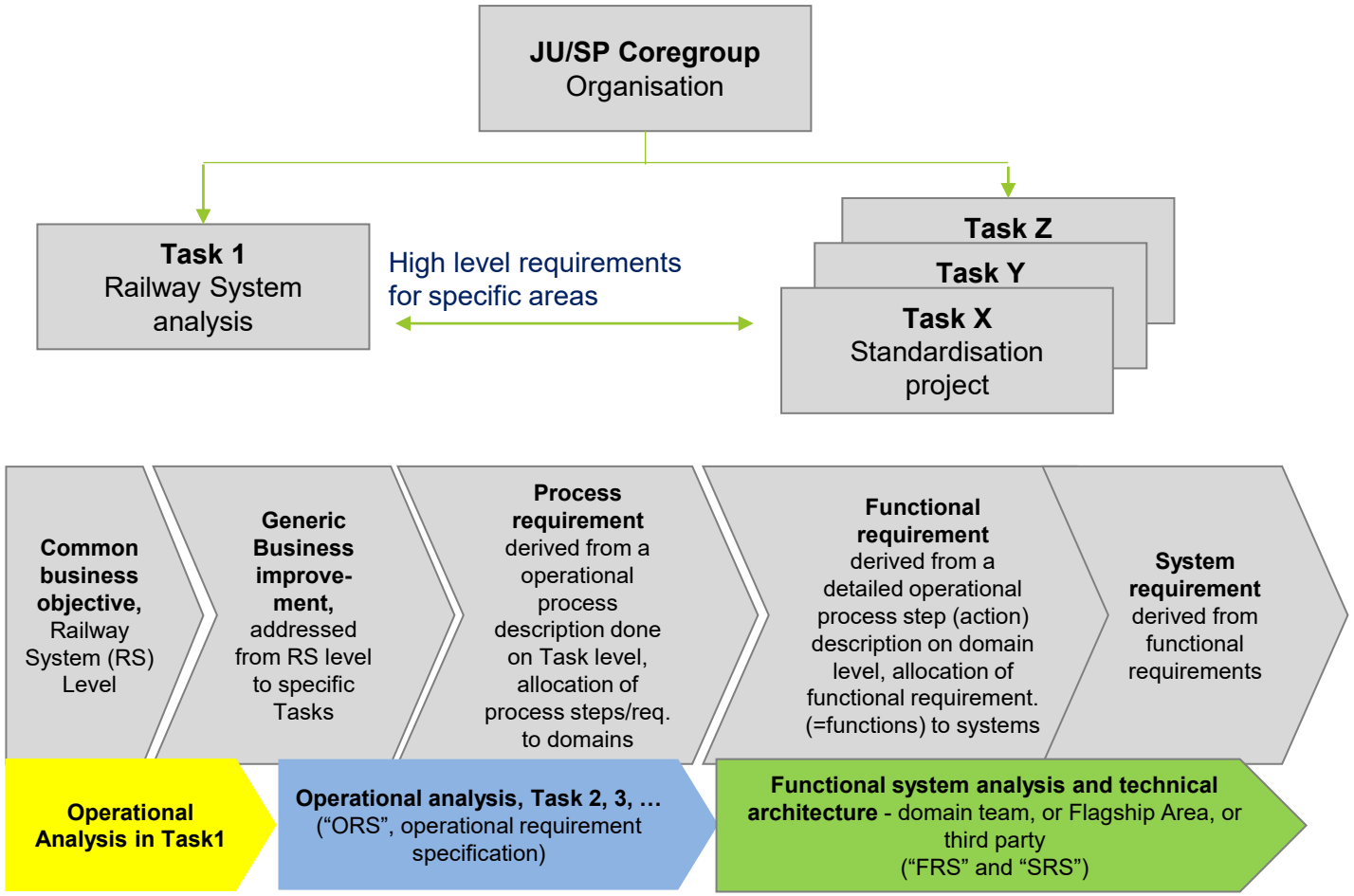
⇒ Drawing and building on sectoral work and L4R activities from S2R

- The “how”
  - The System Engineering Management Plan

- The “what”
  - The planning and expected outputs of the Tasks and Domains

GOVERNANCE AND WORKING ARRANGMENTS

System Pillar: general structure



Task 1: Railway system defines at high level:

- business improvements,
- operational concept, and
- business process architecture

Specific additional Tasks 2,3,4,… define for a subsystem/priority area:

- operational processes,
- requirements and
- architecture.

This is an analytical work that especially breaks down process and system requirements and allocates functions.

More detailed and precise specifications (FRS, SRS) for its "subsystems" on products may be defined by domain teams in tasks. Detailed specification may be carried out in SP, FA, or by third party (to be defined case by case).

The SP Core Group manages progress of and collaboration between the Tasks

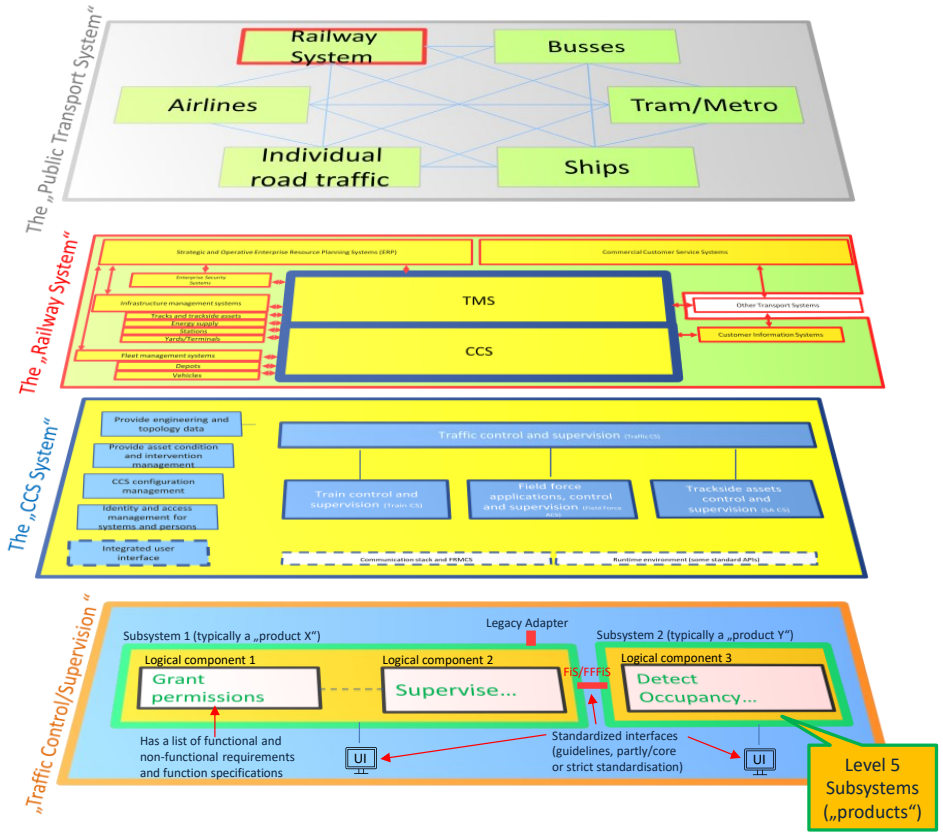
System Pillar: design levels

Railway System

Task 1

Specific sub systems

Tasks 2,3,..



Operational concept and Basic requirements

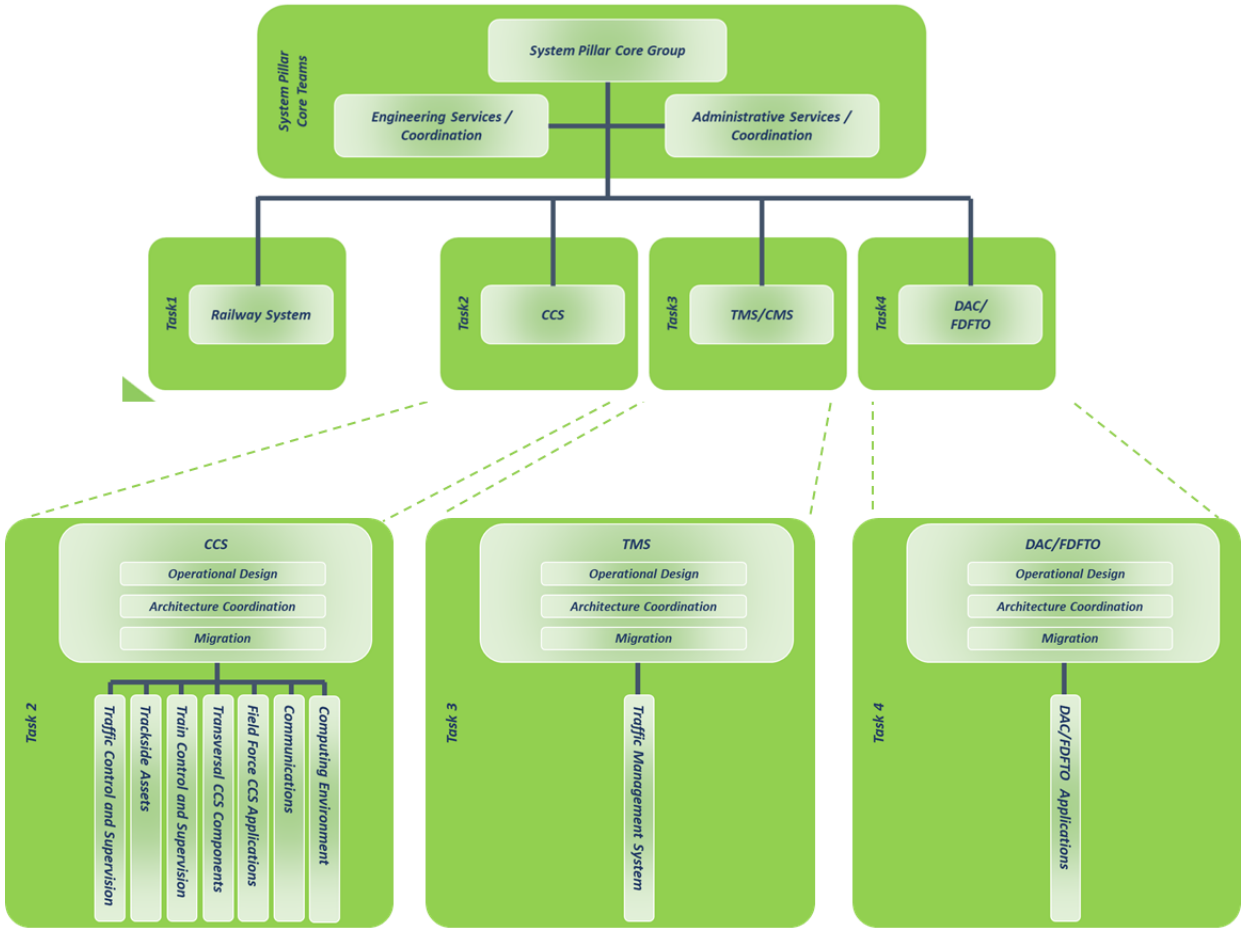
Basic operational processes and requirements

Operational processes and specifications

Examples

- ✓ System layer 1: For public transport, how railways and other transport systems shall interact concerning management connections in a station
- ✓ System layer 2: For Railway system, how shall customer information, TMS and CCS interact in general to manage connections for passengers in case of a deviation
- ✓ System layer 3: For CCS, how shall different actors in the production (trains, field forces, ..) be coordinated to execute a changed plan
- ✓ System layer 4: For vehicle control and supervision, what processes shall happen onboard in general when the movement authorisation changes
- ✓ System layer 5: TSI Specification for interface between ETCS onboard and FRMCS gateway

System Pillar Organisation



CCS Control-Command and Signalling
FDFTO Full Digital Freight Train Operations
DAC Digital Automated Coupling
TMS Traffic Management System

System Pillar **Principles**

- **Integrated leadership team** (*System Pillar Core Group*) Defined set of standardization areas (*Tasks*). For each area a **joint leadership team** with **one representative from Railways and Suppliers each** will work together
  - Task 1 will specify the **Business Process Architecture for the Railway System**
  - Task 2: **CCS**
  - Task 3: **TMS/CMS**
  - Task 4: **DAC/FDFTO**
- Avoid consensus based 'working group style' process, but fast and integrated **system design process**
- **Integration of sector standardization activities**
- Engineering Services, eg:
  - **(Central) Modelling service** (incl. methods & tools definition for the whole system Pillar, support of the modelling platform, derived CDM catalogues)
  - "**Standardisation and TSI Input planning**", mainly structured along the catalogue of processes and interfaces/systems

Operational design
- Creating **harmonized operational processes** and define process improvements

Architecture coordination
- Create and maintain **one consistent target architecture** for the whole system

Migration design
- Define migration plateaus that allows national Infrastructure Managers to **stepwise migrate towards European target architecture**

Domain Specification
- Define per System Pillar Task **standardization granularity and related specifications**

RAMP UP OUTPUTS

Overview

Common Business objectives (CBO)

> 10 Input documents from sector
- CBO document

Approved at SP-STG Meeting 2

TMS/CCS Operational Concept (OpCon)

> 20 Input documents from sector
- Operational vision

Approved at SP-STG Meeting 2

TMS/CCS System Architecture (SysArc)

> 500 Input documents from sector
- Systems Architecture (overview)
- Annex 1: Architecting principles
- Annex 2: Systems Architecture

Reviewed at SP-STG Meeting 2

Common Business Objectives

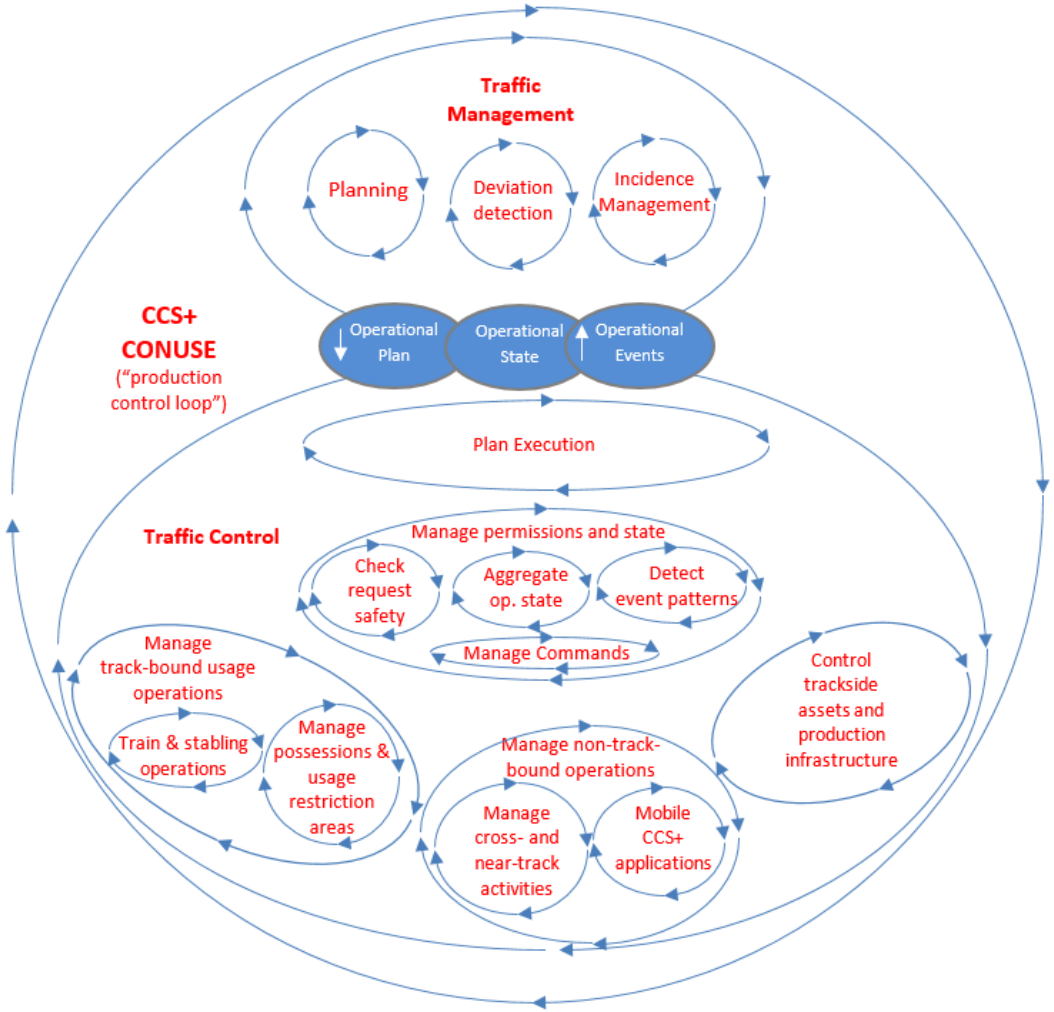
More flexibility and punctuality for passengers and freight	service quality and improve punctuality	real-time data sharing
Improved performance and capacity	Increase capacity, reduce travel time	Better predict capacity needs
	Optimise capacity	efficient capacity of lower used lines
Reduced costs	Affordable LCC	Economically attractive solutions
	Affordable system updates	
More sustainable and resilient transport	efficient energy consumption& smart energy infra	proper security regulations and standards
	Improve availability/reliability/robustness	integration of transport systems in populated areas

Harmonised approach to evolution and greater adaptability	Harmonize ope & strengthen interop	Optimize Safety regulations
	Standardize architecture	Increase systems adaptability
Reinforced role for rail in European transport and mobility	Improve methods and tooling	Reduce regulatory complexity
	Enable fast migration and roll out	
Improved EU rail supply industry competitiveness	Make future railway system attractive	international design authority

Operational concept

Clear operational vision and concept is necessary to build the target system

- The operational concept describes three different conceptual areas
  - CONOPS: Concept of operations, business, legal, commercial, and organisational view
  - CONUSE: Concept how to use the system, production view
  - CONEMP: Concept of employment, provide system and resources, “asset management view”

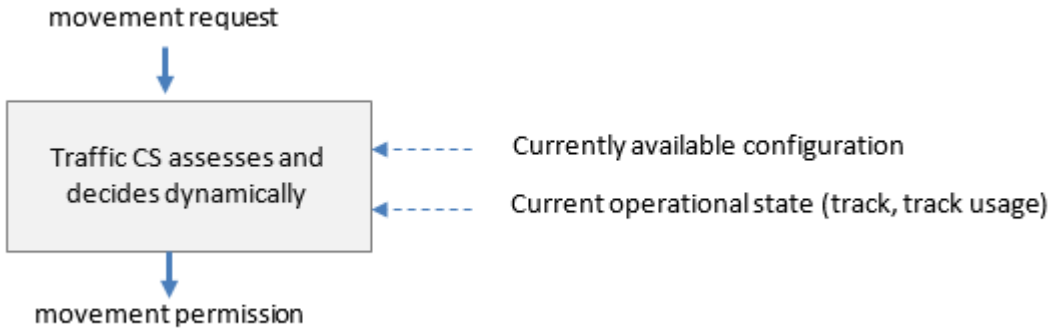


Example of CONUSE control loops to detail scope of TMS

CCS/TMS Operational Vision

CONUSE – Train and Traffic Control and supervision (CCS systems, ATO, ATP…)

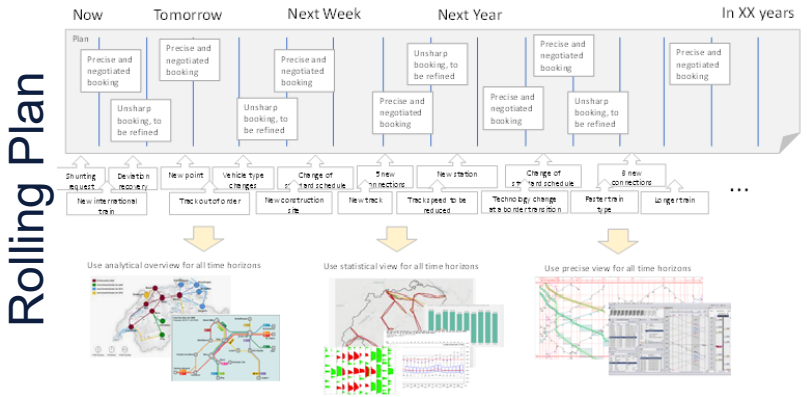
- Precise real-time traffic flow and speed control offered to the TMS
- Precise “operational state” of all production elements offered to the TMS
- High automation of Traffic Control and Supervision
- ETCS L2/3 supervision for all type of movements (e.g., shunting)
- Dynamic adaption to infrastructure changes under production
- “Rich” degraded modes (more options to continue with production)
- Dynamic event pattern recognition based on the full operational state
- Hi performant, scalable, and strictly standardized ETCS L2/3 usage (no lineside signals)

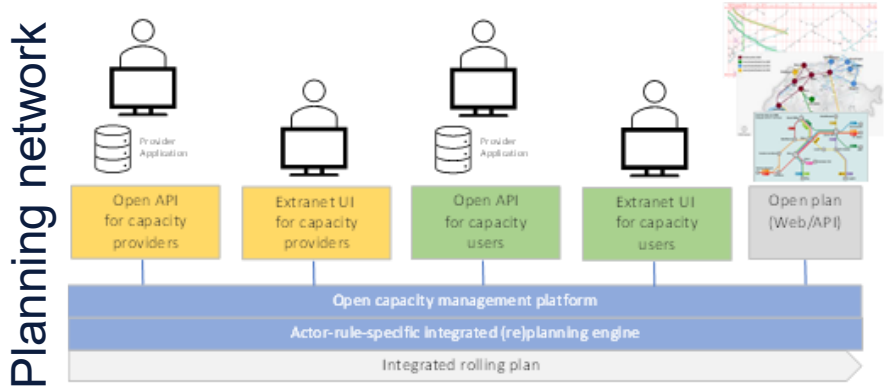


CCS/TMS Operational Vision

CONUSE – Traffic Management, Digital Capacity Management

- Cross-country, cross-company, multi-modal
- Integrated “planning network” of capacity users and capacity providers
- Automation of planning and of dynamic/smart rescheduling/disposition
- Quality of plans – better fulfilment of customer needs and reduction of resource consumption
- Integrated plan – all capacity factors planned
- Rolling plan – avoid multiple plan transitions/systems
- Optimized prognosis and conflict detection
- Automated incident management/communication network
- Energy and traffic flow optimized trackside ATO preparation and driver assistance





CCS/TMS Operational Vision

CONOPS

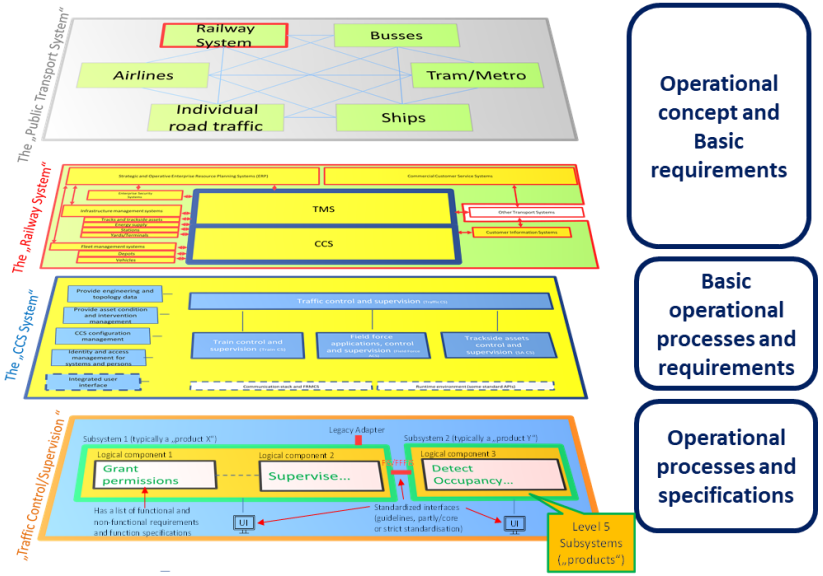
- To implement the SP common business objectives:
  We will *share* everything, that is not really company specific.
- High “reusability” of products, safety cases, know how, specification, tender documents, training, handbooks, rulebooks, etc.
- Strictness: Reusability is reduced quite fast already with the first bespoke specialities – to be avoided
- Standardized processes for CONUSE (TMS/DCM, production/CCS) and CONEMP (asset management / life cycle)
- Set of strictly standardized CCS/TMS/DCM configurations
- Includes alignment of non functional requirements on European level

CCS/TMS Operational Vision

CONEMP – Asset management

- Reduction of number of assets
- Automation and efficiency of asset management and change processes
- Smarter compatibility, less dependencies, less early replacements
- Unique requirement sets (per application category)
- Reduced integration effort
- Knowledge Support and shared asset management information
- Building, maintaining, and configuring ICT components state of the art
- Supported network/fleet wise diagnostics, configuration management
- Enhanced security management and monitoring
- Simplified safety cases and authorisation

TMS/CMS and CCS system of systems in the context of the Railway System Architecture



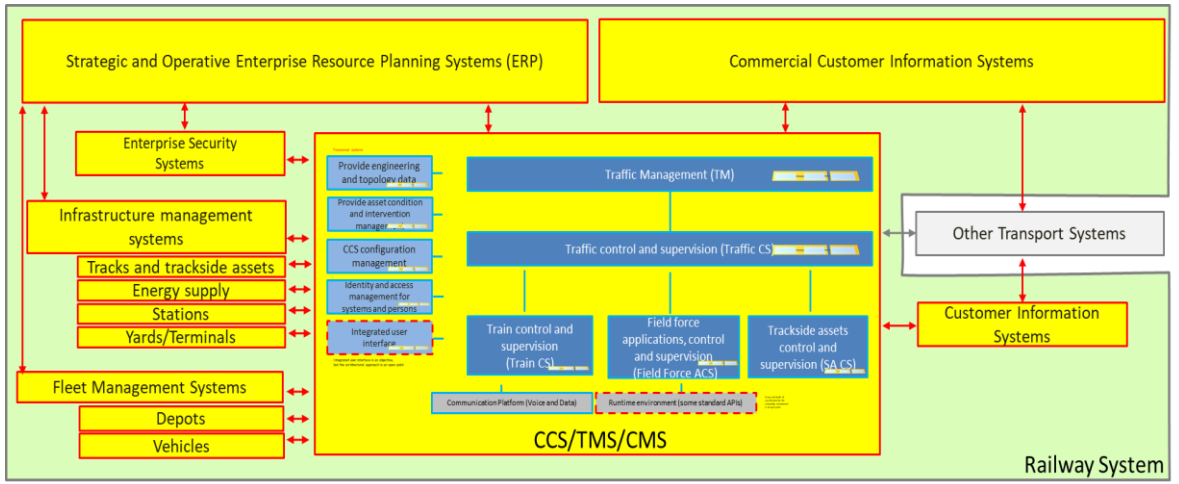
System of systems approach is used inside the System Pillar to recursively refine the structure of the architecture down to the level of subsystems

The design shall achieve several architectural **quality attributes**, including Modular safety, availability, security, scalability, modifiability, modularity, interoperability, extensibility, and low life cycle cost shall be achieved by applying modern architecture principles

The System of Systems CCS/TMS/CMS architecture consists of CCS/TMS/CMS

- core systems (dark blue),
- transversal systems (light blue) and
- technical platforms for communication and runtime environments (grey)

The initial list of functions and interfaces within the target system have been identified during the ramp up



SYSTEM ENGINEERING MANAGEMENT PLAN

System Pillar Engineering Management Plan (SEMP)

The SEMP will describe the processes, methods and tools that the whole System Pillar will use. All System Pillar work will be managed through this process – not "in-house" and then integration.

Tasks of the SP SEMP task force: Create first version for

1 Engineering processes

„(Engineering)processes“ → processes describing the “workflow of engineering”

- **System Design Processes**: E.g., process steps to get from use cases down to functional design
- **Management Processes**: E.g., how to collect, decide or allocate requirements or project management processes; or change management processes
- **Publication/Standardisation Processes**: E.g., TSI Input processes, specification maintenance

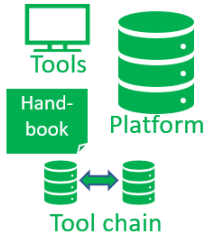
(references: ISO 15288 (5.6) processes, INCOSE Systems Engineering Handbook)

2 Design methods, notation and ontology

„(Design) methods“ → How results should look like/be structured/be named.

- **Methods**: E.g., how hazards should be linked to risks, and risks be linked to requirements
- **Ontology, vocabular**: E.g., how to name results of SP or things in the railway landscape
- **Design and modelling standards, notation**: E.g. template structures for documents like “system definition”, or how to describe and draw a function or interface, or how requirements or use cases shall be formulated

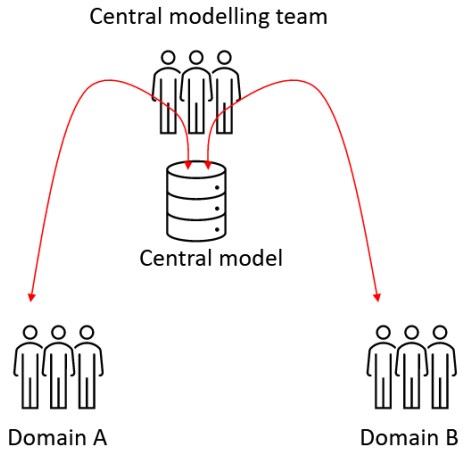
3



„Tools“ → With what to create, store, forward, notify, check, manage, asses, publish….results

- **For the temporary platform and for the later target platform (public procurement)**
- **Design Tools**: E.g., to write traceable content, for modelling, approval tools, model proving etc.
- **Management Tools**: E.g., project management, issue management, workflow automation, etc.
- **Information flow automation:** Carrying, converting and linking files from different tools, manage exchange between teams

Continuous Integration



Principle:

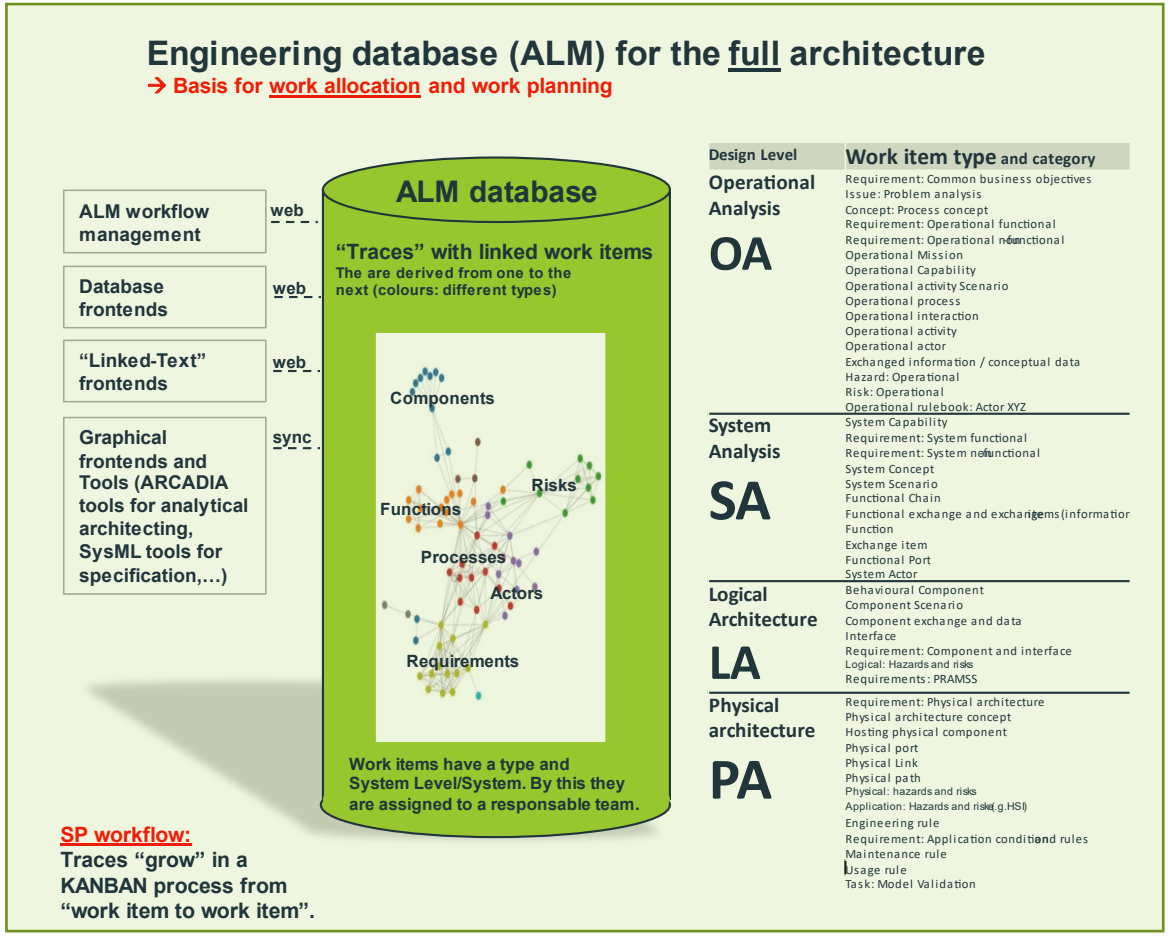
- Open door policy for read access
- Import from **external contributions through Domain Teams and modelling services**

System Pilar Engineering Process

Model Based System Engineering (MBSE)

The engineering service of the System Pillar has decided to develop a Model Based System Engineering (MBSE), with the objectives of:

- Cost efficiency for integration,
- Migration and deployment,
- Cost efficiency for maintenance and evolution of the system
- Quicker roll-out of innovations
- Market accessibility
- Increase overall performance and agility of the railway including time, reliability and safety towards the customer through faster deployment of key new technologies
- Improved train service across the European Union
- Facilitate rail as integral part of the mobility services across the European Union
- Manage diverse rail legacy, bringing interoperability and ease the migration
- Sound, qualified and reliable supply chain.



PLANNING

Outputs: Task and Domain Teams

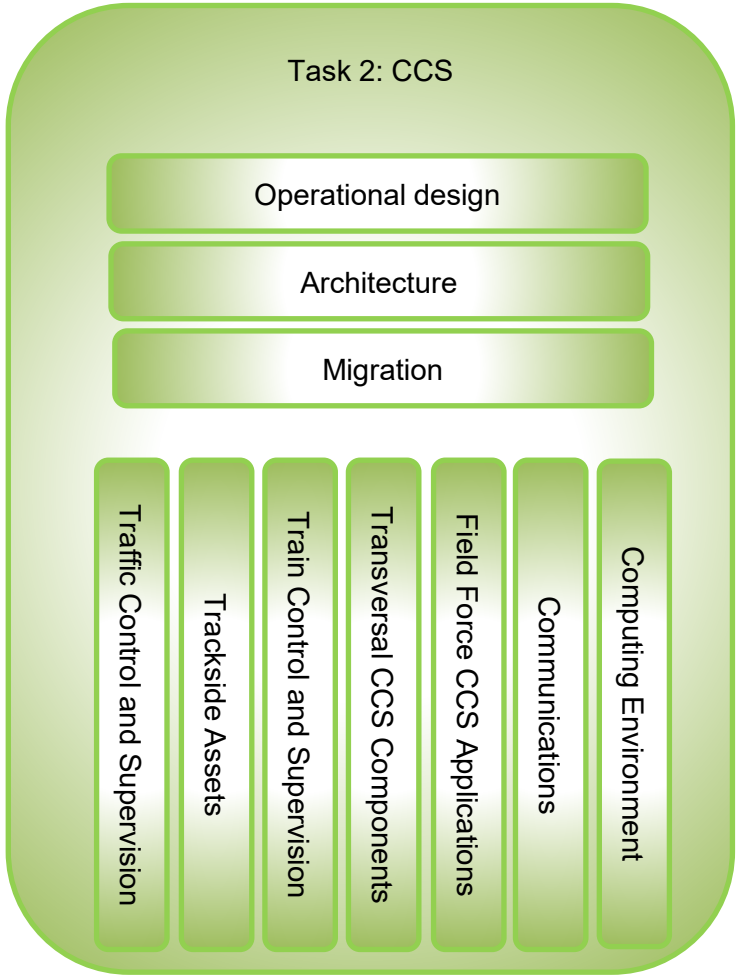
- The planning process is ongoing, and for most Tasks and Domains, largely complete
- The baseline for planning is the current Annex VI in the EU-Rail Annual Work Programme 2023–2024
- The process will be finalized by the end of the year, for approval by the Executive Director – thus the planning as stated is developed but still subject to change

Task 1: Whole Rail System

Deliverables (first 12 months)

- As-is railway system architecture view, considering operational, functional, logical & physical assets
- Diagnosis of the pain points for selected operational interaction processes and derive target performance of railways system functions and the requirement set reflecting the Common Business Objectives
- High-level Business Process Architecture view and Operational Design (Organisational needs, Generic automation needs, …) for the (to-be) Railway System. The high level business process architecture view and operational design for the to be railway system should include consideration of all main railways subdomain and sub-systems including infrastructure (Track, Energy, Telecom, Civil Works), rolling stock, railways operation and services

Task 2: Topic Domains



Area	Standardisation Area	date
Security	Security systems services for CCS/TMS	2024
Yards/Term.	Coordinated capacity planning with TM	2025
Yards/Term.	Coordinated traffic control with TM	2025
Stations	CCS/TMS<>Station interfaces for ATO Processes	2025
CCS operations	Operational concept (harmonized)	2023
CCS operations	Operational processes (harmonized)	2024
CCS operations	Operational rulebooks	2026
CCS core	Interface between Traffic Management and Traffic Control.	2024
CCS core	Interfaces between Traffic Control and Train Control. (e.g. way of using SS26/126 for level R; and additional channels e.g. for onboard digital maps).	2024
CCS Core	Cross-company/cross-installation/cross-border interfaces for Traffic Control	2024
CCS core	Interfaces between Traffic Control and Trackside Asset Control.	2023
CCS core	Interfaces Traffic Control and Mobile CCS/TMS applications (e.g. for trackworker safety)	2026
CCS assets	Engineering, asset and topology data	2023
CCS assets	Asset condition and intervention management (Integrated diagnostics protocols, analytics, event channelling, and smart/integrated event pattern recognition)	2025
CCS vehicle	Vehicle CCS internal modularisation and interfaces to the train	2024
CCS config	Integrated configuration management	2025
CCS UI	Standardisation of integrated workbenches / UI	2024
Computing	Standard (safe) computing environments (e.g. API and communication methods)	2025
FRMCS	FRMCS incl. vehicle/trackside architecture V2	2024
FRMCS	FRMCS incl. vehicle/trackside architecture V3	2026

Task 3: TMS/CMS

First 3 months

- Prioritization analysis (specific Work packages definition), including functionality and interfaces.
- Complete the scope definition of the domain that will be included for the release 1 of the SP target architecture and the respective deliverables, standards, and regulations
- Concept proposals for:
  - Answer the question on the functions within the scope and how they will work at EU level. Is it necessary a European coordination activity or not?
  - Analyze external TMS/CMS interfaces for data exchange with foreign actors and applications that help in the management of deviations
  - Planning partners and interactions related to interfaces
  - Information structure of the “operational plan”

First 12 months

The activities that will be developed during the first year are:

- Cross cutting activities, including harmonized operational concept for TM related processes, architecture of TMS/CMS building blocks and support migration activities
- Operational Analysis for main interfaces and functionalities
- System Analysis for the Traffic/Capacity Management and Traffic CS (operational plan)

These activities will result in the following deliverables during the first year:

- system concept, including scope, context, purpose of the system and its environment
- system definition, detailing functions interfaces and operational requirements
- system requirements specification, Level of detail for this first iteration will need to differ on specific topics, e.g. we expect a level of detail of functional and system requirements for the interfaces TMS- Traffic CS that will allow to reach a first complete FFFIS specification by Q4 2024
- TMS/CMS architecture principles, including functional and logical architecture

Task 4: DAC/FDFTO

Deliverables (First 3 months)

1. Operations/Architecture: Hand-over of trains between ETCS-controlled mainline and local yard authority (alignment Task 4 with Task 2 and Task 3)
2. Train length and train integrity functional interaction and interfaces between wayside and train to be aligned by Task 4 with Task 2 and the PRAMSS Team.
3. First planned inputs for the Standardization and TSI Input Plan (STIP)

Deliverables (First 12 months)

- **Ensuring close alignment and cooperation with Innovation Pillar Flagship Area 5 (FP5) and EDDP@EU-RAIL by continuous collaboration and synchronisation**
- Managing cross-cutting activities for Task 4 (based on EDDP input where available and aligned with EDDP (in the sense of sector alignment) and FP5 (operational and technical solutions))
  - As-is analysis of the railway system, considering operational, functional, logical & physical assets and identifying the pain points related to DAC/FDFTO in cooperation with Task 1.
  - Review input from EDDP (European DAC Delivery Program) and FP5 on **operational concept**, ensuring consistency to the overall rail system and architecture and including the results in the in overall operational concept, including for CCS-related processes in collaboration with Task 2
    As soon as input from FP5 (based on pre-work of EDDP) is available, sector alignment will be managed by SP Task 4, firstly through the EDDP sounding board as a sector mirror group and finally approved through the SP governance to make sure that adaptations / elimination of local rules will be implemented in time to ensure smooth roll out of DAC/FDFTO.
  - A draft proposal overall **architecture** (system of systems) related to the interfaces of FDFTO to the outside world in collaboration with FP5 Seamless, Task 1 (with priority), Task 2 and Task 3 should be defined and interfaces to the train-related entities with locomotives and wagons developed by FP5, should be identified, and agreed.
  - Ensure consistency and take responsibility for overall architecture coherence of any architecture output from FP5 and EDDP and embed it into the overall Rail System Architecture.
  - As-is analysis of the railway system, focusing on existing IT systems for freight operation, wagon handling and wagon keeping in use at the main operators (standardised interfaces and protocols, dispo system for DAC/non DAC - contributions by ROC members necessary). Special focus on relationship to FDFTO + seamless in alignment with Task 1.
  - In addition, provide a proposal for a **central instance for managing data access and processes for SW updates** (bug fixing and system upgrades), taking into account existing responsibilities and legal obligations of different stakeholders (keeper, ECM, operator, supplier, …) – technical communication interfaces will be provided by FP5.
  - Ensure consistency of **DAC/FDFTO migration roadmap** with SP roadmap, based on input from EDDP on migration and deployment
- **Managing the input to the Standardization and TSI Input Plan for Task 4 activities** (based on (but not exclusively) detailed standardisation requests from FP5)
- **Supporting FP5 and EDDP regarding authorisation strategy**
- **Checking CBA provided by EDDP and FP5 for consistency with CBOs**

Rail Research and Innovation to Make Rail the Everyday Mobility

4. IMPLEMENTATION OF THE EU-RAIL PROGRAMME

- Innovation Pillar: PLANNED ACTIVITIES IN THE FIRST EU RAIL FLAGSHIP PROJECTS

Flagship Projects coordinators

Flagship Area 1: Network management planning and control &
Mobility Management in a multimodal environment

FP1 – MOTIONAL*

Lars Deiterding / Hacon

Riccardo Santorro / RFI

EU-Rail General Assembly on 30.11.2022

* *Pending successful completion of the Grant Agreement Preparation phase, this project will be receiving funding from the Europe's Rail Joint Undertaking (ERJU) under project ID 101101973. The Europe's Rail Joint Undertaking receives funding from the European Union Horizon Europe's Research & Innovation Programme, as well as from the ERJU members other than the Union. Neither the Europe's Rail nor any person acting on the Europe's Rail behalf may be held responsible for the use which may be made of the information and views contained in this presentation*

Project plan for the first phase of FA 1 until 2025/26

The project is organized **in 4 focus areas organized in 2 workstreams** covering rail traffic planning, management, multi-modal mobility and digital enablers and therefore starting the work on all enablers included in FA1.

In a joint activity the key stakeholders will **specify, develop and demonstrate** new capabilities for future upgrades of **planning, traffic management and mobility management** applications towards **green, digital and safe solutions** for the rail sector.

WS 1.1 Traffic Planning:
Improved strategic and tactical planning, Integration of planning systems and processes including cross-border planning, Decision support for planning and timetable optimisation, Simulation and operational feedback for improved planning;

WS 1.2 Traffic Management:
Integration of TMSs and processes including cross-border traffic management, Improved resilience and efficiency of disruption management, Linking TMS to ATO/C-DAS for optimised operations, Automated decisions and decision support for traffic management optimisation;

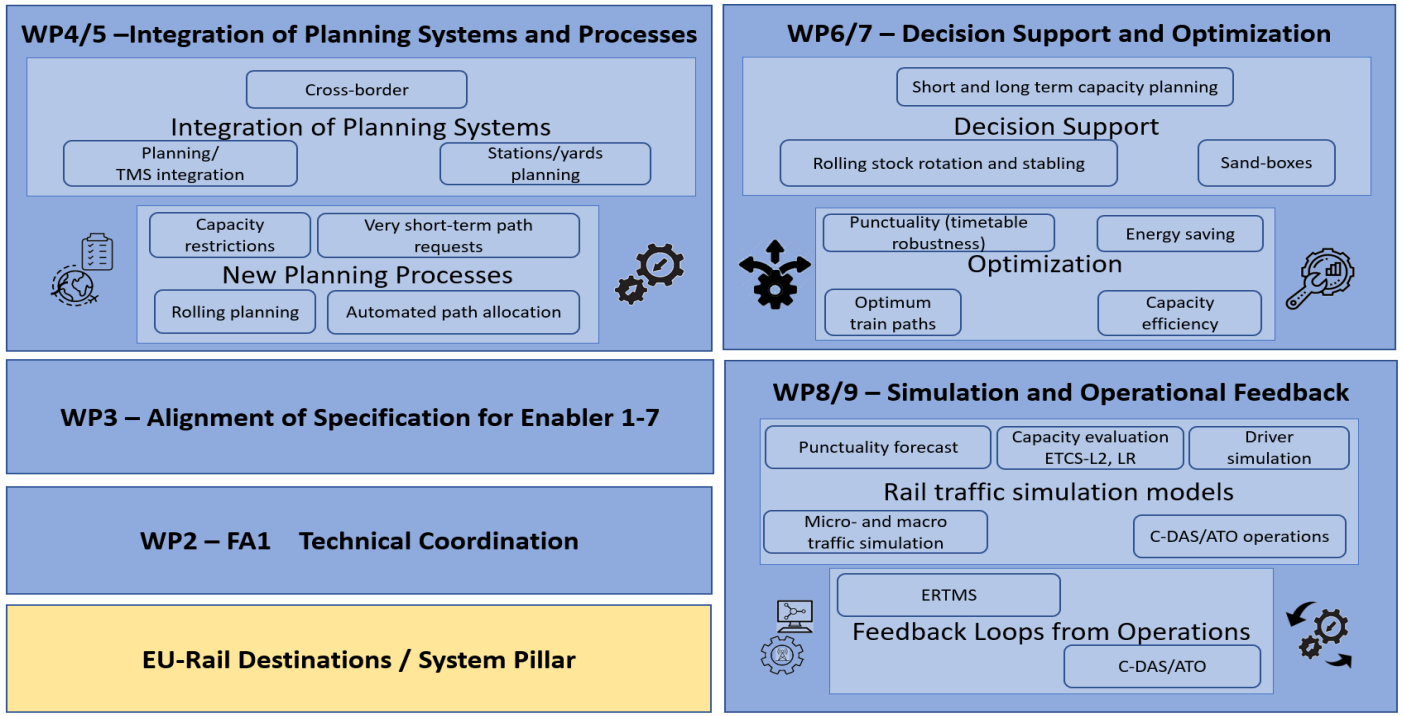
WS 1.3 Mobility integration:
Integrate Rail with other transport modes, Services for inclusive rail-based mobility, Anticipate demand leading to improved resource utilisation,

WS 2.1 Digital enablers:
Digital Process Scenarios , Digital Asset Engineering , Digital Twin, Conceptual Data Model and semantic dictionary evolution, Federated Data Spaces

WS 1.1 Planning focus

The results of this workstream will contribute to an **improved strategic and tactical planning of the rail network**, by the following enabler:

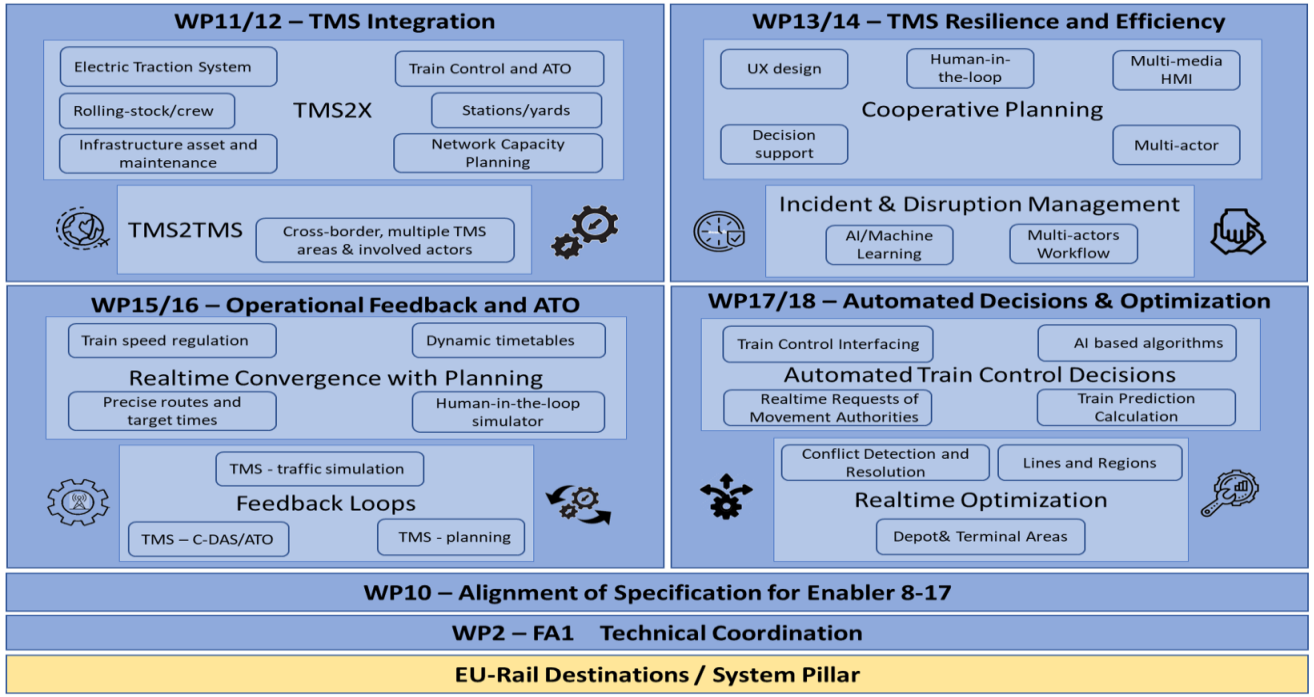
- Enabler 1: European cross-border scheduling with international train path planning *[TRL6/7]*
- Enabler 2: Improved capacity allocation using rolling planning and TTR *[TRL6/7]*
- Enabler 3: Decision support for short term planning *[TRL5/6]*
- Enabler 4: Train path and schedule optimisation methods and strategies for capacity efficiency, punctuality and energy saving for different parts of the network and different traffic situations (level of punctuality) *[TRL5/6]*
- Enabler 6: Integration of planning systems and TMS with a) yard capacity planning and b) station capacity planning *[TRL5/6]*
- Enabler 5: Improved rail traffic simulation models for selected Use Cases to forecast punctuality in the network (e.g., simulating proportion primary and secondary delays, simulations drivers vs. ATO over ETCS) *[TRL6/7]*
- Enabler 7: New planning and operational processes using feedback loops from ERTMS ATO and C-DAS *[TRL5/6]*



WS 1.2 Operational focus

The results of this workstream will contribute to an **increased resilience of a connected 'real time' rail network**, by the following enabler:

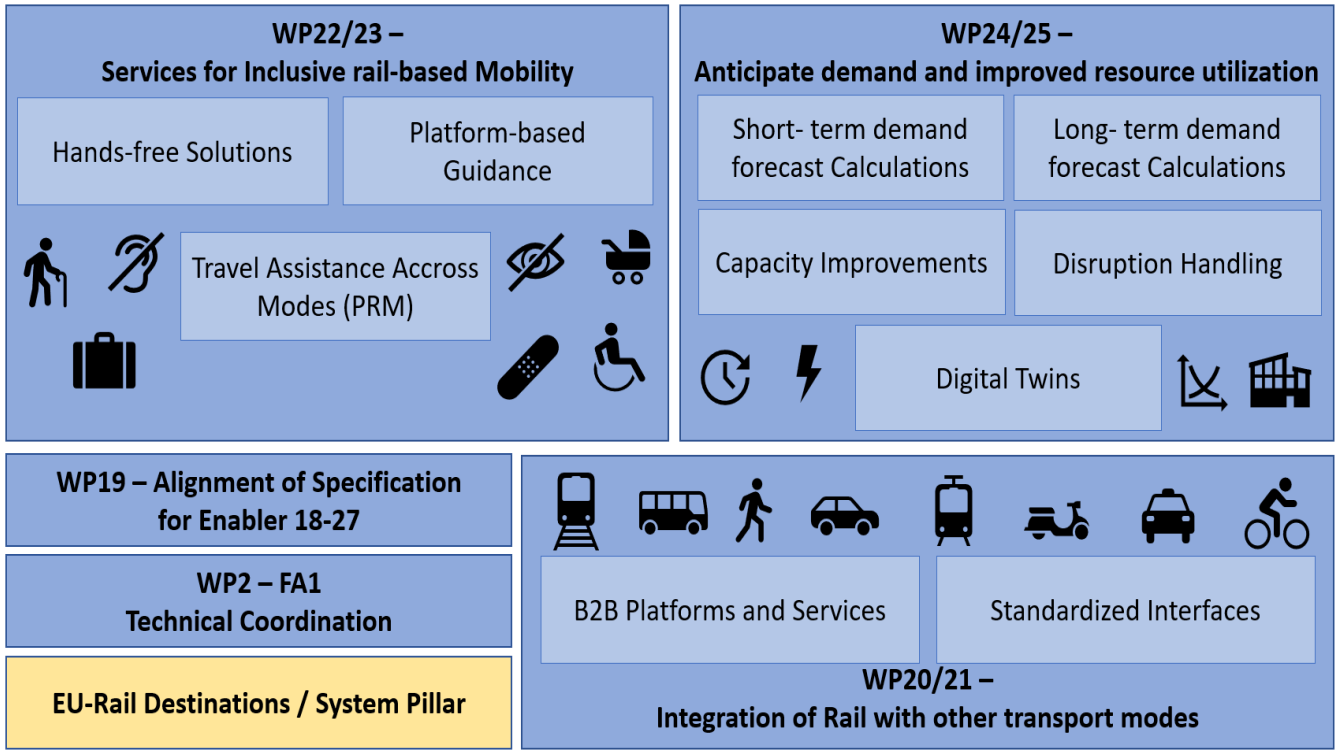
- Enabler 8: Real-time connection of rail networks as managed by TMSs and involved actors *[TRL6/7]*
- Enabler 9: Modelling and decision support for cross-border traffic management *[TRL5/6]*
- Enabler 10: Integration of TMS with a) yard management system and processes; b) station management system and processes; c) energy management (Electric Traction System); d) real-time crew / rolling stock dispatching *[TRL6/7]*
- Enabler 11: HMI for TMS based on User Experience (UX) Design and user input *[TRL8]*
- Enabler 12: Real-time convergence between planning & feedback loop from operations *[TRL4/5]*
- Enabler 13: Cooperative planning multi-actors within rail *[TRL4/5]*
- Enabler 14: Integration of incident management and customer information, with IM and RU interaction and Decision Support for Disruption management *[TRL4/5]*
- Enabler 15: TMS speed regulation of trains, precise routes and target times for ATO and dynamic timetables *[TRL4/5]*
- Enabler 16: Automation of very short-term train control decisions *[TRL5]*
- Enabler 17: Real-time conflict detection & resolution for main line and optimisation *[TRL4/5]*



WS 1.3 Multimodal integration

The results of this workstream will contribute to an **improved integrated rail traffic within door-to-door mobility**, by the following enabler:

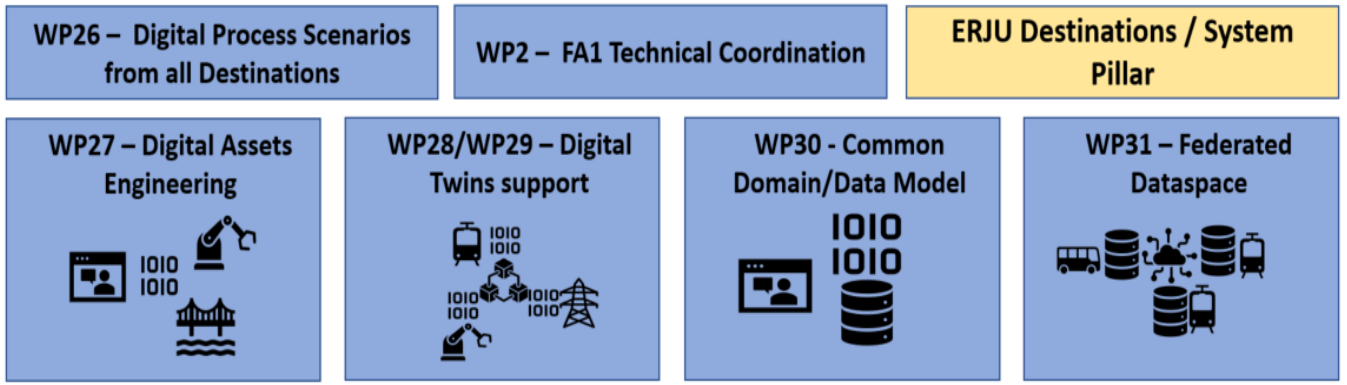
- Enabler 18: Improve Rail integration using B2B Intermodal Services *[TRL6/7]*
- Enabler 19: Develop Standardised Interfaces *[TRL7/8]*
- Enabler 20: Travel Assistance across modes (esp. PRM) *[TRL4/5]*
- Enabler 21: Hands-free Solutions & Smart Information *[TRL7/8]*
- Enabler 22: General approach to platform-based guidance *[TRL4/5]*
- Enabler 23: Short Term Demand Forecast Calculation *[TRL6/7]*
- Enabler 24: Long Term Demand Forecast Calculation *[TRL4/5]*
- Enabler 25: Integration of Demand Forecast into Digital Twin *[TRL4/5]*
- Enabler 26: Optimise rail capacity to better match the demand *[TRL4/5]*
- Enabler 27: Manage/ Inform Disruptions across modes *[TRL6/7]*



WS 2.1 TT Data models and data structures

This workstream will facilitate the provision of **Connectors for Federated Data Spaces, Common Domain Ontology/Conceptual Data Model, as well as Digital Twin support, development and execution environment**, by the following enablers:

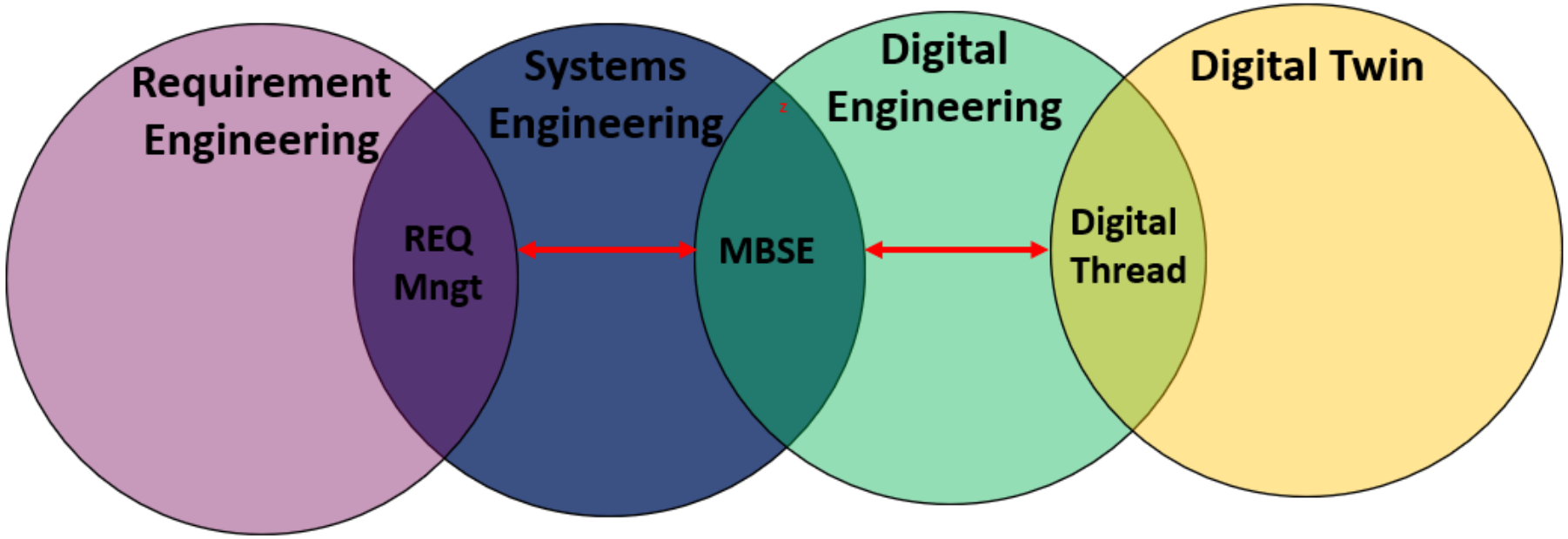
- Enabler 28: Development of federated data space for data sharing and communications across all Destinations
- Enabler 29: Development of machine-readable semantic and syntactic abstract data model for all Destinations
- Enabler 30: Development of methodology supported by toolbox for digital assets engineering
- Enabler 31: Provision of Digital Twin development and run-time simulation environment for creation of modular, interoperable, composable Digital Twins



WS 2.1 TT Data models and data structures

Digital continuity : Requirement Mngt ⇔MBSE ⇔ Digital Twin Toolbox

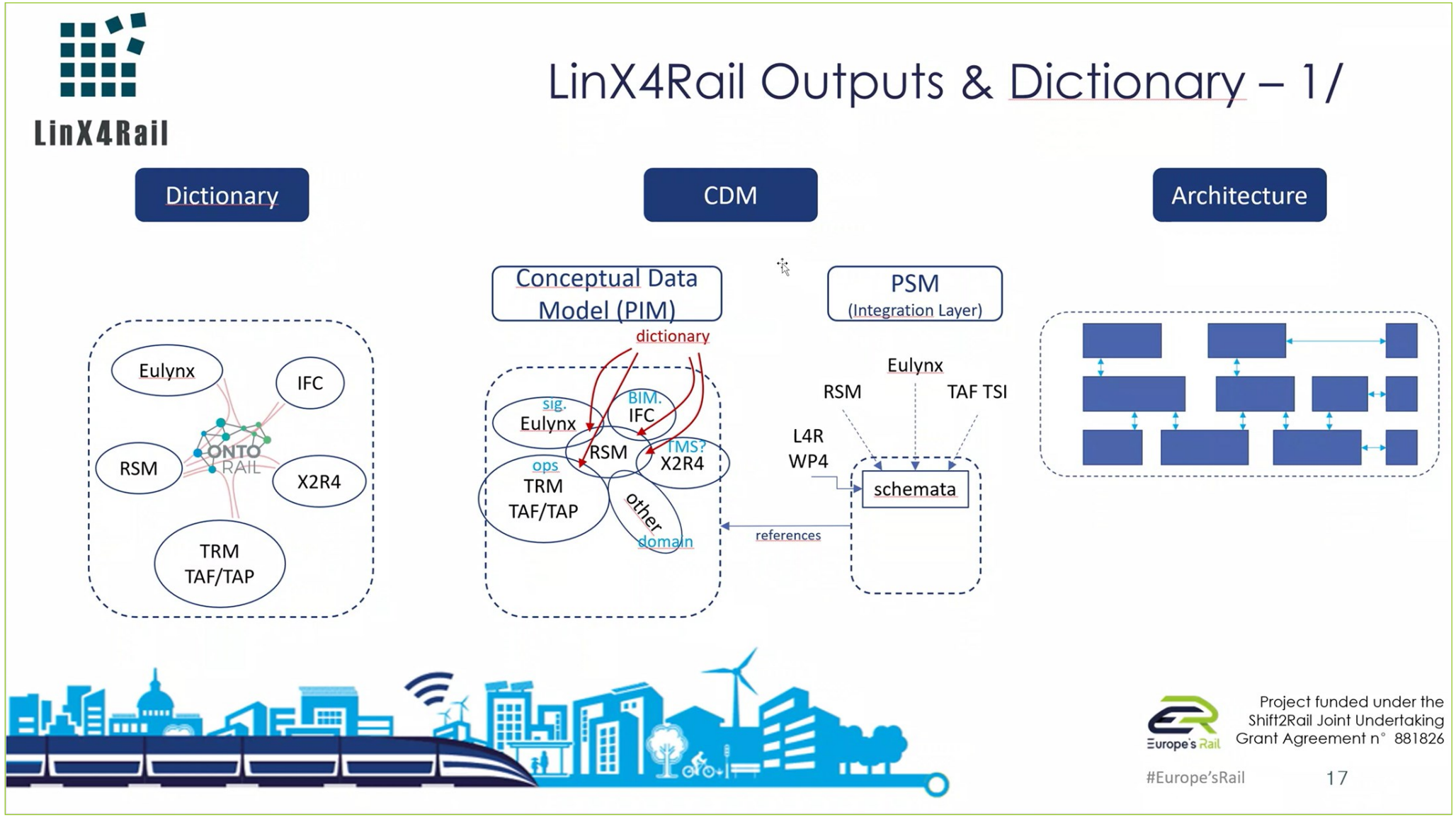
Outcome:
Migration plan between what the railways use now industrially (REQ), what is underway in innovation initiatives (MBSE) and what is targeted (digital continuity)



"Model-based systems engineering (MBSE) is the *formalized application of modelling* to support system requirements, design, analysis, verification and validation activities beginning in the conceptual design phase and continuing throughout development and later life cycle phases." INCOSE

M. Sango «MBSE-R: Model-Based System Engineering for Integrating Railway System Architecture and Business Models», TRA 2022, pending publication

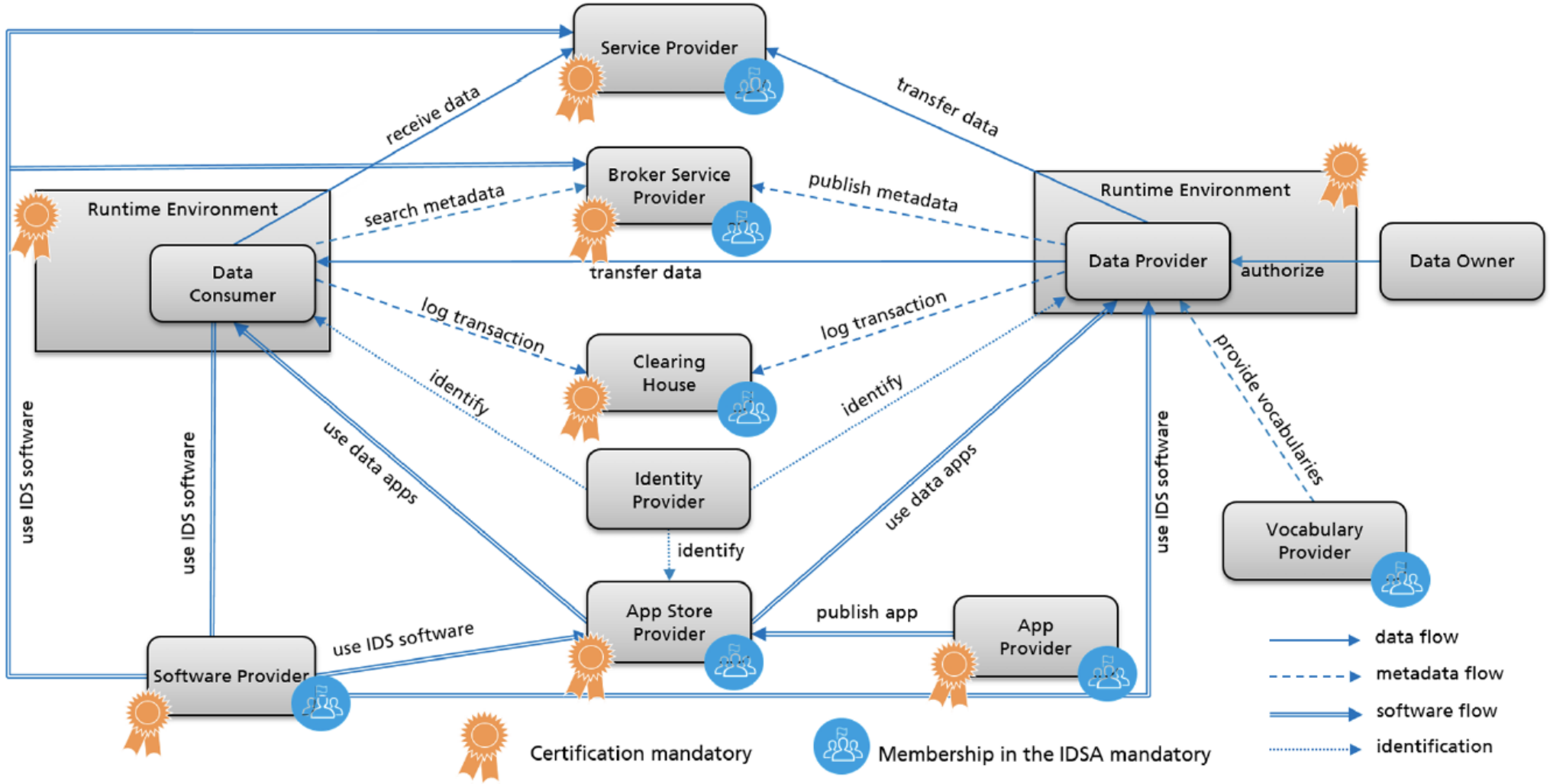
WS 2.1 TT Data models and data structures



Project funded under the Shift2Rail Joint Undertaking Grant Agreement n° 881826

WS 2.1 TT Data models and data structures

Outcome: Federated dataspace architecture



Relations with other FPs/SP

FP1 with System Pillar : **TSI** evolution, standardization ; WS1: **TMS/CMS** (requirements and interfacing) ; WS2: Digital Process Scenarios, **Digital Twin**, **CDM.**

FP1 with FP2 : WS1: **ATO/C-DAS** modelling for FP1 simulators ; **ETCS H Lev. 3** guidelines and parameters.

FP1 with FP3 : WS1: Integration TMS/CMS with **IAMS** (receiving information from Maintenance Planning& Management, asset status ; providing traffic plan and status information for preventive maintenance) ; WS2: Digital Twin (especially asset status and **BIM**).

FP1 with FP4 : WS1: via **energy calculation** for ATO/C-DAS in FP2 ; WS2: **Digital Twins** (energy calculation and related data) ; standardization of data exchange via SP.

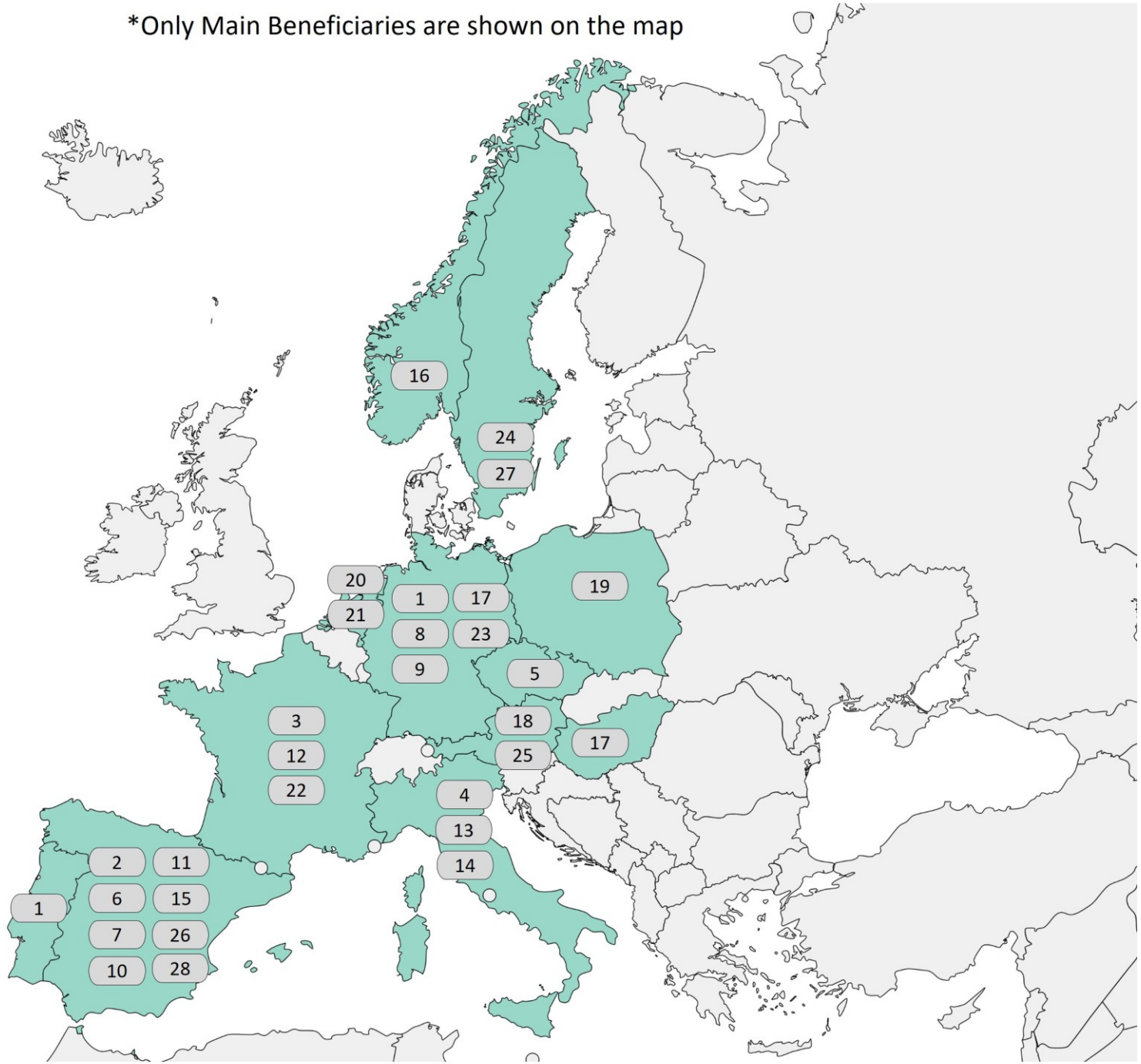
FP1 with FP5: **Seamless planning** of paths (incl. cross-border) for freight trains in CMS ; Dynamic Dispatching of freight trains in TMS ; integration of **Yard** and **last mile operations** with TMS/CMS; standardization of data exchange via SP, esp. TSI TAF.

FP1 with FP6 : WS1: **Demand Responsive Transport (DRT)** integration in **MaaS Platforms ; TMS for regional railways ;** interfacing with **Passenger Information Services (PIS) ;** feedback of **anticipated transport demand** to TMS/CMS.

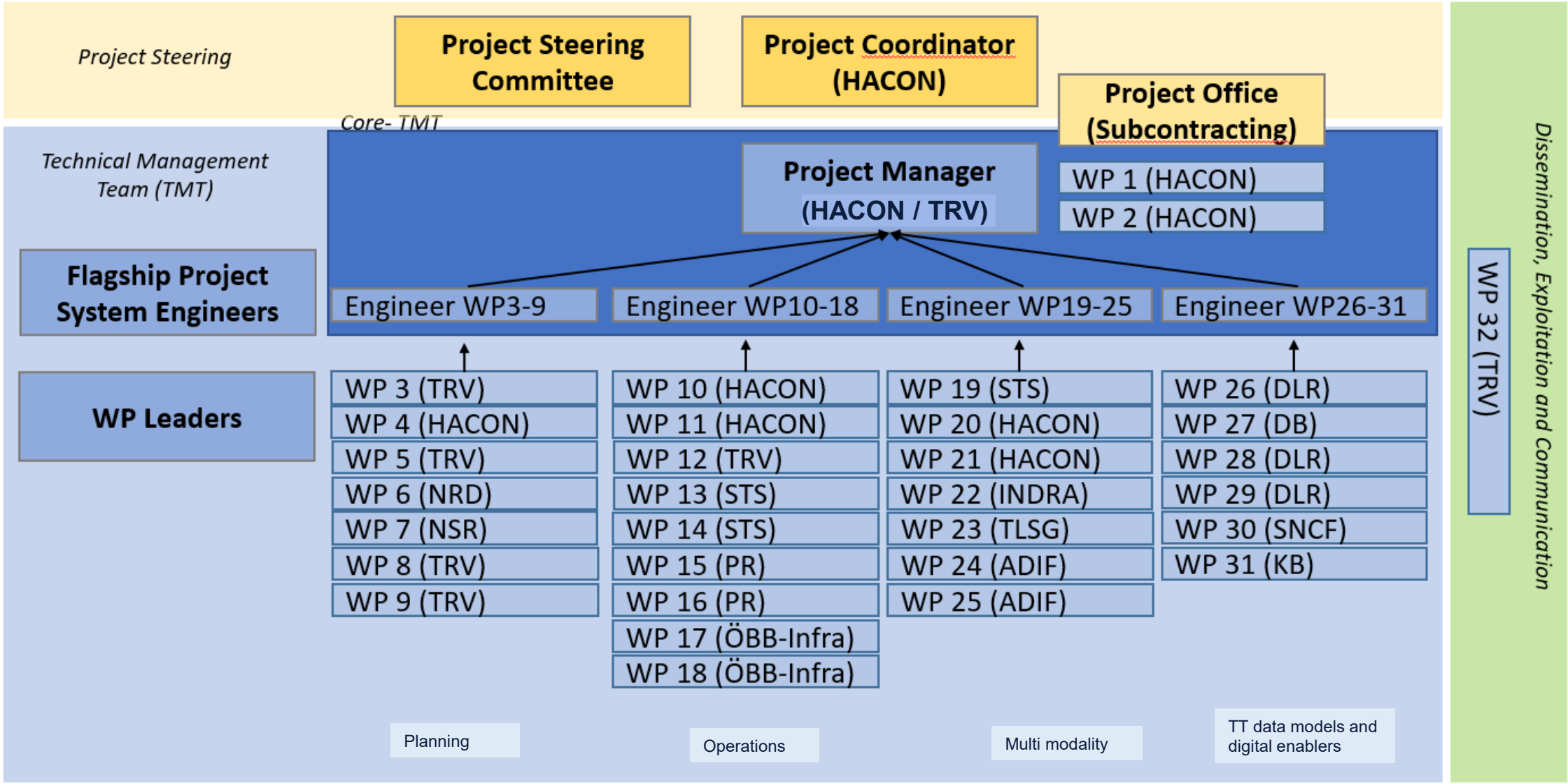
Europe's Rail

1 HACON
2 ADIF
3 ATSA
4 MERMEC
5 AZD
6 CAF
7 CEIT
8 DB
9 DLR
10 ENYSE
11 ETRA I+D
12 FT
13 FS
14 STS
15 INDRA
16 NRD
17 KB
18 ÖBB-Infra
19 PKP
20 PR
21 NSR
22 SNCF
23 TLSG
24 TRV
25 vaRS
26 MDM
27 SJ
28 FGC

*Only Main Beneficiaries are shown on the map



Project Structure



Europe's Rail

Core Team:

- Lars Deiterding [HACON] Coordinator
- Marlene Bamberg [HACON] Lead Project Manager
- Magnus Wahlborg [TRV] Project Manager and Lead Subgroup 1
- Rolf Goossmann [HACON] Lead Subgroup 2
- Laurent Bellet [Thales] Lead Subgroup 3
- Riccardo Santoro [FSI] Lead Subgroup 4
- Anders Johnson [TRV]

  Lead WP32 communication

  and exploitation of results

WP No	Work Package Title	Lead Participant No	Lead Participant Short Name	Person	Person 2
1	Project Management	1	HACON	Lars Deiterding	Magnus Wahlborg
2	Technical Coordination	1	HACON	Lars Deiterding	Magnus Wahlborg
3	Specifications for improved strategic and tactical planning of the rail network	24	TRV	Magnus Wahlborg	Thomas Nygren
4	Development - Integration of planning systems and processes including cross-border planning	1	HACON	Mahnam Saeednia	Rolf Goossmann
5	Demonstration - Integration of planning systems and processes including cross-border planning	24	TRV	Jan Byström	Rolf Goossmann
6	Development - Decision support for planning and timetable optimisation	16	NRD	Carlo Mannino	Dennis Huisman
7	Demonstration - Decision support for planning and timetable optimisation	21	NSR	Dennis Huisman	Giorgio Sartor
8	Development - Simulation and operational feedback for improved planning	24	TRV	Per Köhler	Henri Olink
9	Demonstration - Simulation and operational feedback for improved planning	24	TRV	Per Köhler	Henri Olink
10	Alignment of specifications	1	HACON	Rolf Goossmann	Mahnam Saeednia
11	Development - Integration of TMSs and processes including cross-border traffic management	1	HACON	Mahnam Saeednia	Rolf Goossmann
12	Demonstration - Integration of TMSs and processes including cross-border traffic management	24	TRV	Jan Byström	Rolf Goossmann
13	Development - Improved resilience and efficiency of disruption management	14	STS	Luigi Velardi	Jonny Gustafsson
14	Demonstration - Improved resilience and efficiency in disruption management	14	STS	Luigi Velardi	Jonny Gustafsson
15	Development - Linking TMS to ATO/C-DAS for optimised operations	20	PR	Henri Olink	Peter Olsson
16	Demonstration - Linking TMS to ATO/C-DAS for optimised operations	20	PR	Henri Olink	Erwin Abbink
17	Development - Automated decisions and decision support for traffic management optimisation	18	ÖBB-Infra	Amirreza Tahamtan	Francisco Lozano
18	Demonstration - Automated decisions and decision support for traffic management optimisation	18	ÖBB-Infra	Amirreza Tahamtan	Francisco Lozano
19	Alignment of Specifications for Enabler 18 - 27	14	STS	Claudio Mazzariello	Maurizio Pichierri
20	Development: Integrate Rail with other transport modes	1	HACON	Mareike Mehlich	Marlene Bamberg
21	Demonstration: Integrate Rail with other transport modes	1	HACON	Mareike Mehlich	Marlene Bamberg
22	Development: Services for inclusive rail-based mobility	15	INDRA	Juan Castro	Juan Pablo Zamorano Fernández
23	Demonstration: Services for inclusive rail-based mobility	23	TLSG	Laurent Bellet	Nihad Bahri
24	Development: Anticipate demand leading to improved resource utilisation	2	ADIF	Victoria Guryn Chushenko	Alfonso Lorenzo
25	Demonstration: Anticipate demand leading to improved resource utilisation	2	ADIF	Victoria Guryn Chushenko	Alfonso Lorenzo
26	Digital Process Scenarios from all FA	9	DLR	Christian Linder	Isabelle Tardy
27	Digital Asset Engineering (Multidisciplinary Process)	8	DB	Kehinde Enisan	Ralph Müller
28	Digital Twin Environment Preparation	9	DLR	Andreas Heckmann	Vijaya Adusumalli
29	Digital Twin Environment Implementation	9	DLR	Andreas Heckmann	Vijaya Adusumalli
30	Conceptual Data Model and semantic dictionary evolution	22	SNCF	Pierre Tane	Airy Magnien
31	Federated Data Space	17	KB	Meike vant Hoen	Riccardo Santoro
32	Communication, dissemination and exploitation of results	24	TRV	Anders Johnson	Christian Meirich

Rail to Digital Atomated Train Operations
FP2-R2DATO

119 M€ Total Project Cost

contributors :27 partners+ 1 Associated Partner,12 countries

42 months Dec 2022-June 2026

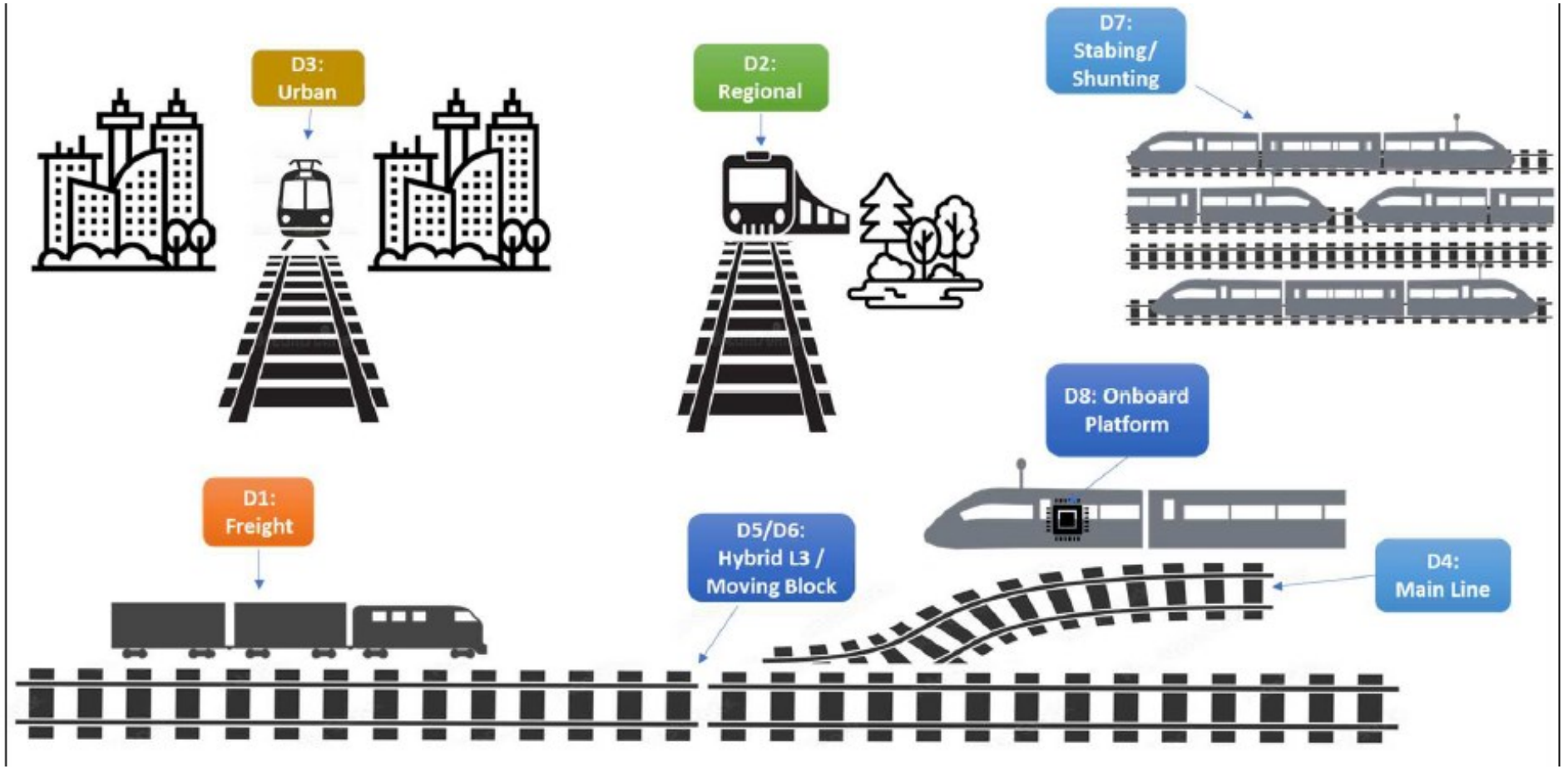
20 Technical Enablers, 10 demonstrators

* *Pending successful completion of the Grant Agreement Preparation phase, this project will be receiving funding from the Europe's Rail Joint Undertaking (ERJU) under project ID 101102001. The Europe's Rail Joint Undertaking receives funding from the European Union Horizon Europe's Research & Innovation Programme, as well as from the ERJU members other than the Union. Neither the Europe's Rail nor any person acting on the Europe's Rail behalf may be held responsible for the use which may be made of the information and views contained in this presentation*

1- FP2- R2DATO Project Plan for 2025

- Demonstrate technical and functional enablers such as ATO GoA3/4 over mixed radio based ETCS levels (**TRL7**), Hybrid Level 3, moving block and TIMS (**TRL6/7)**, connectivity (**TRL6**), perception (**TRL5/6**), train positioning (**TRL5/6**), automated functions and digital register (**TRL6**).
- Demonstration of the remote driving and command in depots and yards, including perception systems (**TRL5/6**).
- A first demonstrator on next generation ATC, with modular onboard and trackside ATC architectures, at proof-of-concept stage, in close collaboration with the EU Rail System Pillar.
- A proof-of-concepts and/or validation in laboratory and field (i.e., up to **TRL5 in Lab and TRL6 on site**) for the following new functions and technical enablers:
  - Virtual Coupling Train Set (TRL4/5)
  - Self-driving wagon (TRL4/5)
  - autonomous path allocation (linked to input from Destination1)
  - validation and certification (TRL6)
  - Demonstrate a Functional Open Coupling System prototype covering all required subsystems in an operational environment (TRL7)
  - Demonstrate a modular hardware platform using architectural software design patterns and methods (TRL5/6) allowing SIL2 respective SIL4 (depending on the application)

FP2 From MAWP scope to FP2 Field Demos overview



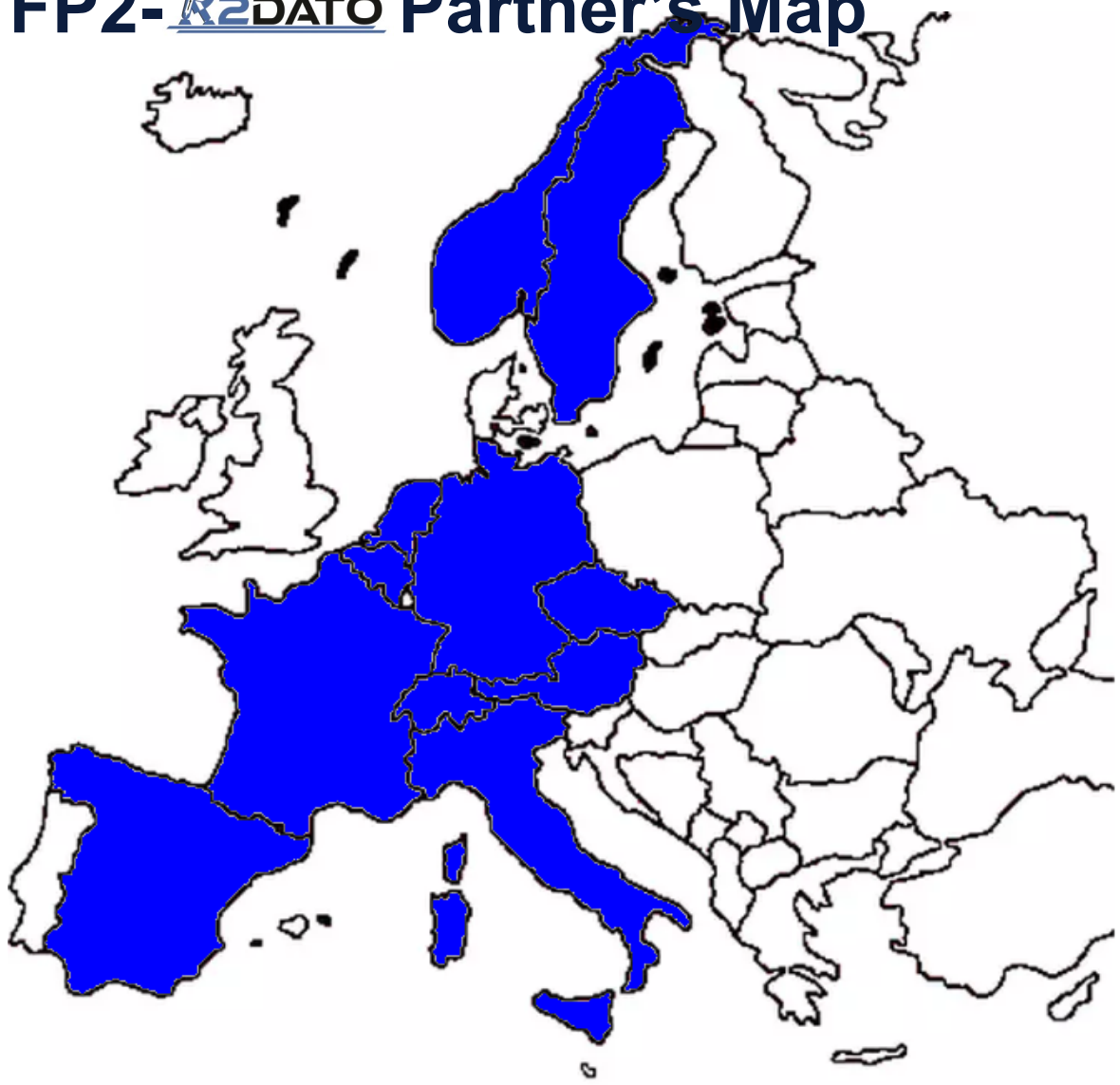
Different kind of demonstrators

- **“Hardcore” –TRL 7-8 technical demonstrators: to show that new techniques bring the expected (intermediate) outcome:**
  - WP38 Automated shunting
  - WP 40-41-42: Urban operation
  - WP 43: Freight

- **Prepatory work for future demonstration (most cases in 2030) by showing parts or building bricks als baseline for future demo by simulations (in FP1):**
  - WP44-45: ETCS L3 Moving Block
  - WP46: Regional

- **Operational demonstrations : as TE maturity isn’t fully achieved to display the final systems’ impact potential by simulation –TRL 6 (in FP1).**
  - WP37 ETCS Hybrid Level 3 demo
  - WP39 ATO Main Line demo

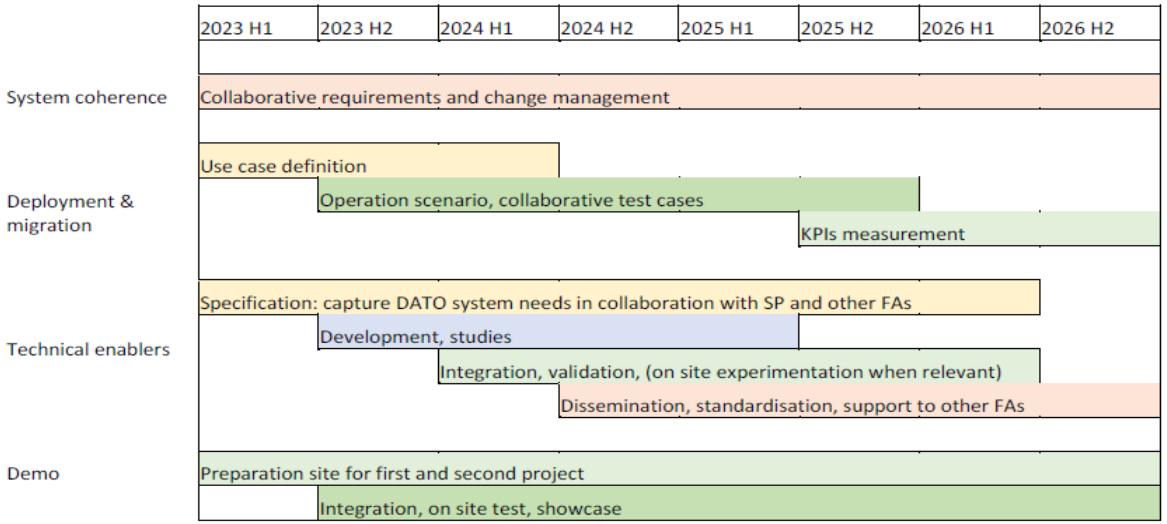
2- FP2- R2DATO Partner's Map



Partner	Country
Société Nationale SNCF – **SNCF**	**France**
ADMINISTRADOR DE INFRAESTRUCTURAS FERROVIARIAS – **ADIF**	**Spain**
ALSTOM TRANSPORT SA – **ATSA**	**France**
MER MEC S.p.A. – **MERMEC**	**Italy**
AZD PRAHA SRO – **AZD**	**Czech Republic**
Construcciones y Auxiliar de Ferrocarriles, S.A – **CAF**	**Spain**
ASOCIACION CENTRO TECNOLOGICO CEIT – **CEIT**	**Spain**
DEUTSCHE BAHN AG – **DB**	**Germany**
DEUTSCHES ZENTRUM FUR LUFT - UND RAUMFAHRT EV - **DLR**	**Germany**
COMSA INSTALACIONES Y SISTEMAS INDUSTRIALES SA – **COMSA**	**Spain**
Faiveley Transport SAS - **FT**	**France**
FERROVIE DELLO STATO ITALIANE – **FSI**	**Italy**
Hitachi Rail STS S.p.A (STS) – **HITACHI**	**Italy**
INDRA SYSTEMAS SA – **INDRA**	**Spain**
Jernbanedirektoratet - **NRD**	**Norway**
Knorr-Bremse Systeme für Schienenfahrzeuge GmbH – **KB**	**Germany**
OBB-Infrastruktur AG - **OBB-INFRA**	**Austria**
ÖBB-Personenverkehr AG – **ÖBB – PV**	**Austria**
ProRail- **PRORAIL**	**Netherlands**
NS REIZIGERS BV – **NS**	**Netherlands**
Siemens Mobility GmbH – **SMO**	**Germany**
GTS DEUTSCHLAND GMBH - **GTSD**	**Germany**
Trafikverket (Swedish Transport Administration) – **TRV**	**Sweden**
SCHWEIZERISCHE BUNDESBAHNEN SBB – **SBB**	**Switzerland**
Kontron Transportation GmbH – **KONTRON**	**Austria**
Sporveien Trikken AS – **Sporveien**	**Norway**
The International Association of Public Transport – **UITP**	**Belgium**
GEOSAT - **GEOSAT**	**France**

2.Next steps (Project implementation within 6 months)

- Signature of the Consortium Agreement on the way (17/34)
- Signature of the Grant Agreement
- Internal Consortium governance structure including detailed roles and tasks based on official documents (C.A; G.A., PM Handbook, etc)
- Project Kick off meeting on December 12&13 2022



3.Relations with other FPs/SP

Major collaborations :

FP2 with System Pillar : **TSI** evolution ;architecture requirement and evolution based on tailor made agenda for each technologies inside R2DATO. There will be a freezing point defined for each technology in order to demonstrate by 2025.

FP2 with FP1: High level interconnections for simulation on **ETCS Lvl3, ATO over ETCS main line demonstrator** and **DATO Assessment**.

FP2 with FP5: we will collaborate on **ATO , Train integrity** and **Automatic Functions.**

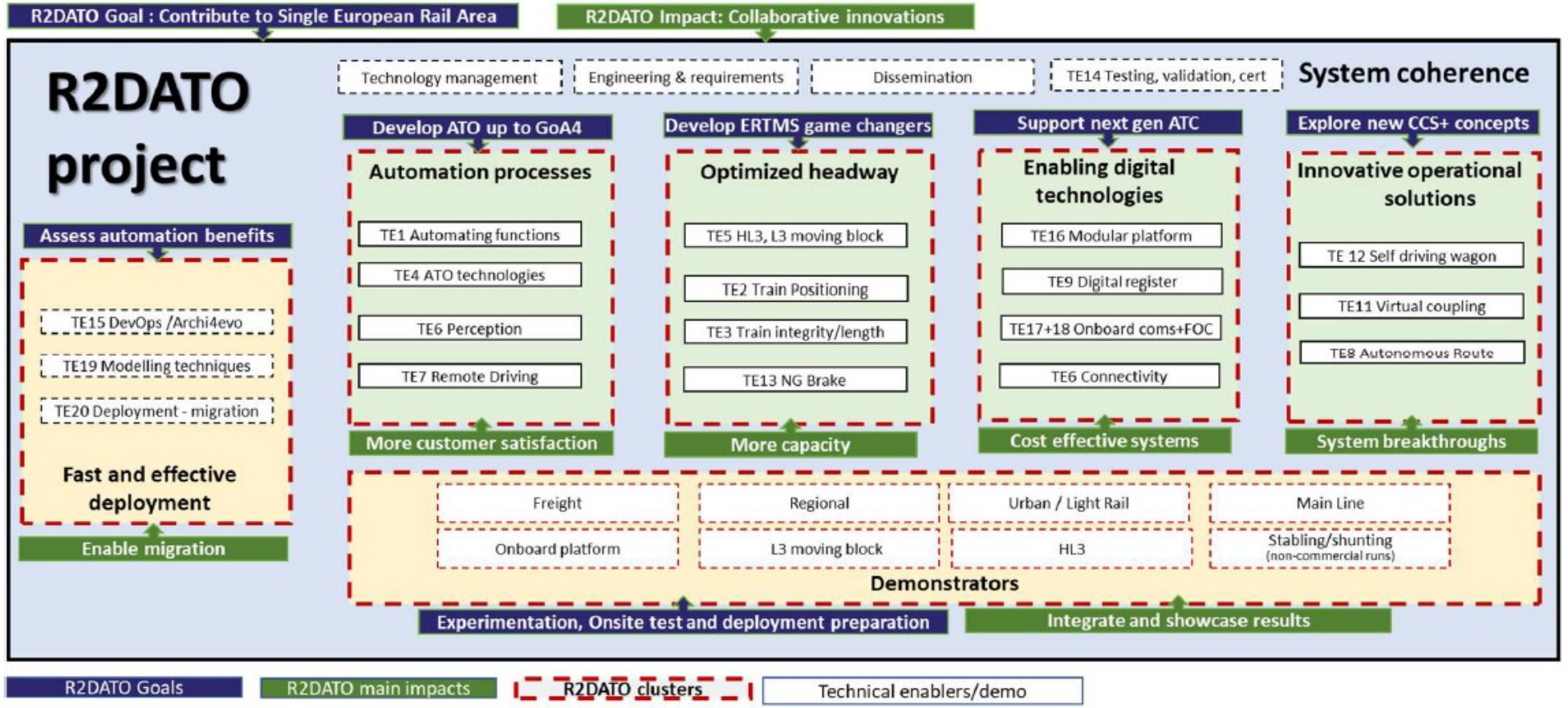
FP2 with FP6 : we will closely collaborate on **HL3, GoA2, GoA3/4** and **Absolute train positioning** and **FRMCS**

And minor collaborations :

FP2 with FP4 : potential impact of FP2 ATO (and Train Control Monitoring Systems) on FP4 Regional low carbon trains energy consumption.

FP2 with FP3 : we will have a complementary work on On board Communication

4 Project Structure



Demonstrators fed by TE development (green boxes) and feed the holistic overview of the benefits of them.

4. FP2- R2DATO Cluster Description 1/2

- **Automation Processes**
  - Deliver scalable automation in rail operation (ATO) up to GoA4 for all segments, including freight and urban light rail.
  - Implementation of operational solutions for automation up to GoA4 to be demonstrated in specific use cases
- **Optimised Headway**
  - Increasing infrastructure capacity
  - Reducing operational/Life Cycle costs by ETCS Hybrid Level 3, ETCS Level 3 Moving Block with new train positioning technologies.
  - Achieving reproducible braking distances even in low wheel/rail adhesion conditions allowing reduced safety margins,
- **Innovative Operational Solutions**
  - Development of concept solutions for the Autonomous Route Setting (ARS), Virtually Coupled Train Sets (VCTS) and Self-Driving Freight Wagons (SDFW) innovative solutions.
  - Research on new technology, for short-range communication (SRC) and relative localisation (RL).
- **Fast and Effective Deployment**
  - Assess Digital and Automated up to Autonomous Train Operations (DATO), derive guidelines for Migration and Deployment
  - Develop a Formal Modelling approach for railway systems in order to support standardisation of approval and certification
  - Support the decoupling from Hardware and Software by developing an Architecture for Evolution as well as rail-industrial DevOps.

4.FP2- R2DATO Cluster description 2/2

- **Digital Enabling Technologies**
  - Provide the future-proof connectivity, IT and data platforms required for the automation of rail operations.
  - Increase the cost efficiency in the rail system by leveraging off-the-shelf IT solutions, by decoupling the life cycles of railway applications and connectivity, IT and data platforms, and by allowing to aggregate multiple railway applications on common platforms.
- **Test and Certification**
  - Define and provide a common strategy and process for virtual certification of complete railway systems as well as functional upgrades.
  - Assess the integration of new technologies and functionalities from Technical Enablers in a virtual railway environment.
  - Define a network of laboratories with linked test facilities to support certification in a system with a modular architecture like interoperability tests.
- **Demonstrators**
  - Validate the benefits of DATO technical enablers.
  - Validate DATO technologies for specific target implementations.

Flagship Project FP3 – IAM4RAIL

Holistic and Integrated Asset Management for Europe's RAIL System

104 M€ Total Project Cost (77 M€ Eligible Costs + 27 M€ IKAA)

94 contributors : 29 partners+65 Affiliated Entities

Duration: 4 years (Dec 2022-Nov 2026)

7 Integrated Demonstrations, 8 Groups of Technical Enablers, 39 Use Cases

* *Pending successful completion of the Grant Agreement Preparation phase, this project will be receiving funding from the Europe's Rail Joint Undertaking (ERJU) under project ID 101101966. The Europe's Rail Joint Undertaking receives funding from the European Union Horizon Europe's Research & Innovation Programme, as well as from the ERJU members other than the Union. Neither the Europe's Rail nor any person acting on the Europe's Rail behalf may be held responsible for the use which may be made of the information and views contained in this presentation*

What is Flagship Project FP3 – IAM4RAIL about? (1)

Traffic Management System (TMS) 1

6 Design & Manufacturing

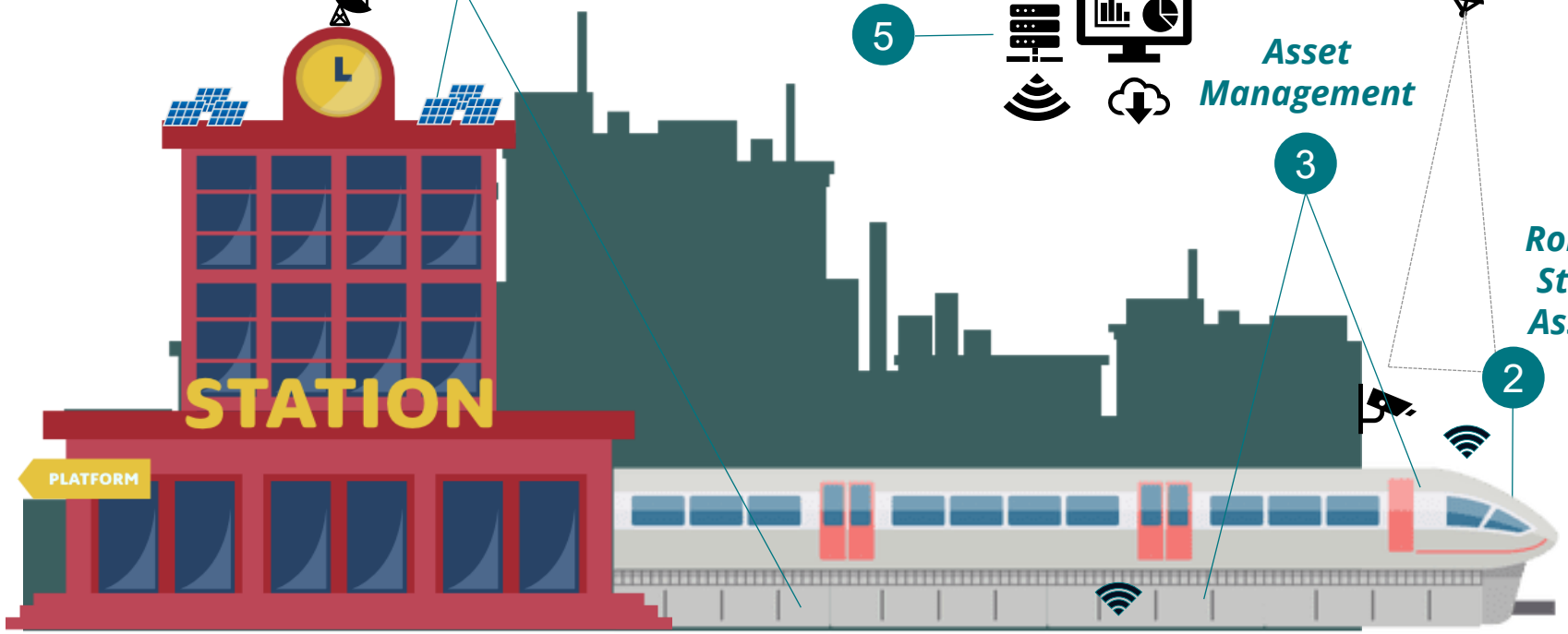
4 Infrastructure Assets

Digital Twins 5

Asset Management 3

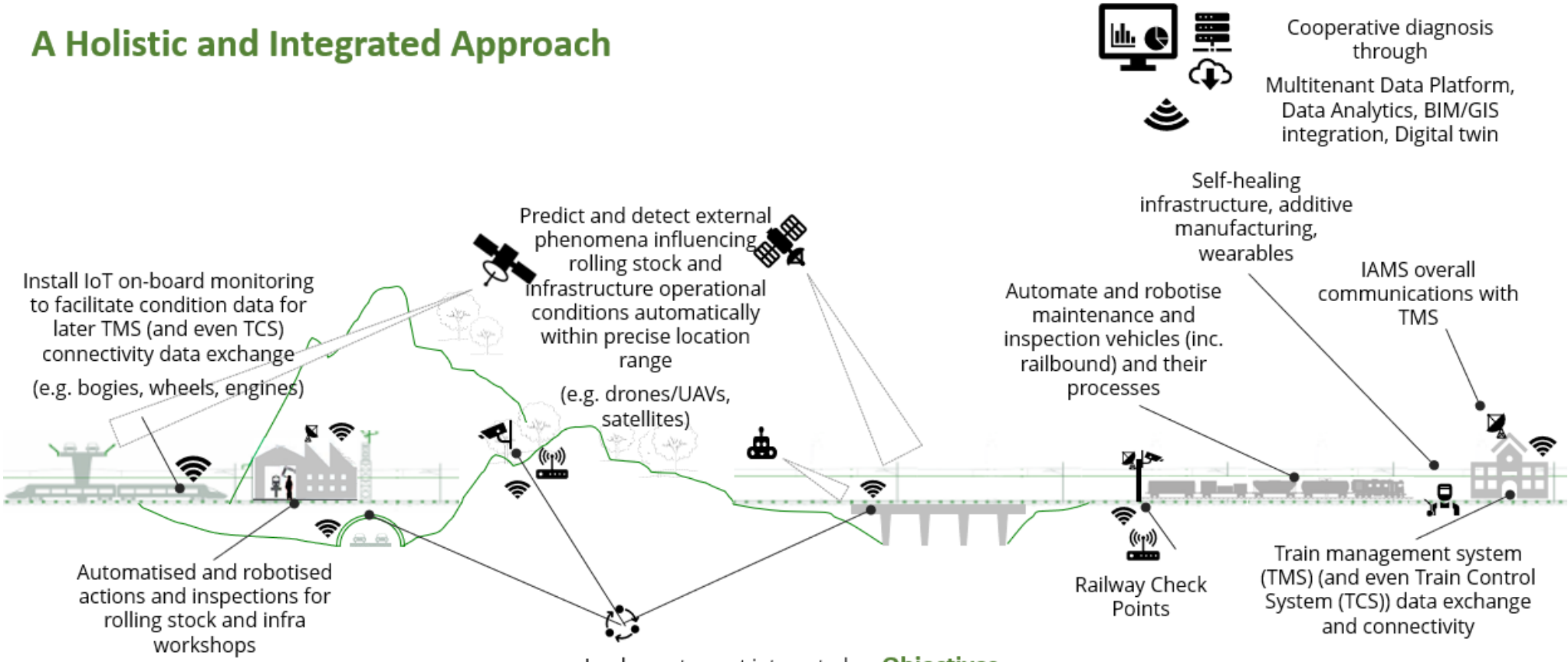
Rolling Stock Assets 2

Interventions 7



What is Flagship Project FP3 – IAM4RAIL about? (2)

A Holistic and Integrated Approach



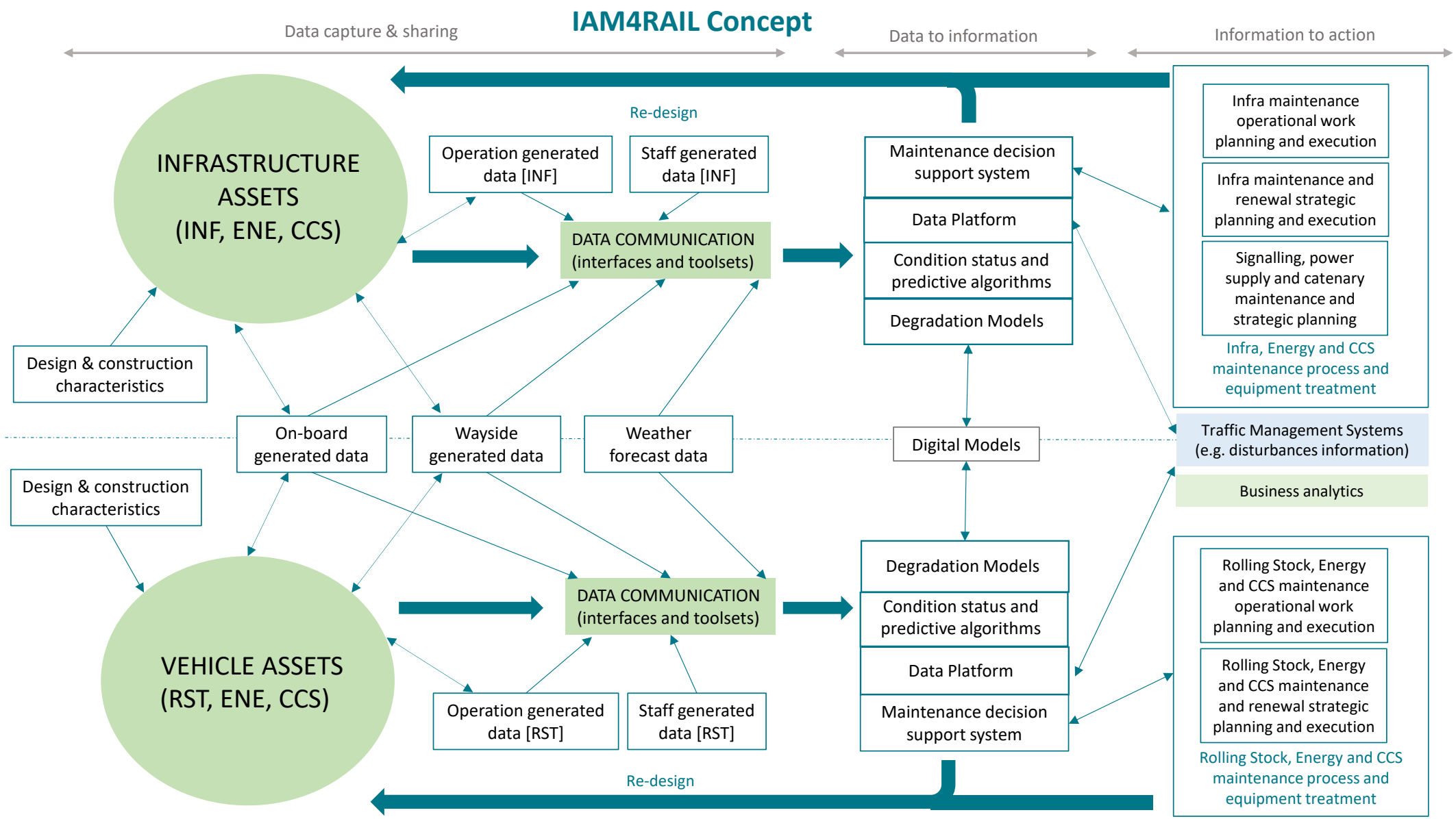
Uses Cases as Business Case

- *Reducing costs & making objective access charges*
- *Increasing automation level in M&O subsystem*
- *Harmonised EU frame added value projects*
- *EU common standards and tech specs*

Objectives

- *Cost-effective asset management for the railway system*
- *Increase reliability and capacity of the overall system*
- *Increase level and technology for automation and robots in construction & maintenance*
- *Sustainable production of resilient assets with new techniques*

What is Flagship Project FP3 – IAM4RAIL about? (3)



1. Project deliveries (Integrated demonstrators)

- ***Demonstrator#1 (DO1): Integration between the Intelligent Asset Management System (IAMS) and the Traffic Management System (TMS)*** across railway assets, amongst various use cases (4):
  - **Secure** standardised interfaces, methods, and processes for store/archive for different **data exchanges impacting integration between IAMS & TMS** ***TRL6 in 2025***
  - Implementation & testing of **data analytic methods** with a focus on **prediction and prescription of wayside and rolling stock asset** status based on heterogeneous data sources ***TRL6 in 2025***
  - Implementation & testing of **analytic results integration with TMS and O&M tools to provide TMS information to optimize traffic** regulation/trains routing and Support O&M activities ***TRL6 in 2025***

- ***Demonstrator#2 (DO2): Asset Management & Rolling Stock***, developing new monitoring and inspection systems leading to decisions and planning of interventions amongst various use cases (4):
  - Basic **data model design for workshop maintenance data** and digital process collaboration between stakeholders in maintenance and asset management ***TRL6 in 2025***
  - **Algorithms for anomaly detection & component health evaluation (Bogie & Traction)** and adhesion management ***TRL6 in 2025***
  - **European railway checkpoint for mixed traffic** (inc. wayside inspection & monitoring systems and data analytics combining both on-board & wayside data sources for health assessment) ***TRL6 in 2025***
  - **CBM algorithms and methodologies for freight** rail applications that are potentially exploitable by the Digital Automated Coupler (DAC) **related data gathering** ***TRL7 in 2025***

1. Project deliveries (Integrated demonstrators)

- ***Demonstrator#3 (DO3): Long Term Asset Management,*** developing decision support applications for asset management and Life Cycle Cost (LCC) optimization, amongst various use cases (4):
  - **Holistic Asset Management decision support tool with HMI** via condition monitoring including visualization, correlation within signalling and with operational & maintenance information ***TRL6 in 2025***
  - **Remaining useful-life analysis of civil structures** via development of new techniques, methods, and algorithms based on new cross-border data sources from existing multiple sensors ***TRL6 in 2025***

- ***Demonstrator#4 (DO4): Asset Management & Infrastructure,*** developing new monitoring and inspection systems able to integrate Big Data from on field and on-board systems, sharing info across the supply chain and TMS, amongst various use cases (10):
  - **Practical solutions for sensing superstructure system components** (including intelligent sleepers, ballast, rail and contact lines) ***TRL6 in 2025***
  - **Multi-sensor / Multi-source monitoring** of tracks, surrounding and switches **for short-term superstructure asset management** ***TRL6 in 2025***
  - **Multiscale monitoring of civil assets**: satellite, aerial and UAV data collection and processing approaches, ground data collection strategies, data analysis methodologies and verifications and user data browsing platform ***TRL6 in 2025***

1. Project deliveries (Integrated demonstrators)

- ***Demonstrator#5 (DO5): Asset Management & Digital Twins*** to support the design, maintenance, upgrade, and renewal of railway assets, amongst various use cases (4):
  - **Digital Twin for Station asset management** exploiting BIM and Digital twin technologies to leverage station supervision and maintenance operations and reducing cost management ***TRL7 in 2025***
  - **Virtual Certification for railway infrastructure** framework and applicative use case ***TRL7 in 2025***

- ***Demonstrator#6 (DO6): Design & Manufacturing***, showcasing the eco-friendly design, production and reparation of resilient assets including Additive Manufacturing (AM), amongst various use cases (7):
  - **Green tracks & turnouts,** developing optimised design solutions for tracks and turnouts decreasing environmental impact ***TRL6 in 2025***
  - **Repair of metallic assets using additive manufacturing AM techniques** with four different technologies ***TRL6 in 2025***
  - **Development of a Digital Warehouse for AM spare parts** (inc. wayside inspection & monitoring systems and data analytics combining both on-board & wayside data sources for health assessment) ***TRL5 in 2025***

1. Project deliveries (Integrated demonstrators)

- ***Demonstrator#7 (DO7): Robotics & Interventions*** showcasing high-tech automated solutions for construction and execution of interventions supported by robotics and wearables, amongst various use cases (6):
  - **Train underbody inspection robot** via development of a modular robotic system addressed at the inspection and monitoring of the underbody of the train (either passenger or freight) ***TRL6 in 2025***
  - **Upper-body hybrid exoskeleton for railway workers' ergonomics support** in railway maintenance tasks ***TRL5 in 2025***
  - **AR (Augmented Reality) architecture, middleware and author tools development** exploiting BIM and Digital twin technologies to leverage station supervision and maintenance operations and reducing cost management ***TRL5/6 in 2025***

2.Next steps **(Project implementation within 6 months)**

Fixed start date December 1st 2022:

- Project Kick-off meeting on: December 15th 2022 (remote session) *and TBC January–February 2023 (face-to-face)*
- *Governance (Steering Committee) and Technical Management (TMT) for FP3-IAM4RAIL in place*
- *Alignment meetings with FP1 and FP5*
- *Preliminary architecture definition to allow specific use cases in Cluster B*
- *System analysis and requirements for Rolling Stock Asset Management in Cluster C*
- *Deliverable Data Management Plan (DMP)*
- *Deliverable Quality Plan*
- *Deliverable of Use Cases, including Innovation, Business Assessment, KPIs definition and roadmap*
- *Deliverable of Demonstrator vision and architecture global for Railway Checkpoint*
- *1st System Pillar Inputs*
- *Advisory Board Set-Up*
- *Upon request of the JU Communication and dissemination Plan*

3.Relations with other FPs/SP

Relevant collaborations:

FP3 with System Pillar: Inputs for **TSIs** evolution and revision, mainly Technical subsystems related to Infra / Rolling Stock / Energy. Also 2 main Interfaces Maintenance Planning and Intervention Management and the Input to TMS/CCS & Asset Condition -> Output from TMS/CCS **Task 1 and Task 4**

FP3 with FP1 (TT): **Reports** addressing use case definition and the sharing of data structures, especially in Digital Twins needed **for the joint development of the CDM** (Conceptual Data Model)

FP3 with FP1 (TMS): **Alignment of use cases and interfaces IAMS with TMS** and inputs for the specification of a TMS platform specific Data Model with class diagrams comprising all data elements

FP3 with FP5: **Alignment and potential use of CBM algorithms and methodologies for freight rail applications** potentially exploited by DAC

And minor collaborations:

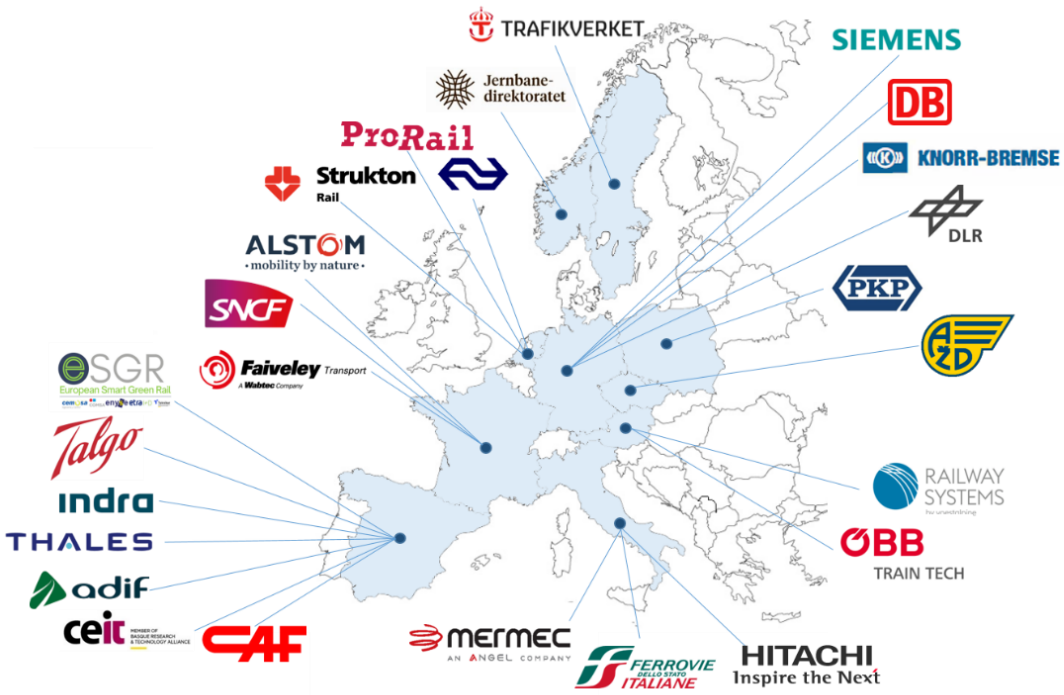
FP3 with FP4: specific demonstration of a converter DC/AC on test bench, using IGBT Si to verify accuracy of remaining useful life of power semi-conductors; providing installation in FP3 of optical fiber along the tracks to be used to provide data on track vibrations (linked to noise and vibration reduction).

FP3 with FP2: complementary work on Onboard Communication and Wheel/Rail Adhesion Management

4. Our partners

29, including

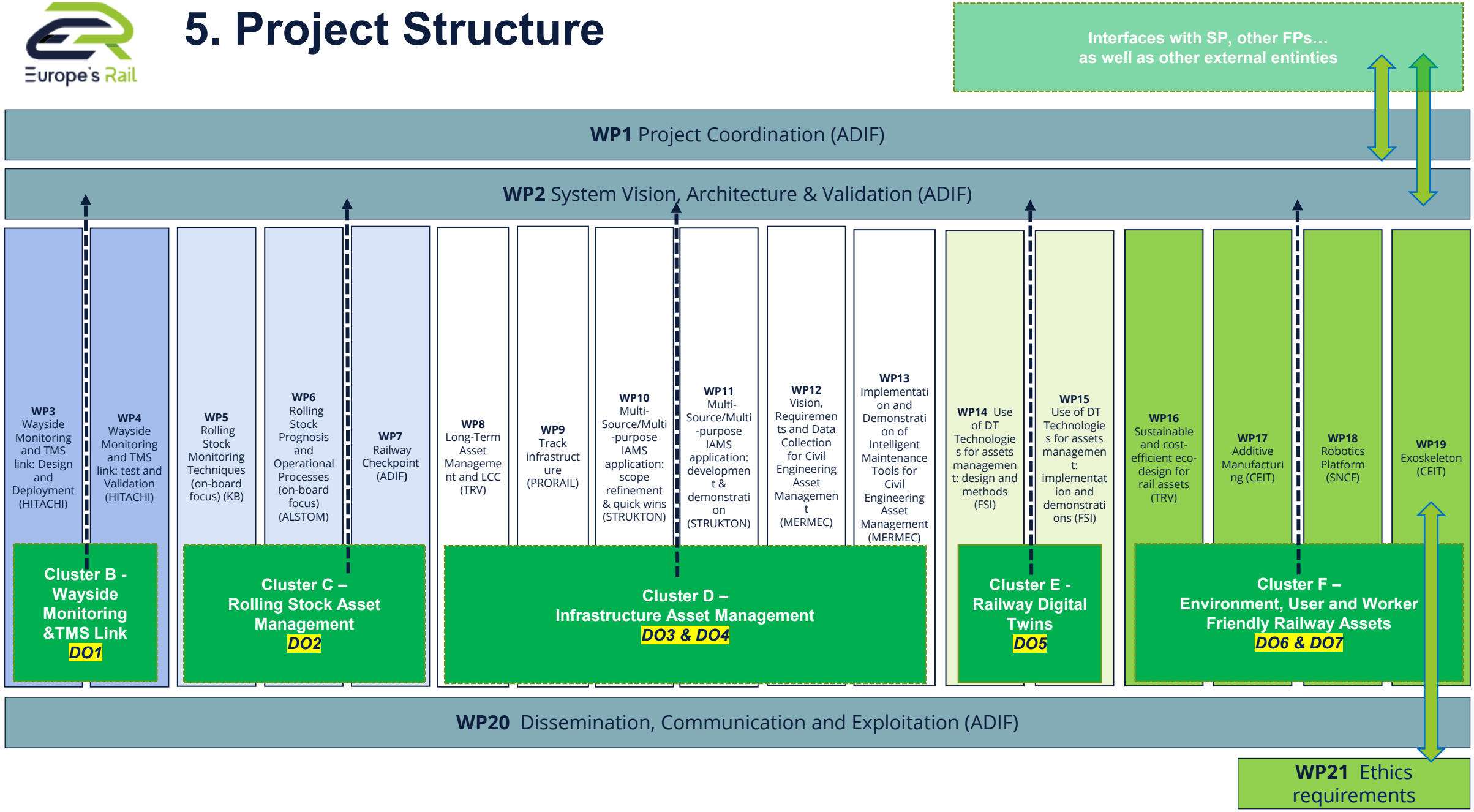
- 9 Major Operators (ROCs)
- 17 Railway integrators & suppliers
- And 3 research centers



An Advisory Board will bring more representation from other members states/countries and SMEs

…Plus 65 Affiliated Entities

5. Project Structure



5. Project Structure (Cluster Structure)

- **1. Cluster B - Wayside Monitoring and Traffic Management System Link.** The cluster focuses on the design, development, testing and validation of an Intelligent Asset Monitoring System capable of supporting the railway operators and infrastructure managers in maintaining smooth and uninterrupted operations (WP3 and WP4). ***DO1***
- **2. Cluster C - Rolling Stock Asset Management:** On-board and Wayside Technologies. This cluster addresses both on-board (WP5 and WP6) and wayside (WP7) monitoring technologies for the design, testing and validation of intelligent rolling stock asset management solutions. ***DO2***
- **3. Cluster D - Infrastructure Asset Management.** The infrastructure asset management cluster addresses (i) long term maintenance and costs (WP8); (ii) track systems (WP9); (iii) innovative multi-purpose IAMS infrastructure applications (WP10 and WP11); and (iv) civil assets including structures, earthworks and geotechnics (WP12 and WP13). ***DO3 & DO4***
- **4. Cluster E - Railway Digital Twins.** This group of developments focuses on the implementation of railway Digital Twins across the rail sector (WP14 and WP15). ***DO5***
- **5. Cluster F - Environment, User and Worker Friendly Railway Assets.** Cluster F has the objective of creating environment, user and worker friendly railway assets eco-design addressing sustainability and cost-efficiency (WP16), new additive manufacturing repair processes (WP17), robotic platforms for railway interventions (WP18) and Augmented Reality and exoskeletons to support railway maintenance (WP19). ***DO6 & DO7***

Flagship Project 4-Rail4Earth

Green and Sustainable Railways

(Rolling Stock, Infrastructures, Stations)

96 M€ Total Project Cost

72 contributors : 23 partners+49 Affiliated Entities

4 years Dec 2022-Dec 2026

16 Enablers, 38 demonstrations

* *Pending successful completion of the Grant Agreement Preparation phase, this project will be receiving funding from the Europe's Rail Joint Undertaking (ERJU) under project ID 101101917 . The Europe's Rail Joint Undertaking receives funding from the European Union Horizon Europe's Research & Innovation Programme, as well as from the ERJU members other than the Union. Neither the Europe's Rail nor any person acting on the Europe's Rail behalf may be held responsible for the use which may be made of the information and views contained in this presentation*

1. Project deliveries

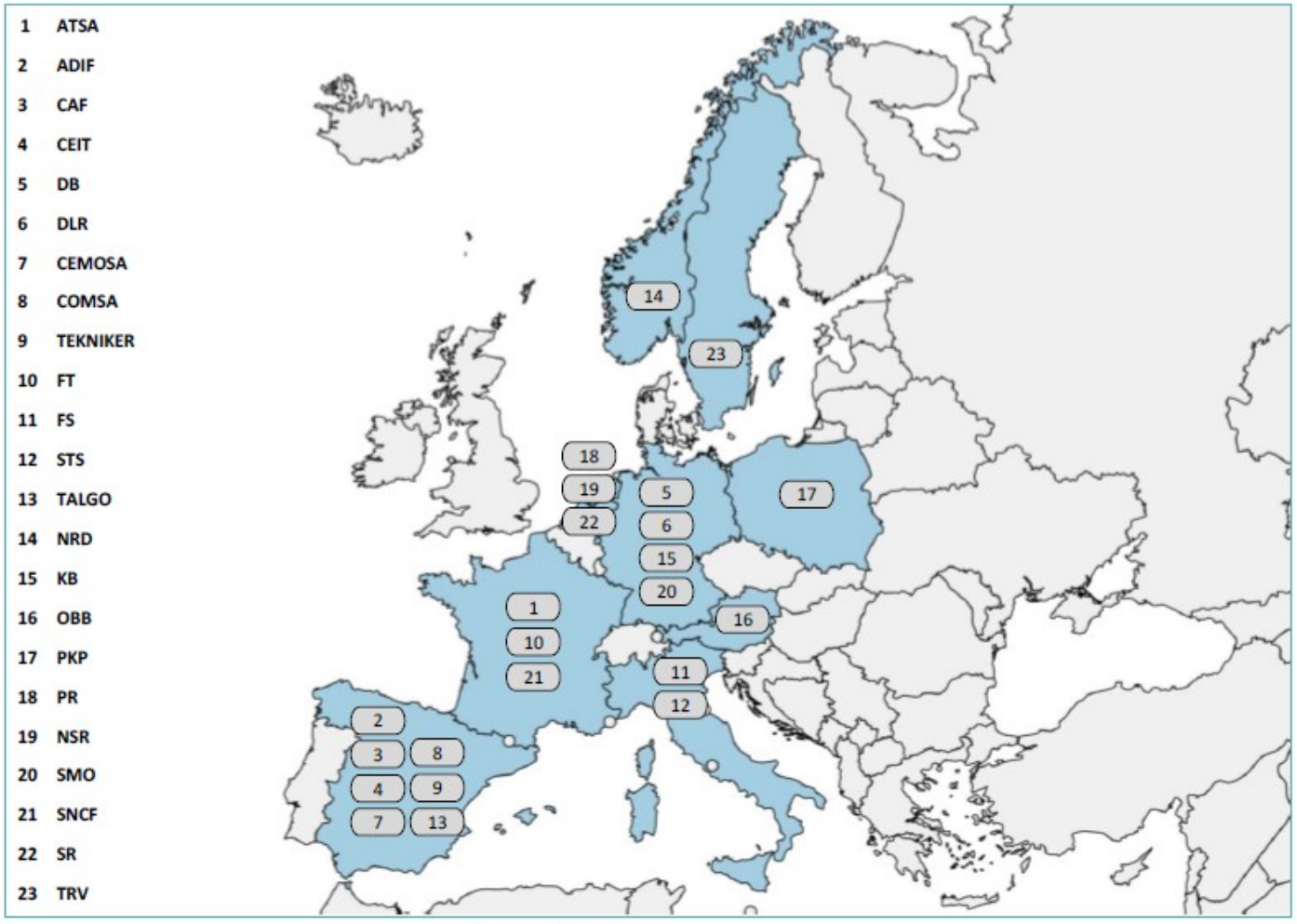
- **Sub-project 1 Alternative (to Diesel)** energy solutions for the **rolling stock**, 6 Demos
  - High performances Battery powered Regional trains (200km), TRL6-7 in 2026
  - Hydrogen hybrid locomotive TRL 5-6 in 2026, Infrastructure inspection vehicles TRL 5 in 2026
- **Sub-project 2** Energy in rail **infrastructure and stations**, 7 demos
  - H2 refuelling station TRL6 in 2025
  - Smart low consumption electrical infrastructures (with local renewable energy **sources**, ground **energy storages**, etc), TRL6 in 2025
  - Smart stations as energy hubs, TRL 5 in 2025.
  - Methodologies/ guidelines for the optimal design/rehabilitation of stations including modularity and carbon footprint reduction TRL5/6 in 2025.
- **Sub-project 3 Sustainability** and **resilience** of the rail system, 3 demos
  - Software tool specification on European **climate variables** usable for railway assets Reports, TRL5 in 2025
  - **Noise** indicators, simulation tools and development of optimized components for noise and vibrations minimisation, TRL6 in 2025
  - Software tools and indicators to promote **eco-design**, assess **environmental performance** /standardised reporting of the environmental impacts of the rail sector, TRL5 in 2025.

1. Project deliveries

- **Sub-project 4 Electro-mechanical components** and sub-systems for the rolling stock, 18 demos
  - (Airless) electro-mechanical braking system, pantograph and suspensions, TRL7 2025
  - Optimised (energy, weight) motors and gearboxes, TRL in 2025
  - Replace hydrofluorocarbon refrigerants by HVAC system using green refrigerants or new cooling technologies, TRL6 in 2025
  - Enhanced experimental and numerical methods on train **aerodynamic** optimization, TRL6 in 2025
- **Sub-project 5 Healthier** and **safer** rail system, 2 Demos
  - Healthier HVAC **- air quality** improvement, contaminant (particle / aerosol) removal, reduced virus/bacteria lifetime, TRL7 in 2025
- **Sub-project 6** Trains **Attractiveness** (Interiors), 2 demos
  - Reinforce train attractiveness via on-demand comfort for users (access, lighting, thermal and acoustic comfort), TRL5-6 in 2025.
  - Reinforce the facility to adapt rolling stock interiors (like modular architecture) to support the increase of capacity of the rolling stock targeting TRL5-6 in 2025.

2. 23 partners

- Major Operators
- Railway integrators & suppliers
- And research centers



3.Relations with other FPs/SP

FP4 with System Pillar : **TSI** evolution ; **Energy Management** (macro level :Railway system level RS/Infra/Signalling)

FP4 with FP1 : **Influence** of FP1 **Automatic Train Operation/Connected-Drive Assistance Systems** on FP4 low carbon **Regional trains energy consumption**; **Standardisation of data** exchange related to **energy** (between train / infra/ traffic management system); **Digital Twins in energy calculation** (macro level) and potential updates of FP1 specifications of such Digital Twins.

FP4 with FP2 : potential impact of FP2 **ATO** (and Train Control Monitoring Systems) on FP4 Regional low carbon trains **energy consumption**.

FP4 with FP3 : specific demonstration of a converter DC/AC on test bench, using IGBT Si to verify accuracy of **remaining useful life of power semi-conductors**; use of FP3 **optical fiber** along the tracks to provide data on **track vibrations** (linked to noise and vibration reduction in FP4).

FP4 with FP5: Potential impact of **Freight trains aerodynamic** and **C-DAS** from FP5 on FP4 **H2 pass loco energy consumption**

FP4 with FP6 : European Regional Railways priorities (CO2 suppression in FP4 vs LCC reduction in FP6), Diesel **Regional train replacement by Battery powered** trains, **H2 Regional trains refueling interfaces**.

4. Project

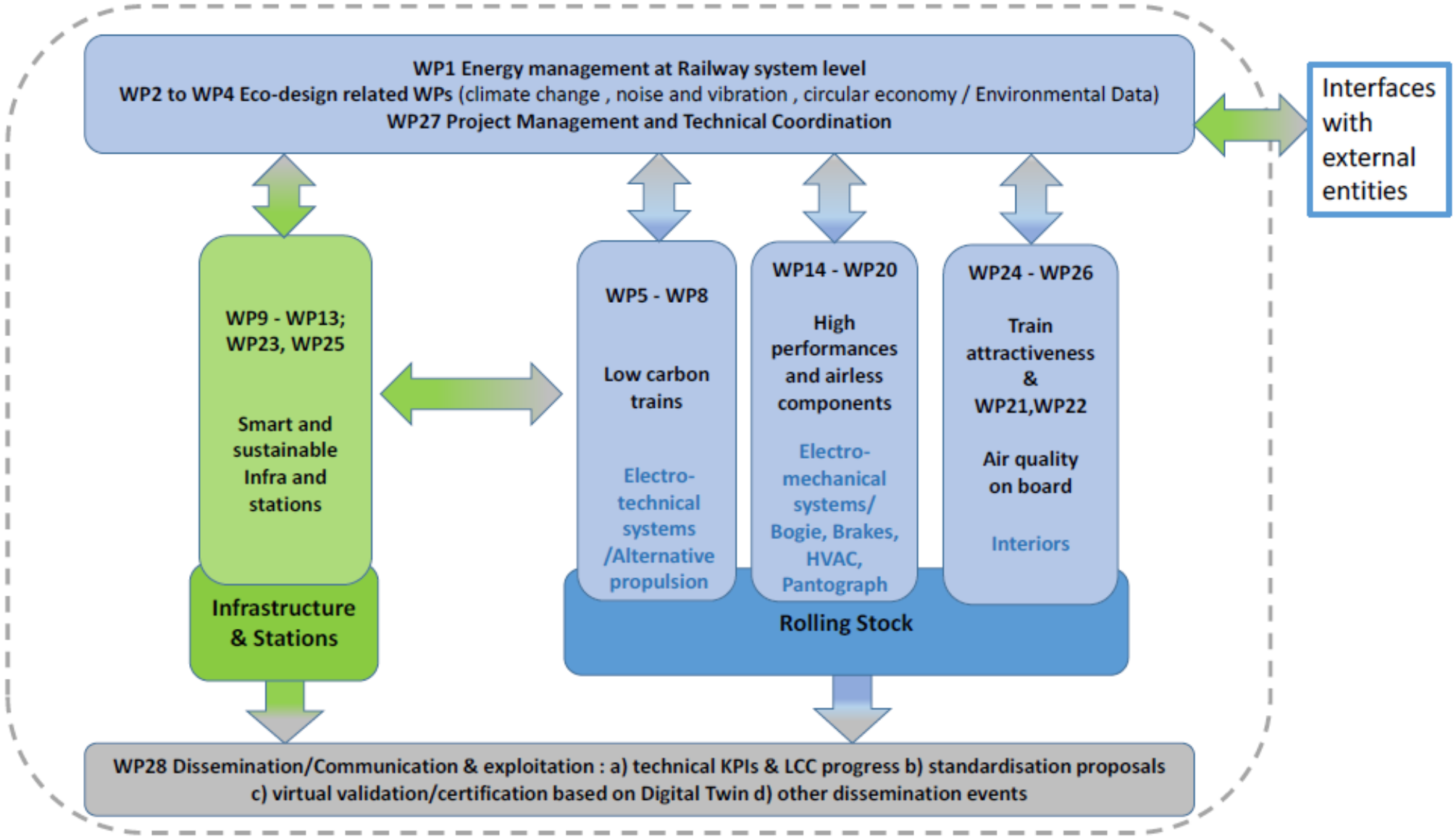


Figure 1: Schematic diagram of Rail4EARTH

FP5- TRANS4M-R

Dr. Patrick Seeßle

DB Cargo AG

(in repr. Molley Morgan, DB AG; FP5 PM)

** Pending successful completion of the Grant Agreement Preparation phase, this project will be receiving funding from the Europe's Rail Joint Undertaking (ERJU) under project ID 101102009 . The Europe's Rail Joint Undertaking receives funding from the European Union Horizon Europe's Research & Innovation Programme, as well as from the ERJU members other than the Union. Neither the Europe's Rail nor any person acting on the Europe's Rail behalf may be held responsible for the use which may be made of the information and views contained in this presentation*

FP5-TRANS4M-R divided into two work streams with focus on DAC development and deployment preparation

Competitive Digital Rail Freight Services: Transforming Rail Freight in Europe

Full Digital Freight Train Operation

- **Demonstration of Digital Freight Trains** in **2025** with DAC Type 4 & 5 incl. Energy and Data Supply, Hybrid Coupler and automated brake test **(TRL 8)**
- Preparing further development of **Full Digital Freight Train** incl. Distributed Power, EP-Brake for further **Demonstrators** in 2027 and 2030 **(TRL 7-8)**
- Development of systems and solutions for **automated shunting operation (TRL 7)**

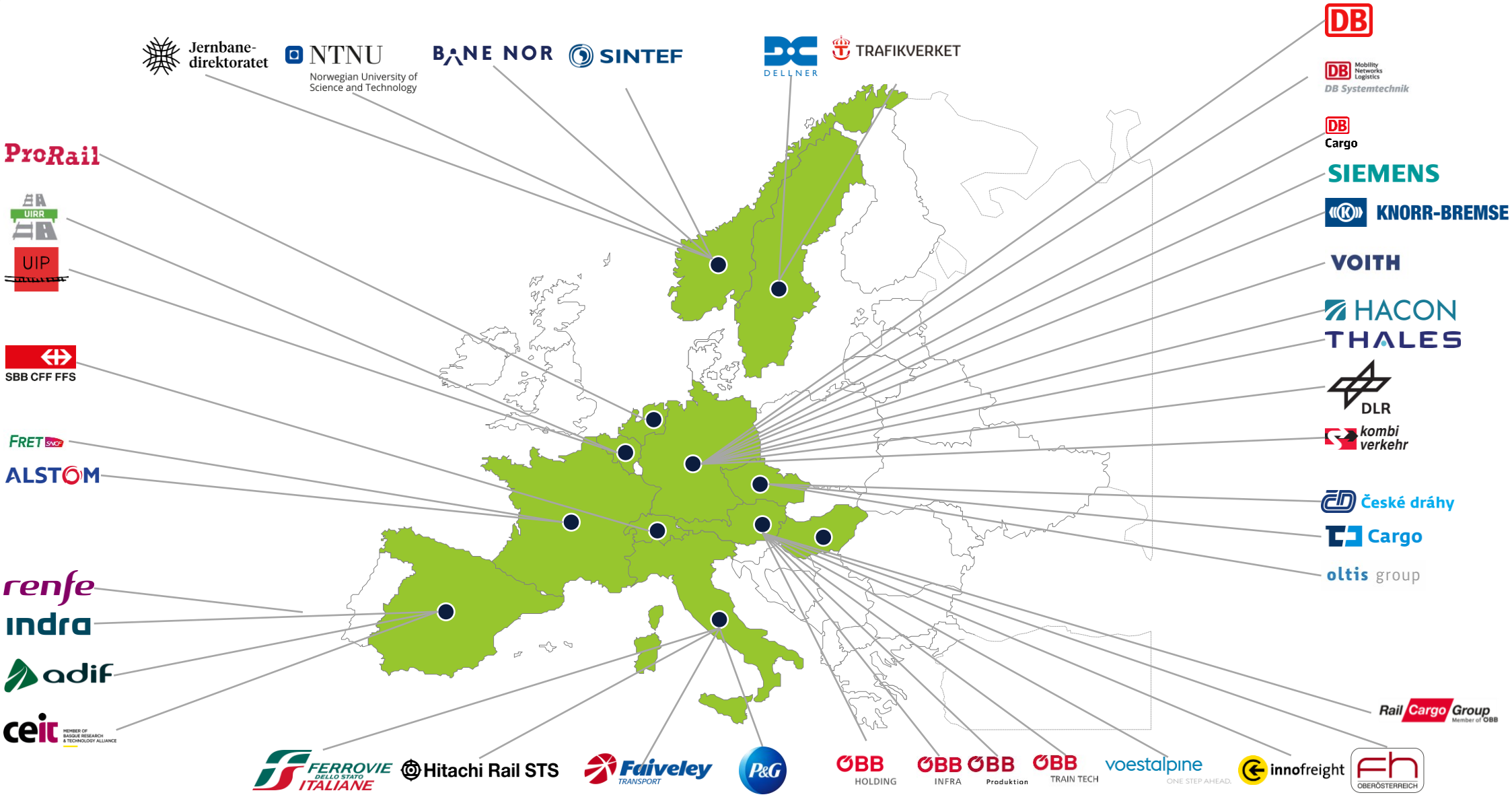
Total Work-Stream Costs 2022 to 2026: EUR 80m

Seamless Freight

- **Real-time data management and processing** to improve cross-border timetable planning, timetable management and train path ordering **(TRL 6-8)**
- Development of **standardised railway checkpoints** to automate handover controls using e.g. sensors, videogates and handhelds **(TRL 8)**
- Development of **dynamic yard/terminal management** systems **(TRL 6)**

Total Work-Stream Costs 2022 to 2026: EUR 20m

FP5 brings together in total 71 partners from across Europe to transform rail freight in the next 4 years



FP5-TRANS4M-R improves the European rail freight by increasing flexibility and reliability

Higher throughput and shorter transportation duration

European harmonized, scalable, upgradable DAC systems

Digital Yard Automation and Management Solutions

digital-enabled operational procedures

Mitigating demographic change

minimizing physical health exhaustion

automate/digitalize operational processes

maximize the acceptance of the newly developed digital technologies

Maximize flexibility and reliability of rail freight services

Provision of effective intermodal prediction algorithms

Seamless planning covering the complete end-to-end rail service

Gain awareness on EU-Level for the developed technology frameworks

Large-Scale demonstration activities

Provision of resources, inputs and recommendations for standardization & authorisation

The goal of FP5-TRANS4M-R is to bring new technologies to market maturity by fast collaborative development testing and demonstration

FP5 Dev. Structur

Development

- Coordination between the operators
- Definition of requirements with the partners from the industry
- Prototype development

Testing

- Testing the new technologies
- Finding fields of action for improvements

Demonstration

- Demonstration of market ready solutions with high TRLs
- Demonstrate benefits
- Enabling migration with preparatory works

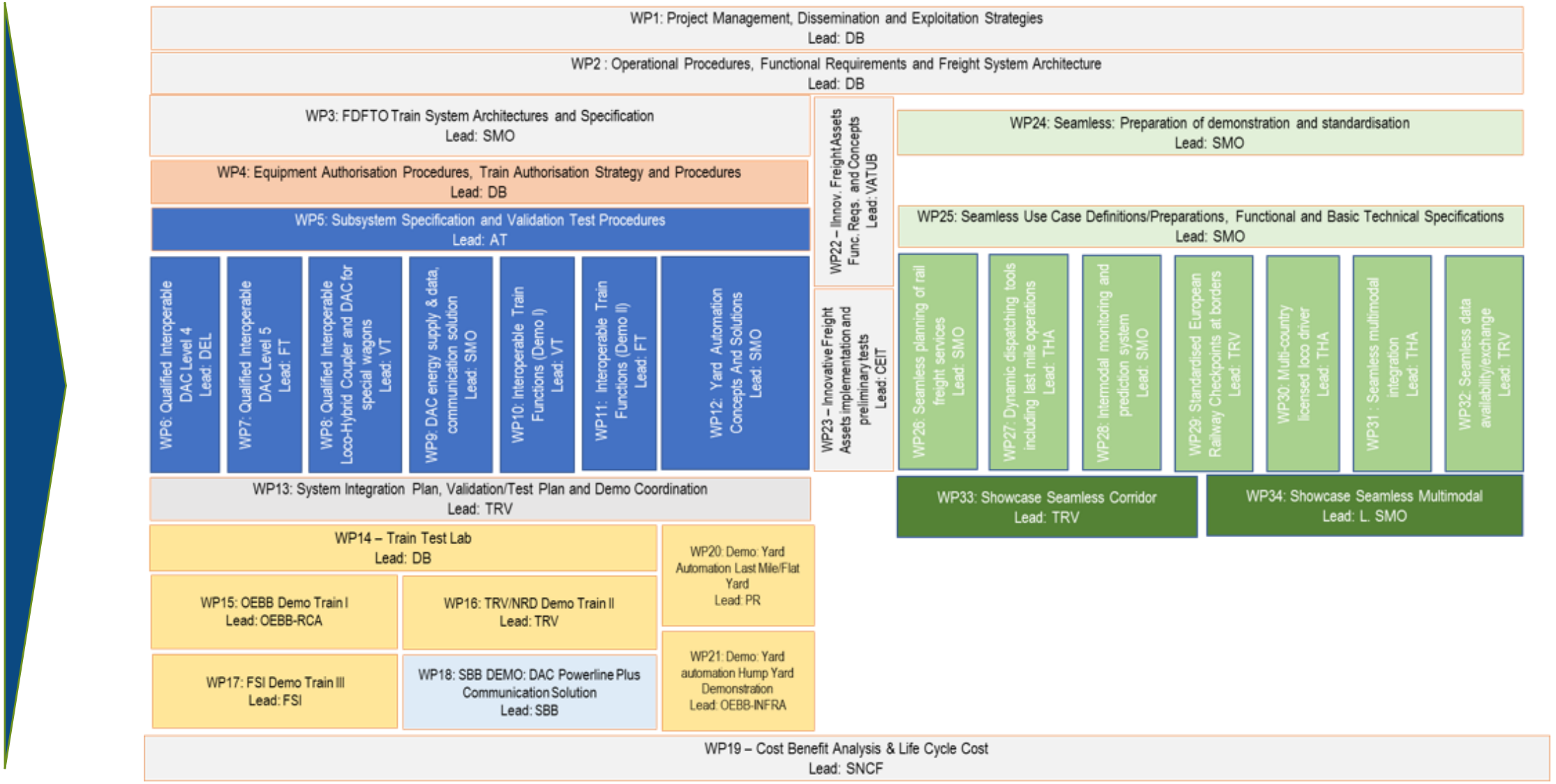
TRANS4M-R project brings together end-users, large industry, railway undertakings – operators and wagon keepers, SMEs, academia and research, thus, covering the entire value chain to deliver **fully digital freight train operations** by means of development **of interoperable DAC-enabled technologies and applications** ensuring a seamless operation across actors, transport modes and countries.

The FP5 Consortium will by 2025 at least deliver the following ambitious technological achievements

Deliver by 2025 at least the following

- Demonstrate **DAC Level 4 (functional) and level 5 ready** couplers for testing on train lab and for largescale demonstrators **(TRL 8)**
- Demonstrate locomotive **hybrid-coupler and Wagon DAC** for special wagons for testing on trains lab and largescale demonstrators **(TRL 8)**
- **Interoperable power supply and communication system** for Locomotives and wagons **(TRL 8)**
- Operational procedures and harmonization
- Train functions
  - **Train composition detection** (train inauguration) **(TRL 8)**
  - **Automated brake test (TRL 8)**
  - **Automatic coupling and uncoupling** (controlled from a locomotive) **(TRL 8)**
  - **Train integrity monitoring** and **train length determination (TRL 7)**
  - **Automated parking brake control function** (controlled from locomotive) **(TRL 7)**
  - Distributed Power System – **DPS (TRL 7)**
  - **Train brake control & monitoring** (via train network parallel; EP-Brake) **(TRL 7)**
- Consolidated **Full System Integration plan**, test concept & Validation Concept and Plan
- Authorization, safety analysis and **DAC Running Safety Assessment** Tool
- Definition of use cases and conceptual system specification for **self-propelled wagon**
- Requirements Specification **Yard Automation** for Hump Yard and Flat/Last Mile Yard
- Demonstrate **flat yard/ last mile yard automation** and management and Hump YAMS
- Provision of effective **intermodal prediction algorithms** based on AI models **to boost decision making performance (TRL 7)**
- Development of the functions, **tools or supporting systems ensuring a seamless planning (**end-to-end) **(TRL 6-7)**
- Harmonised **real-time interface between Railway Traffic Management System and the yard/terminal** management systems to dynamically adapt planning and tasks **(TRL 6-8)**
- Enabling improved cross-border operations through the use of **Standardised European Railway Checkpoints**, including the deployment of innovative technologies such as **Intelligent Video Gates (TRL 8)**
- **Integration of multimodal services for harmonised transport** planners with booking support functions **(TRL 7)**

Efficient approach with division of work packages between development, testing and demonstration activities



The FP5-TRANS4-MR Project is aligining with several other Flagship Areas

FP1 / FP5

- FP5 will provide Input to FP1 on the basic functional and technical specifications for Seamless Planning, Dynamic Dispatching and Intermodal Prediction
- Collaboration are focused on Seamless Topics

FP2 / FP5

- First alignment topics are identified like Automatic Shunting Operations (ASO) in connection to Automatic Train Operations on Mainline
- Needs to be finalized within the first months of the project

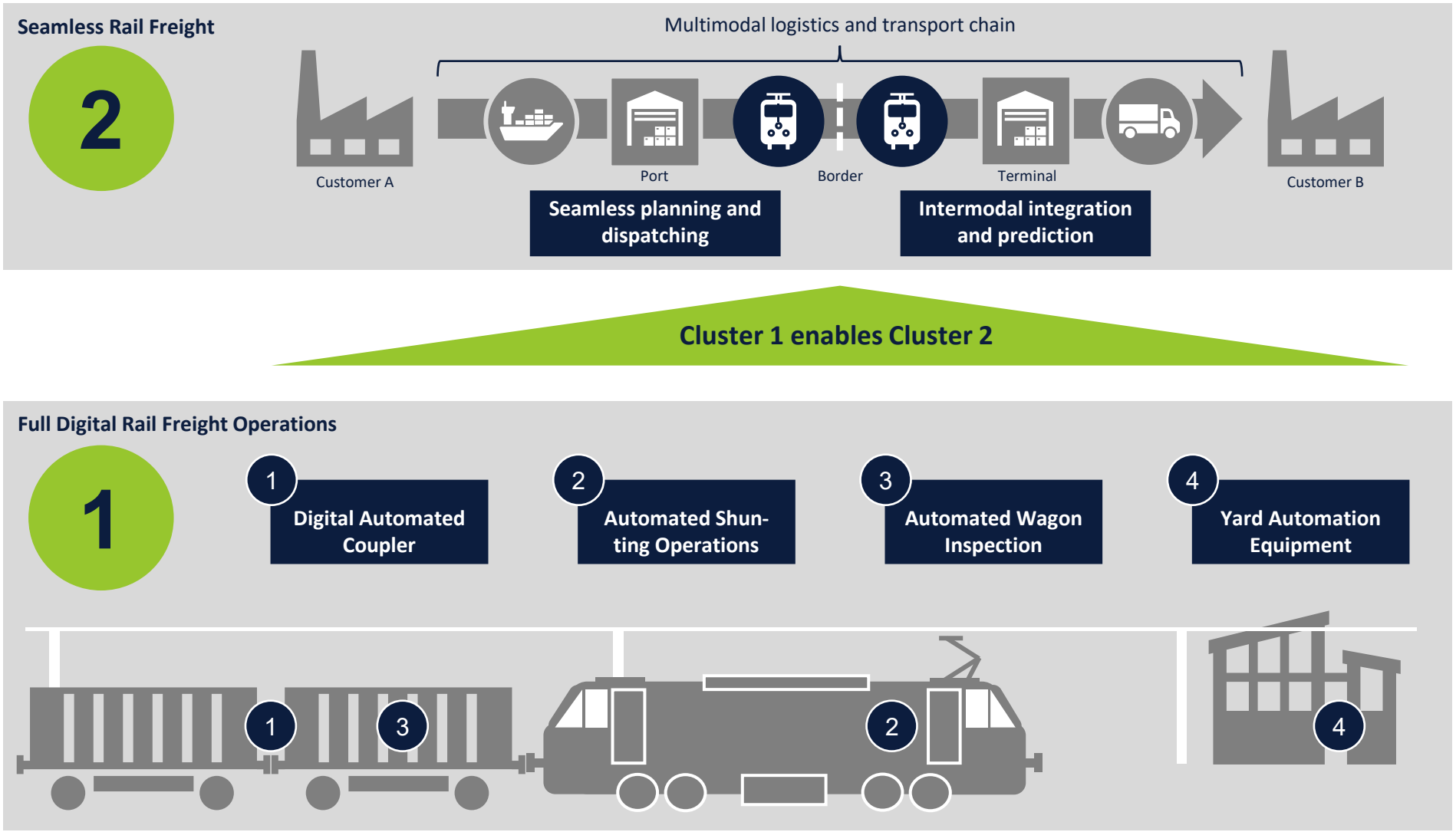
FP3 / FP5

- Alignment for Condition Based Maintenance algorithms; early deliverable on the basic functional and technical specifications as relevant input for FP3 planned
- Needs to be finalized within the first months of the project

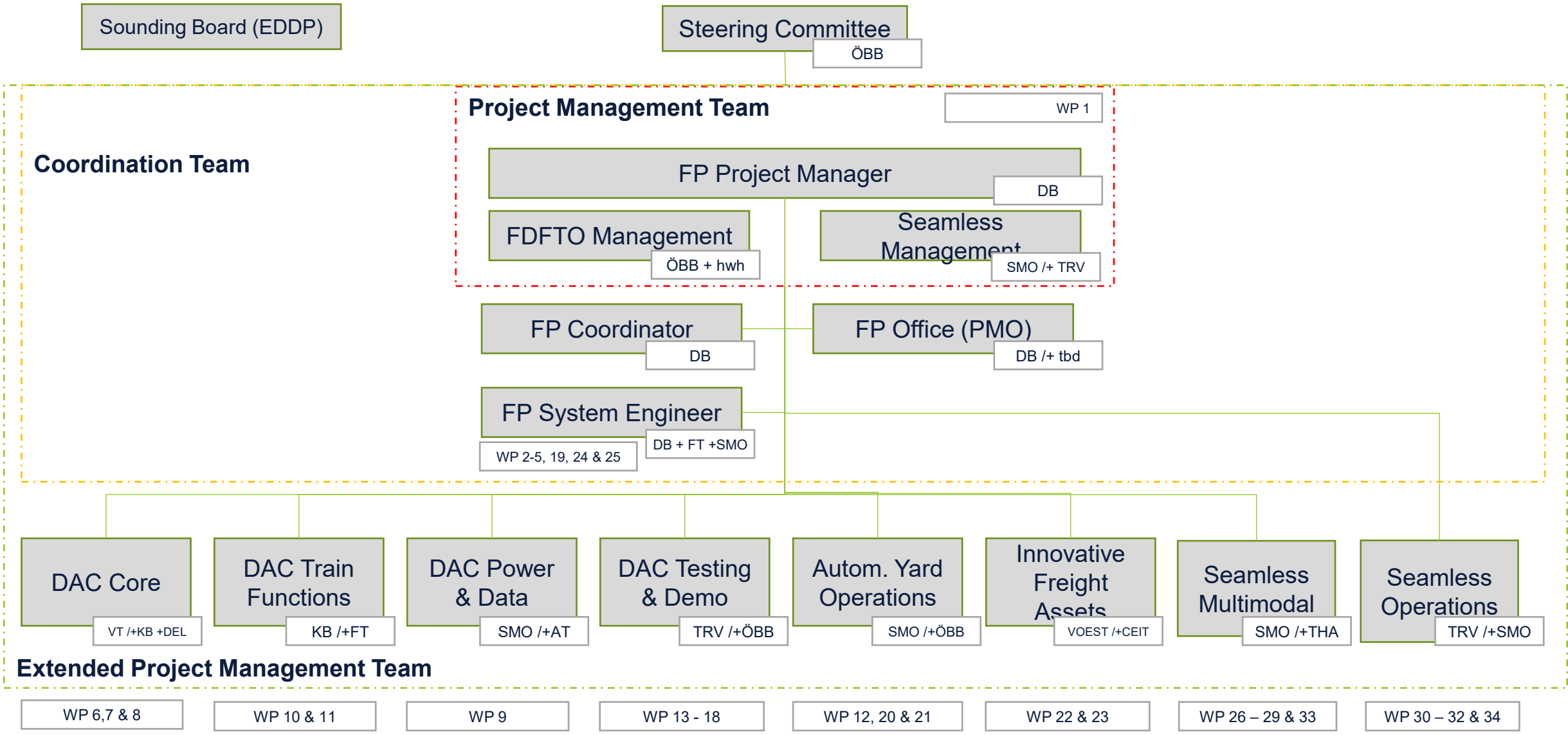
FP4 / FP5

- FP5 will provide results from the analysis for energy efficiency of the self propelled wagon to FP4
- Further alignment are possible with the exchange of the results

The DAC enables European rail freight to develop a multimodal, seamless logistics and transport chain



The project structure of FP5



Flagship Project 6

FP6 - FutuRe

Future of **Re**gional Rail

Bertram Ludwig (bertram.ludwig@oebb.at)

Alessandro Mascis (alessandro.mascis@wabtec.com)

* *Pending successful completion of the Grant Agreement Preparation phase, this project will be receiving funding from the Europe's Rail Joint Undertaking (ERJU) under project ID 101102009 . The Europe's Rail Joint Undertaking receives funding from the European Union Horizon Europe's Research & Innovation Programme, as well as from the ERJU members other than the Union. Neither the Europe's Rail nor any person acting on the Europe's Rail behalf may be held responsible for the use which may be made of the information and views contained in this presentation*

FP6 - FutuRe in a nutshell

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**.
- **But:** many of these lines were given up in the past – due to **high costs**. Thus, these railway **lines need to be revitalized or even rebuilt to make them economically, socially, and environmentally sustainable** and meet the current customer needs but also reduce CO2 emissions of the European transport sector.

A clear project goal

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

- to ensure long-term viability of regional rail by reducing total cost of ownership (TCO), i.e., cost per kilometer in terms of both OPEX and CAPEX, while ensuring high service quality and operational reliability. In addition, the target is to increase customer satisfaction and become an attractive and preferred mode of transport:
  - **Lowering CAPEX system costs,**
  - **Lowering OPEX,**
  - **Increasing productivity** (unit costs per train kilometer),
  - **Improving customer satisfaction**.

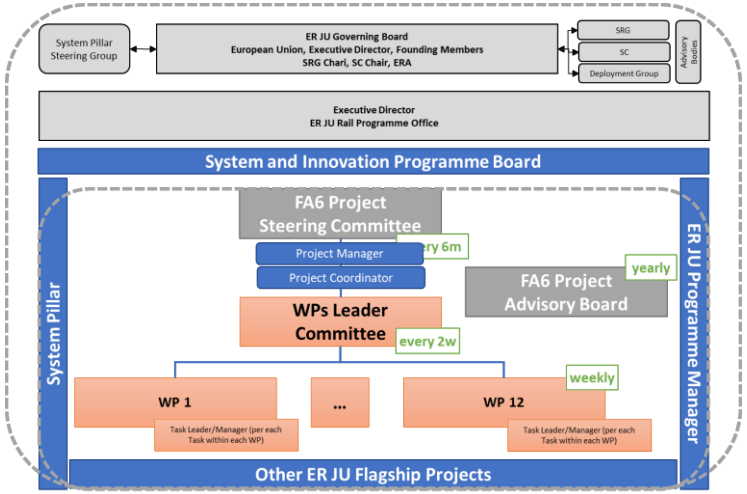
Project key facts

- **Project duration:** 01.12.2022 - 01.12.2026
- **Total Project Costs** (funding+IKOP+IKAA)**:** ~35MEUR
- 21 Beneficiaries, >30 Affiliated Entities and Subcontractors

FP6 - FutuRe: a clear project structure

A clear project structure to achieve our goals

- 12 Work Packages – with all technical WP (WP3, WP4, WP5, WP6) 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

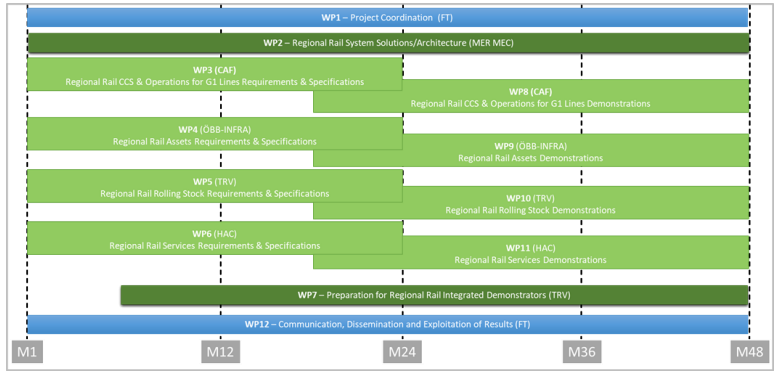
- Defining the needs of regional lines and development of system architecture.
- Architecture and functional requirements for all WP and KPI achievement monitoring.

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

- WP6: 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)

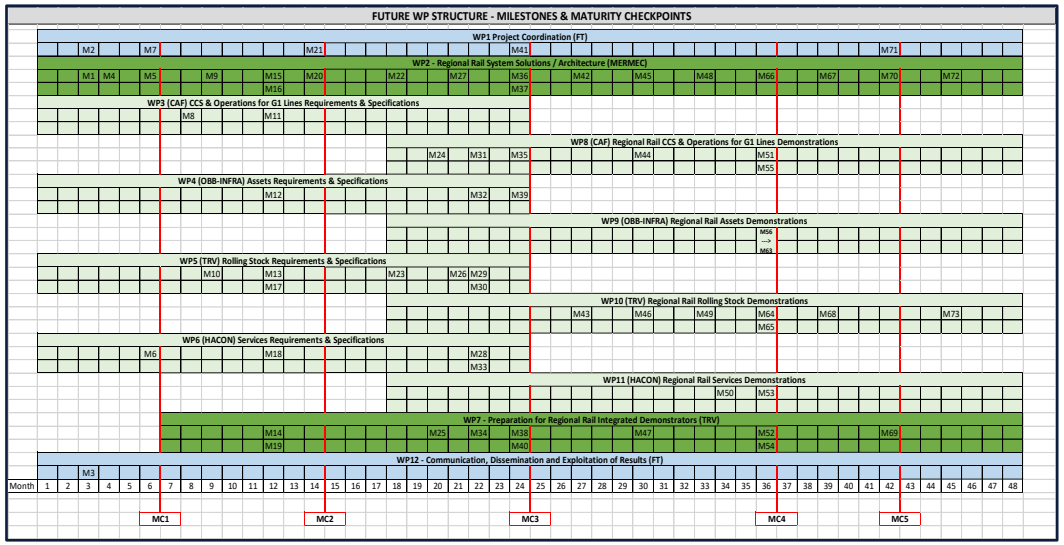
FP6 - FutuRe: link with other FPs & SP

An efficient cooperation with other Flagship Projects

The ER JU is an integrated programme; thus, it is of paramount importance to establish a good cooperation and coordination with other Flagship Projects. FP6 will interact mainly with FP1, FP2 and FP4. The project will receive and provide elements to other Flagship Projects notably for demonstrations activities.

FP6 will share with the other destinations at month 6 preliminary requirement on Regional lines needs. During the project execution a continuous alignment with the other FPs on specifications, prototypes of technical enables and final versions of the technical enablers will ensure a successful implementation of FP6 demonstrators.

Preliminary alignment was performed with FP1, FP2 and FP4 in the last months and a final planning to manage interactions will be finalized at an early stage (month 3) of the projects.



A smooth and efficient cooperation with the System Pillar (SP)

Cooperating with the System Pillar is extremely strategic for FP6, also in relation with the collaboration with other FPs, therefore FP6 will organize: quarterly meetings with SP for progress information and new findings and will invite the System Pillar to participate to all FP6's Maturity Checkpoints and relevant FP6/FPx workshops (where applicable based on the topics to be discussed).

High priority topics of research to be integrated into SP work will be the following:

- Optimisation of ETCS onboard costs (especially refitting, life cycle cost);
- Reduction of trackside assets: the right minimum;
- Main cost/performance scalability factors for CCS, TMS;
- G2 line solutions/economic assessment / TSI;
- Validation, operationalisation and monitoring of pertinent KPIs.

FP6 - FutuRe: clear outcomes by 2026

Regional Railway System (CCS & Operations) Demonstration

- Demonstrate a single integrated **Operations Control Center** (OCC) covering interlocking, radio blocking and traffic management for regional lines that are not functionally/operationally connected with mainline (TRL4/5)
- Demonstrate simple on-track radio network based on the results of the Flagship Project 2 ("R2DATO") related with **cost effective communications**, supporting all FRMCS applications, minimizing civil works and energy consumption, to the achievement of cost-effective Gigabit Train, the use of public network coverage and compatibility with main lines (TRL4/5)
- Demonstrate a specific application for **Traffic Management Systems** for regional lines improving resilience of a connected rail network, optimizing train operations including disturbing events considering high/low-demand situations (disturbance and distraction) (TRL4/5)

Assets Demonstration

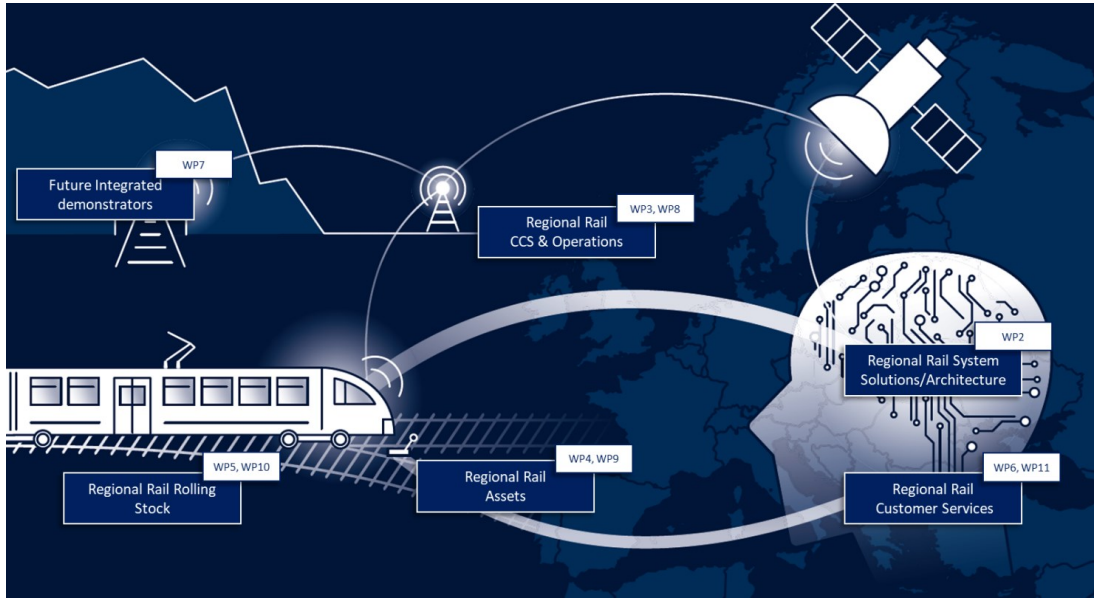
- Demonstrate a **systemic approach** with the implementation of different railway assets in particular for cost-efficient wireless, energy self-sufficient wayside components in particular CCS track-side components (e.g., switches, level crossings) and if applicable for track vacancy detections and signalling shall be evaluated and demonstrated (TRL4/5)

Suitable Customer Services

- Demonstrate cost-efficient integration of **on-board information of multimodal services** integrating regional multimodal services such as carsharing (TRL4/5)
- Demonstrate **passenger congestion rate monitoring**, flow optimization application as well as a low-cost passenger information system for regional services developed within this action (TRL4/5)

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.



FP6 – Strong Consortium & Advisory Board

A strong consortium

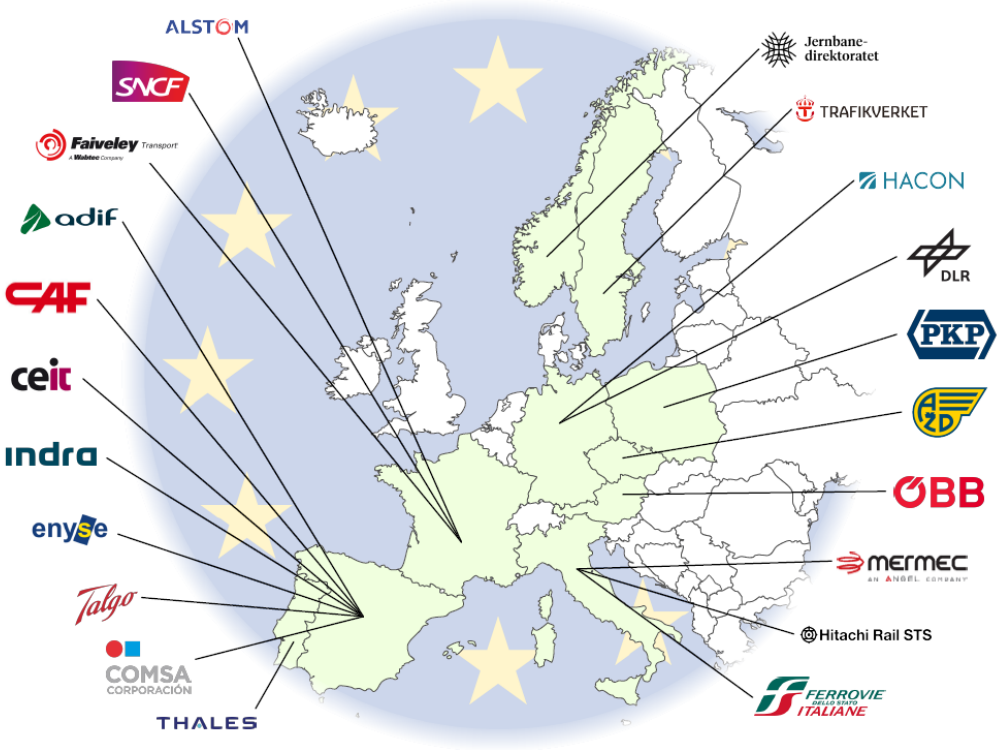
- A strong consortium with more than 20 partners, including RU/IM and leading industry partners as well as plus over 30 affiliated entities and subcontractors will ensure that project results will be achieved.

Advisory Board

- A global Advisory Board with a specific focus on regional railway operator/infrastructure manager.
    - Calea Ferata din Moldova (CFM, Moldova), Canadian Urban Transit Research & Innovation Consortium (CUTRIC, Canada), Ceske Drahy (Czech Republic), Destination Sälen (Sweden), GYSEV – Raaberbahn (Hungary), Hilfsgemeinschaft der Blinden und Sehschwachen Österreichs (Austria), Lithuanian Railway (LTG, Lithuania), Magyar Allamvasutak (MAV, Hungary), Niederösterreich Bahnen (Austria), Sälen Municipality (Sweden), Slovenske Zelenice (Slovenia), Steiermarkbahn und Bus GmbH (Austria), Transport for New South Wales (Australia), Zeleznicna spolocnosť Slovensko, a. s. (ZSSK, Slovakia), Zeljenice Republike, Srpske a.d. Doboj (Bosnia and Herzegovina), Zeljeznicki prevoz Crne Gore (ZPCG, Montenegro)

Are you a **regional railway operator/infrastructure manager, R&D institution or a region** with interest in solutions for your regional rail system?

Join the Advisory Board now with a Letter of Support!



Rail Research and Innovation to Make Rail the Everyday Mobility

5. ADVISORY BODIES

Carlo Borghini

Executive Director, Europe’s Rail JU

Rail Research and Innovation to Make Rail the Everyday Mobility

5. ADVISORY BODIES
- STATES' REPRESENTATIVES GROUP

Haltuf Miroslav
Vice-Chair EU-Rail SRG

Federal Ministry
Republic of Austria
Climate Action, Environment,
Energy, Mobility,
Innovation and Technology

Europe‘s Rail SRG

Summary of Small Group Discussions

Federal Ministry for Climate Action, Environment, Energy, Mobility,
Innovation and Technology
Directorate General III – Innovation and Technology
Department I.4 – Mobility and Transport Technologies
3 June 2022

What for?

- (Re)start of the SRG
- Getting MS involved / Onboarding new MS (representatives)
- Transition to a living SRG with win-win for MS and Europe’s Rail

Objectives

In these small group meetings SRG members had the opportunity

- (1) to share their **priorities and expectations for the SRG** of Europe´s Rail,
- (2) to inform about the **expected R&I results from Europe's Rail which their MS is most interested in**, and also
- (3) briefly talk about the focus of their **national instruments for railway R&I**, if any.

Each MS had about 10 minutes to cover these three questions.

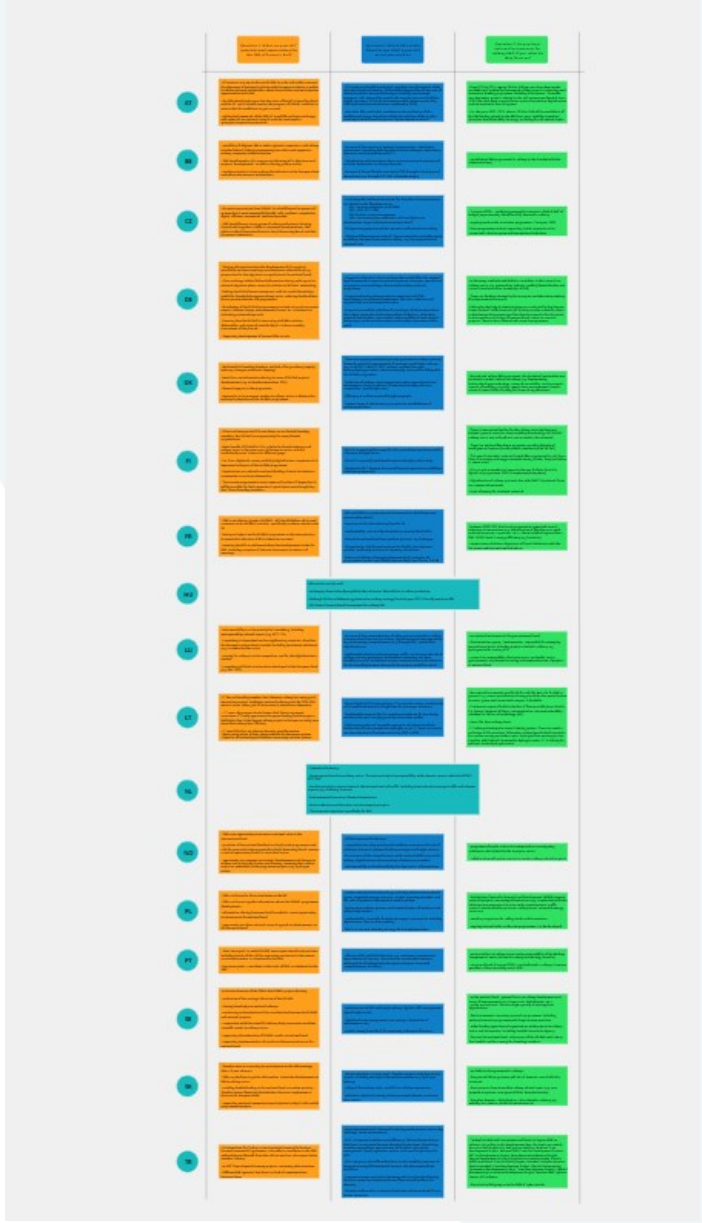
4 SRG Small Group Discussions

- 28 March: DE, DK, NL
- 1 April: FI, LT, TR
- 5 April: BE, CZ, LX, NO, SK
- 8 April: FR, PT, PL, SE
- HU, AT → written answers

→ **17 states (MS or Associated Countries)** participated

Minutes on Concept Board

- Please find an overview of the detailed answers here: https://app.conceptboard.com/board/e6q6-k3ma-mm4y-p4x4-akpq => Thanks to Theresa!
- Thanks to Magda and Florian for taking the minutes!
- Please inform us soon about any changes you would like to make!
- Other SRG members are very welcome to add their answers in the future



Outcomes

Priorities and Expectations for the SRG (1)

- For those having a national **rail industry:**
  - Opportunity for the industry (and also academia) to participate (funding)
    - Making Europe's Rail more open and transparent (reducing „black-box factor")
- For all: Achieving an **environmentally friendly, safe, resilient, competitive, digital, efficient, automated, and interoperable** rail system ➔ European rail system

Priorities and Expectations for the SRG (2)

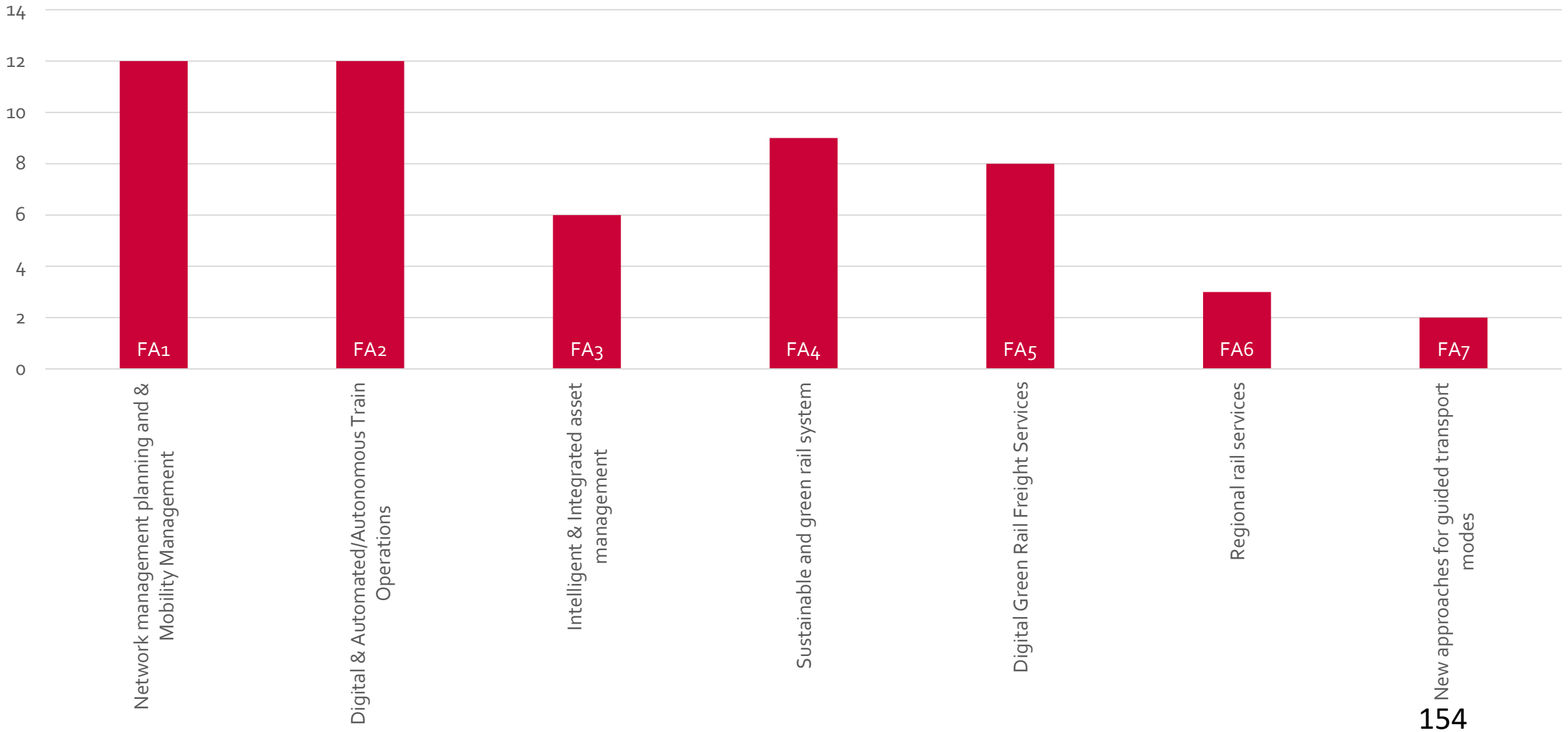
- Linking research activities with MS level
  - Information sharing on progress, achievements and results
    - Preparation for the migration or regulation at the national level (e. g. supporting implementation of results and demonstrations at the national level) ➔ **interest in System Pillar**
    - Avoiding double funding at MS level & foster coordination between funded projects by Europe's Rail and national projects ➔ idea for establishing **platform on exchange at content level**

Priorities and Expectations for the SRG (3)

- **Advisory role** to support the **strategic development** of JU
  - Make the MS‘s voice heard at EU level

  ⇒ **strong(er), (more) active SRG**
- Socio-economic aspects in railway sector to balance the technical orientation of Europe’s Rail

Number of states who mentiones a certain FA as priority (explicitly or implicitly)



Expected R&I Results which EU-Rail MS are most interested in (2)

- Increase competitiveness of rail (for shifting transport)
  - Increasing efficiency & capacity of network
  - Reducing costs, noise and vibration

  } covered by Europe‘s Rail

  - Meeting customers’ requirements by improvement of passenger and freight railway **services** based on **multimodal solutions** for freight transport and passenger journeys

  } not or only partly covered by Europe‘s Rail

Expected R&I Results which EU-Rail MS are most interested in (3)

- Keys to get there:
  - Digitalisation and Automation (**ERTMS**: **ETCS**/CBTC; **ATO; DAC**; safety and (cyber)security; predictive **maintenance;** regional lines)
  - Renewable energy in rail / alternative fuels (**hydrogen trains** or others)
  - Interoperability (**cross-border,** different gauge)
  - Others: circular economy principles, training / human resources

National Instruments for Railway R&I & Focus (1)

- **no**: DK, NL, BE, HU
- **yes** (general R&I ecosystems open for rail or similar initiatives with a specific focus that includes rail):
  - Digitalisation: FI, SE
  - Transport: AT, CZ, LT, NO, SK
  - Infrastructure / Operators: PL, FR
  - Centres: DE, PT, TR
  - Others: LX, TR (vehicles)

National Instruments for Railway R&I & Focus (2)

- Obviously, new initiatives are currently being developed
- European Recovery and Resilience Fund (RRF) as enabler

Rail Research and Innovation to Make Rail the Everyday Mobility

5. ADVISORY BODIES
- SCIENTIFIC COMMITTEE

Juan de Dios Sanz Bobi
Vice-Chair EU-Rail SC

LEGAL FRAMEWORK

The Scientific Committee is adopted in the EU-RAIL Governance based on Regulation (EU) 2021/2085 (1) whereas it is declared

Clause 33 the scientific advisory body concept in the Joint Undertakings in Horiozon Europe

- Joint undertakings should be able to set up an advisory body with a scientific advisory function.
- That body or its members should be in a position to provide independent scientific advice and support to the respective joint undertaking.
- The scientific advice should concern, in particular, annual work programmes and additional activities, as well as any other aspect of the joint undertakings' tasks, as necessary

Article 21 defines the term and the action for the Scientific Advice

- Independent Scientific advice
- Two possible actions: an advisory body or an "ad hoc" request for independent expertise

Article 91, Bodies of the Europe's Rail Joint Undertaking, clause 2, opens the extension of the Scientific Advisory Body

(1) Council Regulation (EU) 2021/2085 of 19 November 2021, establishing the Joint Undertakings under Horizon Europe and repealing Regulations (EC) No 219/2007, (EU) No 557/2014, (EU) No 558/2014, (EU) No 559/2014, (EU) No 560/2014, (EU) No 561/2014 and (EU) No 642/2014

SCIENTIFIC COMMITTE TASKS

- To advise on the scientific priorities to be addressed in the work programmes. It extends to the scope of calls for proposals preserving the alignment to the Master Plan and the Horizon Europe strategic planning;
- To advise on the scientific achievements to be described in the annual activity report;
- To suggest, in view of the progress of the Master Plan and the particular EU-RAIL actions, corrective measures or re-orientations to the governing board
- To provide independent advice and scientific analysis on specific issues as requested by the Governing Board

(1) Council Regulation (EU) 2021/2085 of 19 November 2021, establishing the Joint Undertakings under Horizon Europe and repealing Regulations (EC) No 219/2007, (EU) No 557/2014, (EU) No 558/2014, (EU) No 559/2014, (EU) No 560/2014, (EU) No 561/2014 and (EU) No 642/2014

IMPLEMENTATION

As a general framework, the Scientific Committee takes the role of an Advisory Body to the Governing Board and the Executive Director.

The action from Shift2Rail to EU-RAIL:

- The EU-RAIL Governing Board decided last 21 December 2021 to extend the mandate of the existing Scientific Committee of Shift2Rail
  - The current Scientific Committee rounds a table of 12 experts (1) from different railway disciplines, chaired by one of their experts under voting process among the members.
  - The work of the Scientific Committee is organized in meetings (4 during this EU-RAIL activity period), chaired by the SC Chair, where the scientific advising actions are promoted and discussed with the Executive Director. Delegates from DG-Research, DG-Move, and ERA are participants in the meeting.

- This extension will in the action till a new Decision would have been taken to establish the necessary scientific advice

(1) The list and expertise for SC members is available in https://rail-research.europa.eu/about-europes-rail/europes-rail-structure-of-governance/europes-rail-scientific-committee/

REPORT OF THE WORK DONE

The Scientific Committee has advised to GB and Executive Director in the following actions

- Shift2Rail Annual Plan and Activity report
- Shift2Rail KPIs Workshops
- Shift2Rail Project evaluation
- Railway Application Standardization from the research results
- EU-Rail Master Plan and EU-Rail Multi Annual Work Programme
- EU-Rail program for 2022 and first amendment to 2022 program

The Scientific Committee has supported Shift2Rail and EU-Rail in different events

- TRA editions
- Innovation Days
- European Year of Rail
- Rail Live

A BODY OF THE
EUROPEAN UNION

EU-RAIL GENERAL ASSEMBLY

Thanks!

ADVISORY BODY: *SCIENTIFIC COMMITTEE*

ANGELA DI FEBBRARO, *JUAN DE DIOS SANZ BOBI*

30 November 2022

Rail Research and Innovation to Make Rail the Everyday Mobility

6. COMMUNICATION AND DISSEMINATION STRATEGY

Catherine Cieczko

EU-Rail Chief Stakeholder Relations and Dissemination

Stakeholder Relations, Dissemination and Communication Objectives

- Engage the mobility ecosystem more strategically to expand and improve proximity with stakeholders, whilst promoting the added value of the JU
- Highlighting the Innovation Programmes technology potential and strongly communicating Project Results and System Pillar outputs
- Centrally manage internal communication to foster a unified culture and vision for optimal collaboration

Objective #1

Engage the mobility ecosystem more strategically to expand and improve proximity with stakeholders, whilst promoting the added value of the JU

Expected Outputs

- Maintain the high reputation of EU-Rail
- Increase in visibility of the JU and its mission showing by more interest in our Calls for Proposals and Tenders
- Interest in our programme results (linking with dissemination of project results) and challenge the programme
- Ensuring links and coherence with the System Pillar and Deployment group activities
- More circulation on our social media
- More attendance at key events
- More interest from the media

Channels

- EU-Rail website - Dedicated Results/Success Stories Area
- High-level meetings with International, National and European policy-makers
- Participation to and organisation of events
- Joint workshops with EU programmes, workshop for regional involvement
- Timely use of social media
- Production of adequate publications such as the EU-Rail newsletter and contribution to articles in trade and mainstream media
- Printed and digital press coverage
- Audio-visual and digital production

Objective #2

Highlighting the Innovation Programmes technology potential and strongly communicating Project Results and System Pillar outputs

Expected Outputs

- Increased visibility for EU-Rail project results
- Maintain the high reputation of EU-Rail as leader in Rail R&I
- Coordination of deployment of innovative solutions to deploy in the market
- Higher number of applications to EU-Rail Calls for Proposals and Tenders
- More engagement from stakeholders in EU-Rail projects leading to the implementation of the Single European Railway Area (SERA)
- Increased synergies with System Pillar and Deployment Group

Channels

- EU-Rail website
- M365 as platform for communication of project results
- Press releases targeted at specific media globally
- Attendance to specific regional, national and international events
- Organisation of yearly events/summits
- International & European exhibition organisation to highlight the tangible aspects of our solutions
- Timely use of social media
- EU-Rail newsletter
- Mapping of the European Scientific conferences and matching with EU-Rail innovation per Flagship Area

Objective #3

Centrally manage internal communication to foster a unified culture and vision for optimal collaboration

Expected Outputs

- Increased sense of belonging for staff
- More structured circulation of important communication within the JU avoiding knowledge gaps
- Improved newcomers experience

Channels

- Dedicated M365 environment
- Team building events
- Regular staff meetings
- Other communication channels as deemed necessary

Stakeholders

Governance

- EU-Rail Members
- System Pillar Steering Group
- Deployment Group
- States Representatives Group (SRG)
- Scientific Committee (SC)

Stakeholders

Decision makers

- Commissioners and High Representatives of the European Commission
- Members of the European Parliament ITRE, TRAN, BUDG, ENVI Committees
- Council of the EU
- Member States, individually, through Permanent Representations and Ministries of Transport and Research - Presidencies
- Committee of the Regions (COTER and SEDEC)
- European Economic and Social Committee
- Transport Programme Committee of the Horizon Europe Programme
- European Agency for Railways (ERA)

Stakeholders

Other Stakeholders

- Associations/industry bodies: ALICE, ALLRAIL, CEN-CENELEC, CER, CLECAT, EIM, EPF, EPITTOLA, ERCI, ERFA, ETF, ETSI, ETTSA, EURNEX, FEDEC, NB-Rail, SEMAF, UIC, UIP, UIRR, UITP, UNIFE, etc
- Industrial community
- Research and Scientific Community, i.e. Universities, Research Centres, etc
- Other European agencies (EUSPA, ESA, EDA, EEA, other JUs, etc.)
- Funding bodies (EIB)
- European Rail Research Advisory Council (ERRAC)
- International, EU level, Member States, regional and municipal authorities, councilors, and scientific attachés of Permanent Representations to the EU
- International, European and National environmental & energy and mobility associations, NGOs, etc.
- General public, potential applicants and the media

Project Results Dissemination

EU-Rail consistently promotes project results through EU-Rail corporate communication channels:

- EU-Rail website, Social Media accounts (LinkedIn, Twitter, Facebook), monthly newsletter

Projects are encouraged to:

- communicate the importance of their results within the holistic EU-Rail programme view
- produce high quality images and videos of innovative solutions for promotion
- liaise with EU-Rail on the dates and format of their mid-term and final events
- send all of the above to communication@rail-research.europa.eu

A regular joint meeting with all Project Managers and dissemination work package leaders will be organised every 2-3 months in order to exchange strategies, examples, best practices, provide feedback, key results, etc.

Initial counselling during 6 first months for projects to define their dissemination and communication strategies, including template for strategy.

Social Media & Newsletter

- @EURail_JU – 4.6k
- Europe's Rail Joint Undertaking – 8.8k

- Newsletter
  - https://rail-research.europa.eu/e-news/
  - End of each month

- Any news you would like to share?
  - communication@rail-research.europa.eu

GENERAL TERMS AND CONDITIONS FOR USE OF THE EU-Rail TRADEMARK AND LOGO

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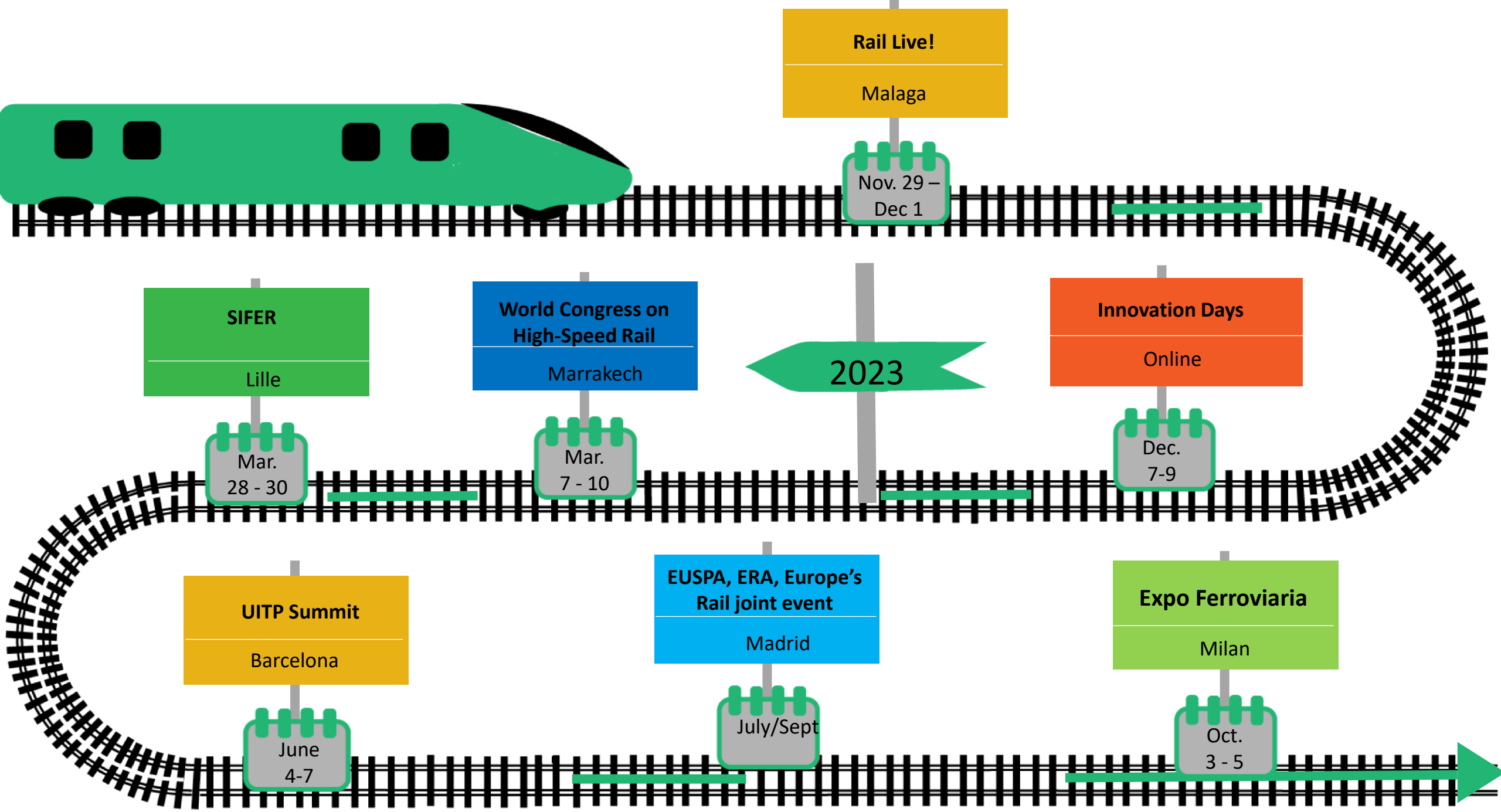
Key priorities for 2023

- Dissemination/Comms strategy for project results, including production of legal and financial guidelines video, and intro/outro video for projects
- Community management on Teams, Dissemination and Internal Communication
- Website revamp and creation of dedicated ‘Success stories’ area
  - Setting up EU-Rail project websites – reshaping the S2R sections
- Media relations and editorial support (Politico, Euractiv, Railway Gazette, IRJ, possible collaboration with BBC)
- Design and print work
  - Re-design of key Europe’s Rail graphs and images for use on website and social media
  - AAR 2022 Executive View and factsheet
  - Christmas Card 2023
  - Members roll-ups – promotional cubes for all FM
  - Goodies (pins, lanyards, light cubes)
- Participation in events

Upcoming Events


Rail Live!
Malaga
Nov. 29 – Dec 1
SIFER
Lille
Mar. 28 - 30
World Congress on High-Speed Rail
Marrakech
Mar. 7 - 10
2023
Innovation Days
Online
Dec. 7-9
UITP Summit
Barcelona
June 4-7
EUSPA, ERA, Europe's Rail joint event
Madrid
July/Sept
Expo Ferroviaria
Milan
Oct. 3 - 5

Impact Assessment

The following Key Performance Indicators (KPIs) will be used to evaluate the impact of our activities, and shall be updated as further analysis becomes available:

- **Stakeholders Relations activities:** • Presence of correct EU-Rail branding in stakeholders communication activities • Joint communication campaigns • Coordinated presence with Members at events and additional requests for interventions from EU-Rail
- **Communication activities:** • Website statistics • Social media traffic • Newsletter registrations and active readership• Press coverage • Press release • Events
- **Dissemination activities:** • Quality of calls for proposals submitted, • Number of calls for proposals submitted • Number of appearances at scientific conferences correctly branded EU-Rail projects • Presence on DG RTD dissemination tools

Risks

The EU-Rail Joint Undertaking is a small entity and therefore the following critical risks need to be identified and monitored carefully prior to all activities:

- Legal framework and budget
- Manpower
- Evaluation and understanding of target audiences' needs
- Perception of added-value
- Migration of the project solutions into concrete applications
- Commitment to deliver innovative solutions
- Inclusiveness and openness

Innovation!

Europe's Rail

Europe's Rail

Rail Research and Innovation to Make Rail the Everyday Mobility

7. CLOSING WORDS BY THE GOVERNING BOARD CHAIR

European Commission