

Shift2Rail JU

Driving innovation on railways

Barcelona 5 July 2019

“Mobility Dialogues Railgrup”

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@Shift2Rail_JU
#Horizon2020



S2R OBJECTIVES



INCREASE RELIABILITY & PUNCTUALITY **BY 50%**



DOUBLE RAILWAY CAPACITY



HALVE LIFE-CYCLE COSTS OF RAILWAY TRANSPORTS



CONTRIBUTE TO **REDUCTION OF NEGATIVE EXTERNALITIES**, SUCH AS NOISE, VIBRATIONS, EMISSIONS & OTHER ENVIRONMENTAL IMPACTS



CONTRIBUTE TO THE **ACHIEVEMENT OF THE SINGLE EUROPEAN RAILWAY AREA**

S2R PROGRAMME, ABOUT € 1BLN and A NEW APPROACH TO R&I IN RAILWAY

working together & driving innovation

AN OPEN and ACTIVE ORGANISATION



28
MEMBERS



375
PARTICIPANTS INVOLVED
FROM **28** COUNTRIES



101
SMEs

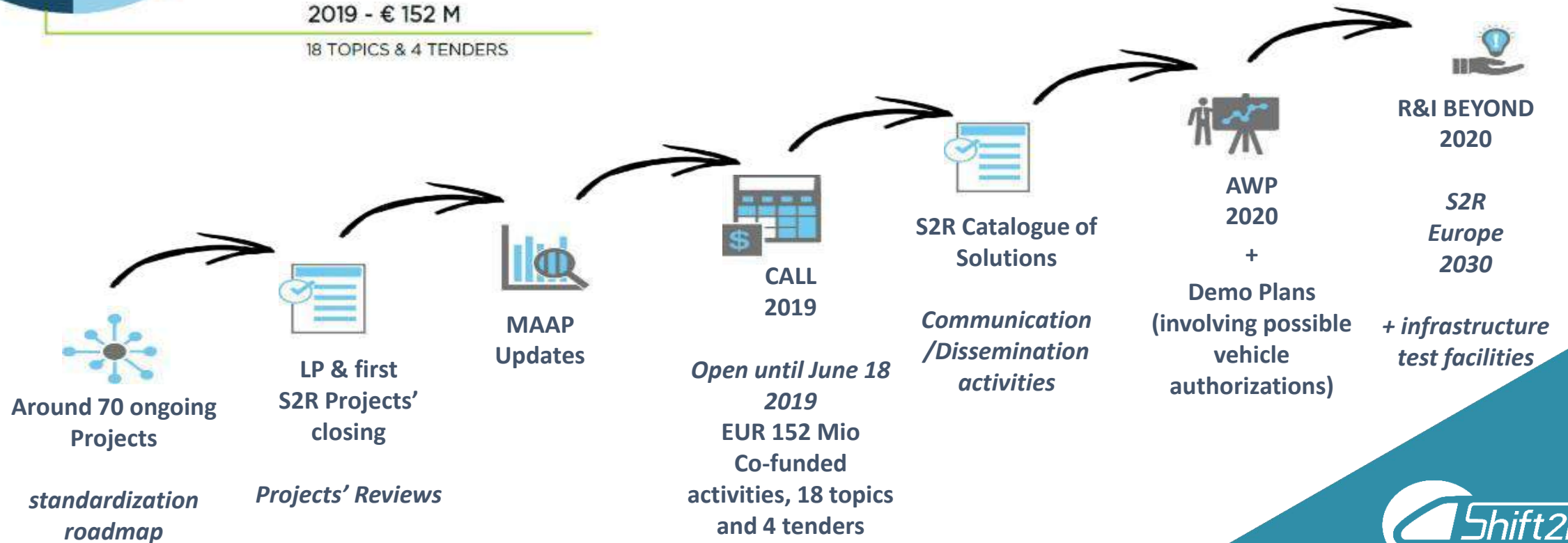
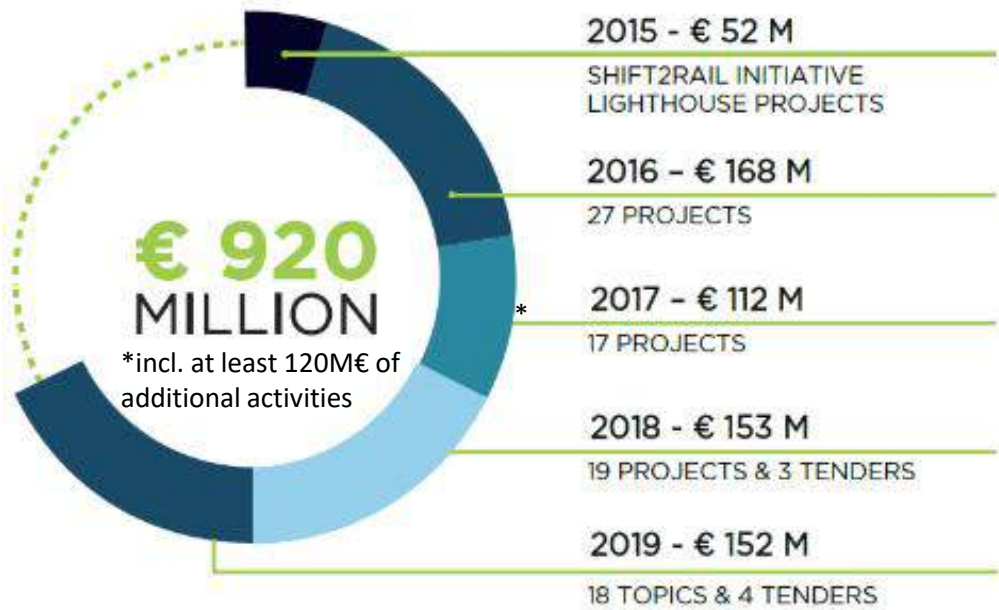


103
RESEARCH CENTRES
AND UNIVERSITIES

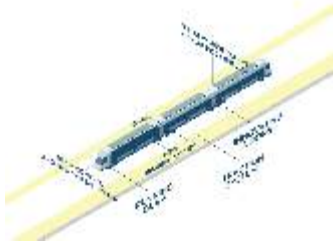
¹Data extracted from CORDA database in February, 2019

...opening up new
Capabilities coming from
emerging technologies or
concepts!

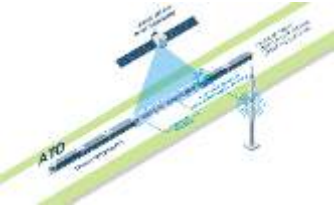
An Innovation Programme in motion



S2R solutions derived from Technical Demonstrators



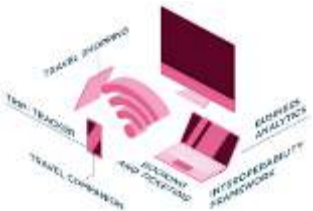
IP1 Cost-efficient and Reliable Trains, including high-capacity trains and high speed trains



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

WHO BENEFITS?

CUSTOMERS

FINAL USER

OPERATOR

INFRAMAN

SUPPLIERS

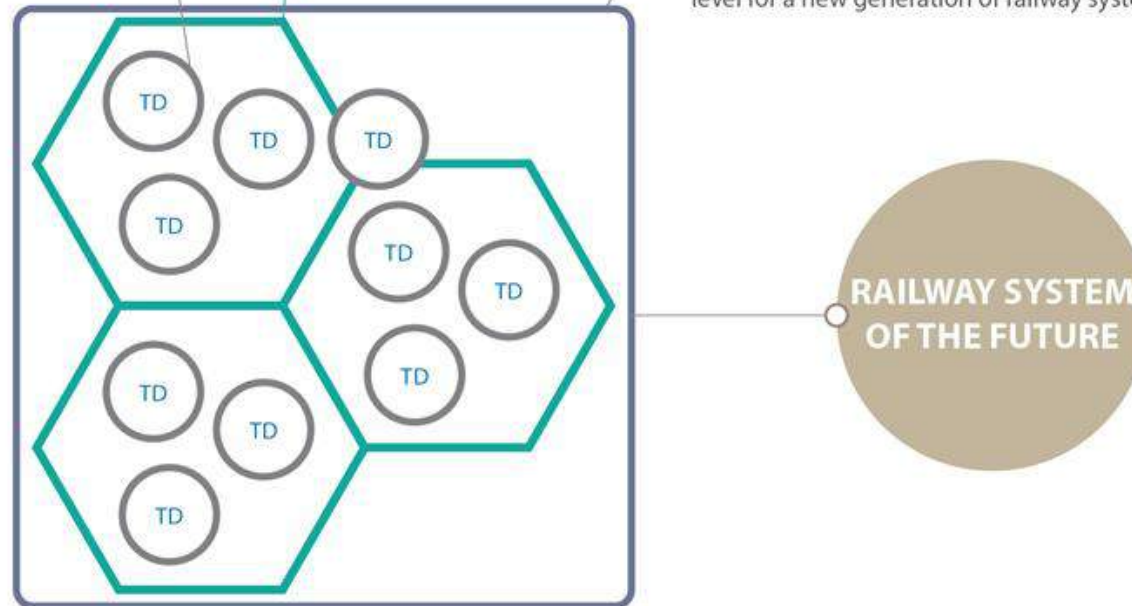


From TRL0 to TRL6/7

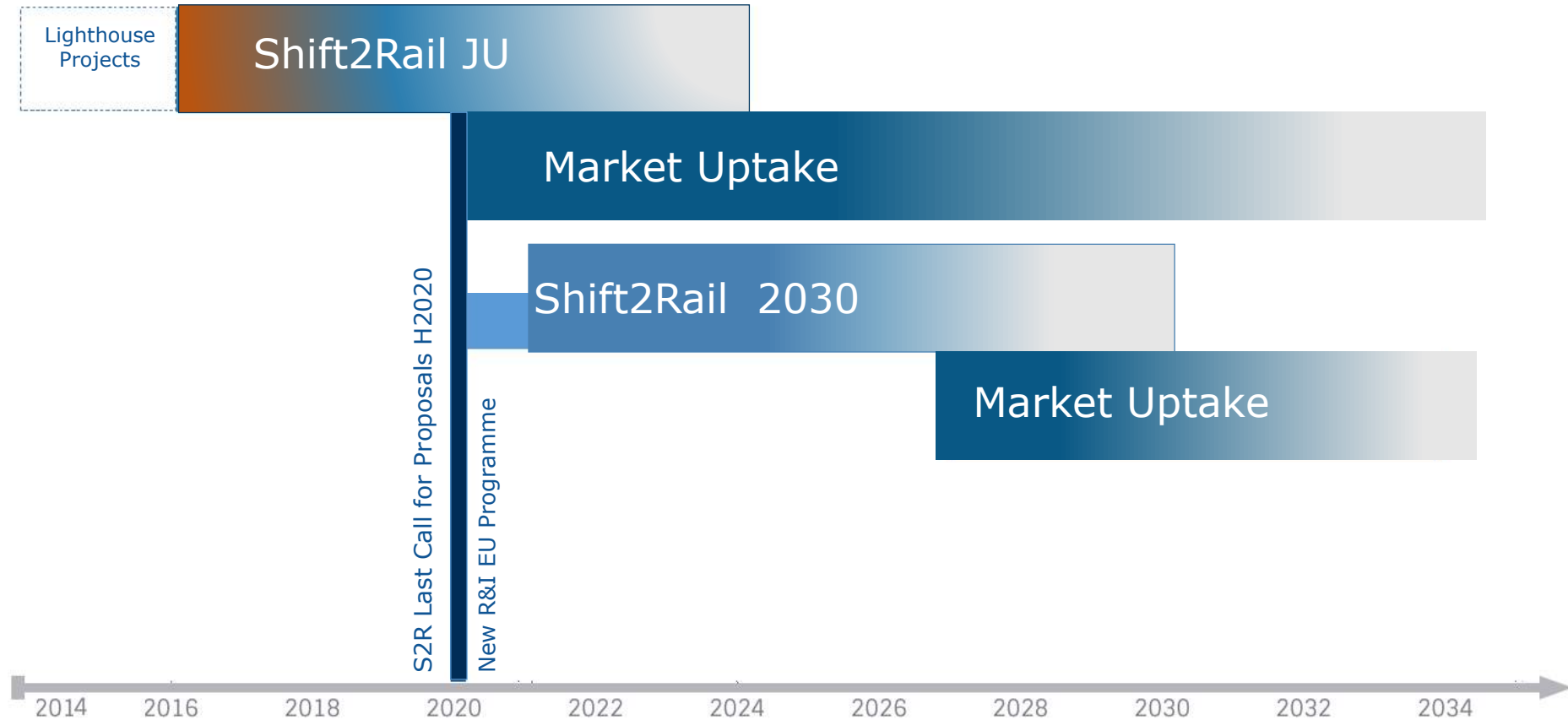
Technology Demonstrator (TDs)
Projects specifying, developing and demonstrating a specific technology resulting in a lab tested and/or simulated prototype

Integrated Technology Demonstrators (ITDs)
Projects integrating/combining TD prototypes at system level (lab and on-site) and testing performance

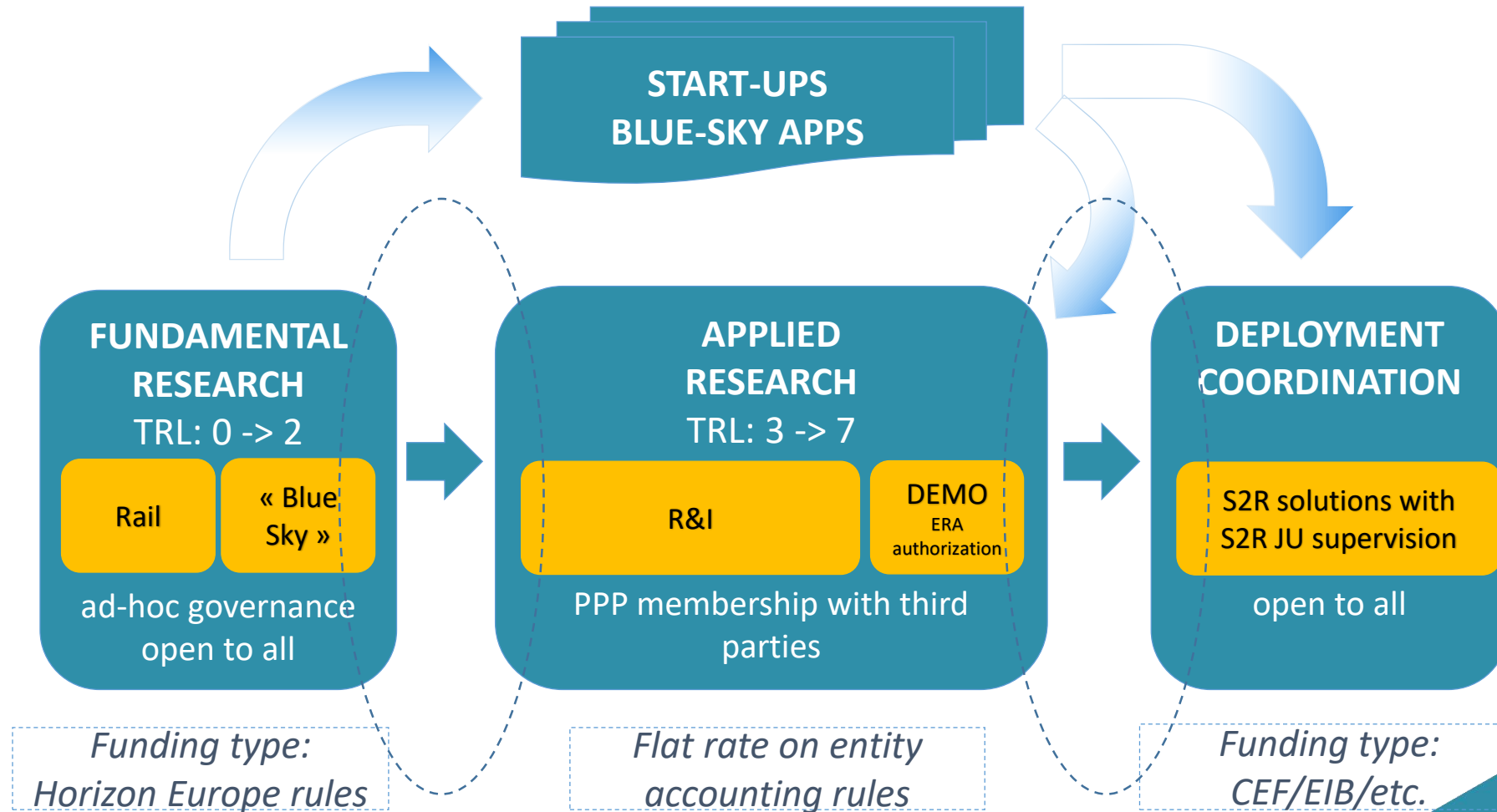
System Platform Demonstrators (SPDs)
Assessment of the whole systems performance based on the results of TDs and ITDs. SPDs bring S2R innovative solutions to a technology maturity level for a new generation of railway system



R&I BEYOND 2020

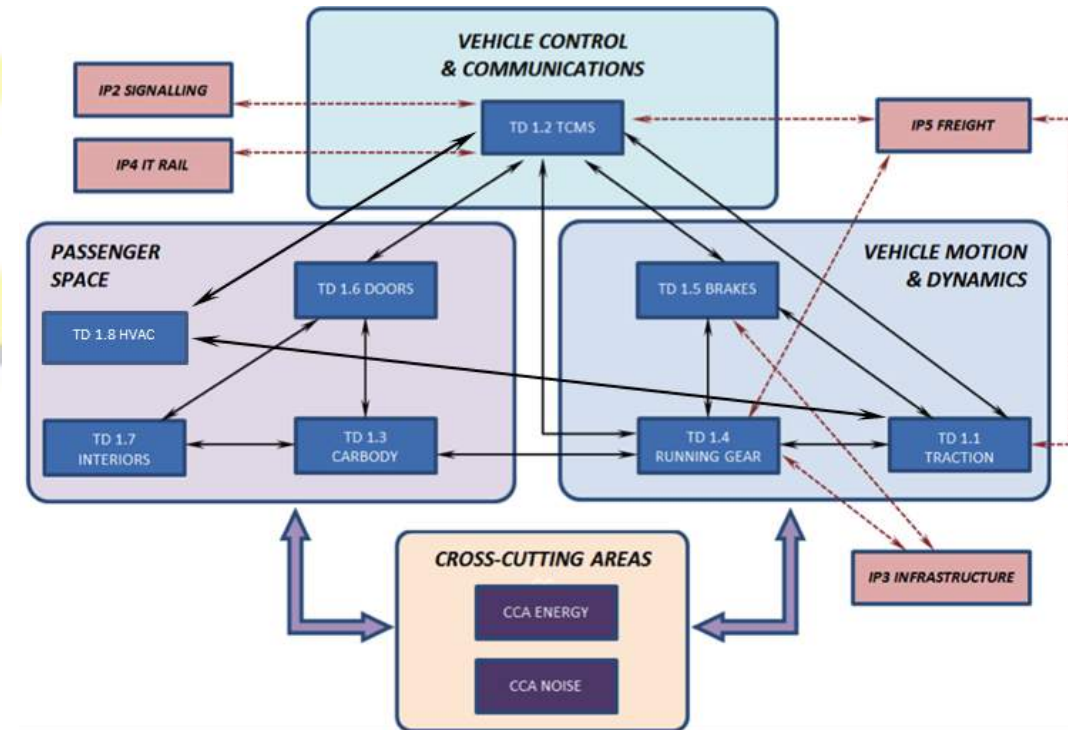
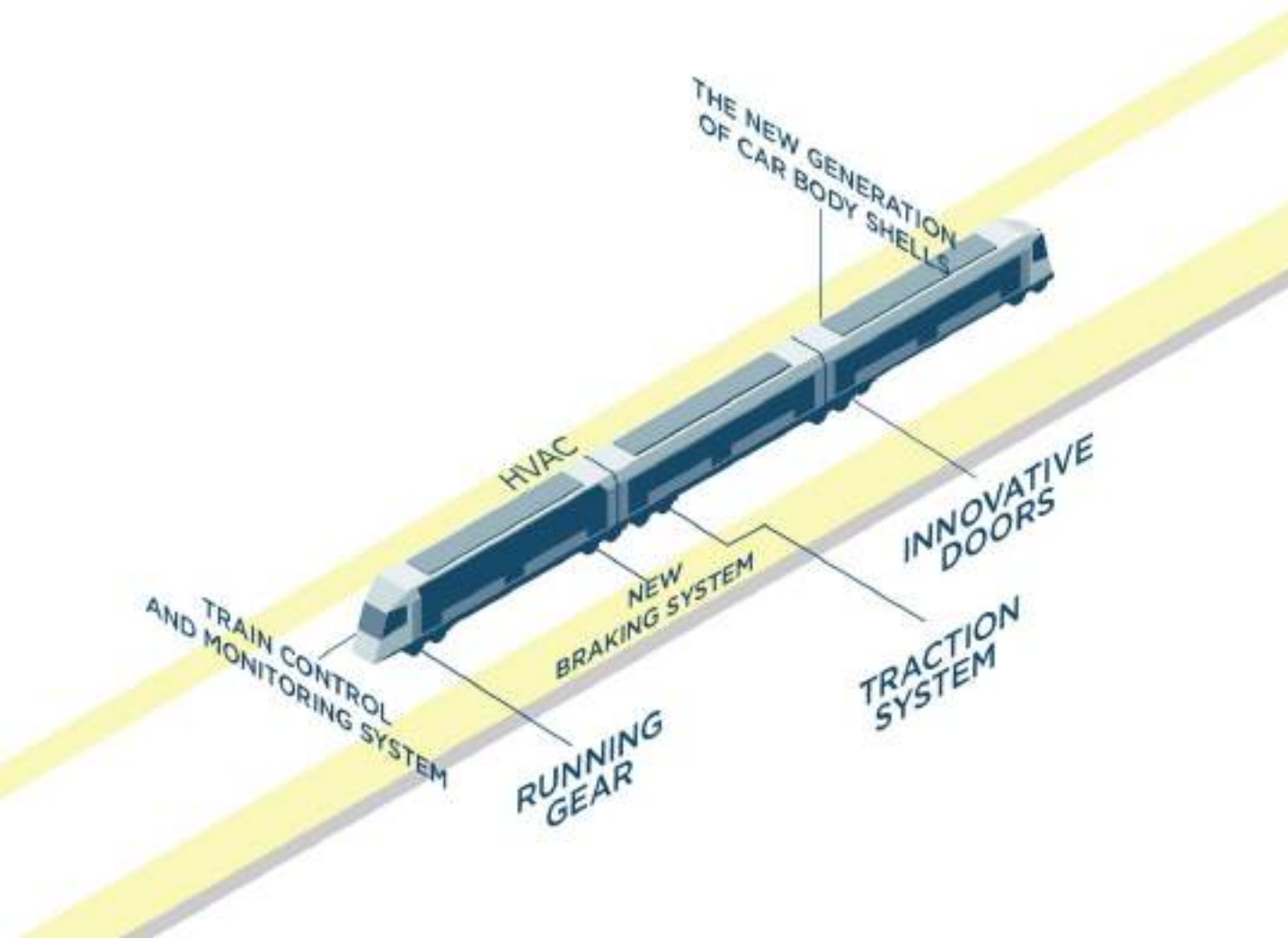


S2R Europe 2030 Research and Innovation beyond 2020



S2R R&I programme results

IP1: Cost-efficient and reliable trains, including high-capacity trains and high-speed trains



IP1: key achievements and ongoing activities

- ✓ **Traction:** Technical Demonstrator with innovative components for energy saving, weight and size reduction, using mainly SiC technology
 - ➔ up to 20% of Energy saving for Traction chain on Regional Platform
- ✓ **TCMS:** Wireless Technology for train communication network, Drive by Data and Functional Open Coupling concept.
 - ➔ Prove of concept for integration of SIL4 functions in TCMS, significant reduction of wires (Installation and Maintenance Costs)
- ✓ **Doors:** next gen doors, PRM access, noise attenuation and increased accessibility
- ✓ **Interiors:** new modularity concepts, easier upgrades



InnoTrans 18 – Virtual Coupling Demo

IP1: key achievements and ongoing activities

- ✓ **Carbody Shell and Running Gear:** Introduction of composite material for hybrid consist's structure.

➡ Weight reduction - impact on vehicle's payload -> capacity increase



Spoke Wheel for Metro Bogie

- Wheel wear (use of new materials) and rail wear
- Weight (by 10%)
- Noise emission



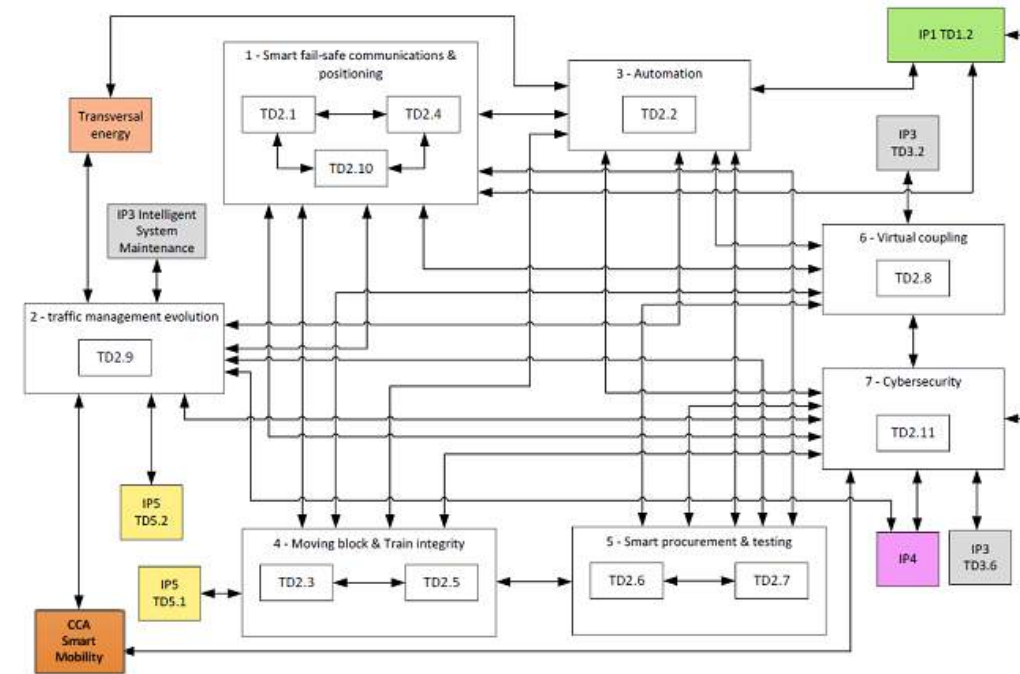
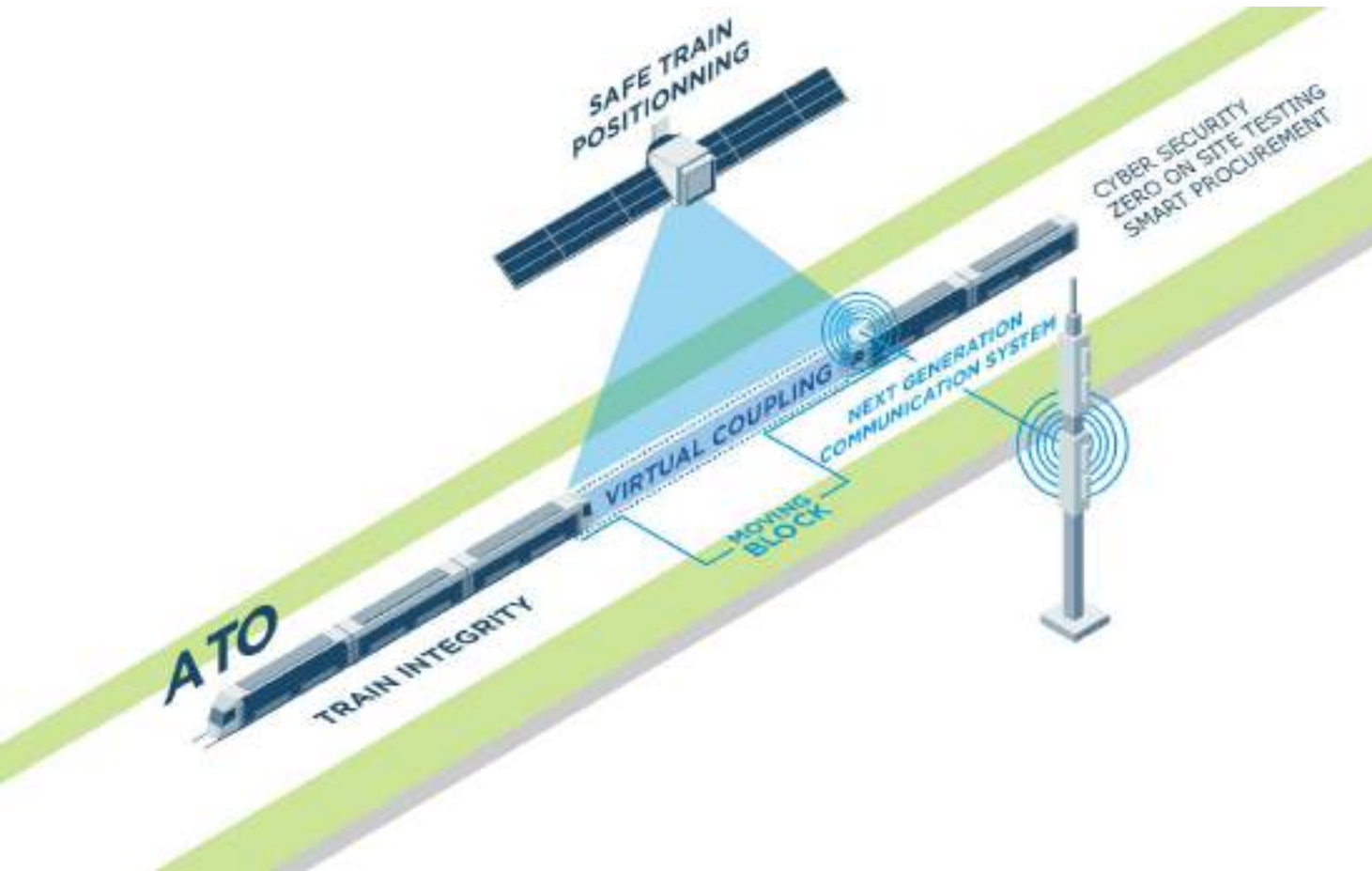
Antenna Beam

- Carbon Fibre laminate
- 13 kg vs 60 kg for conventional solution

- ✓ **Brakes :** Design of Electro-Mechanical Brakes, High SIL Electronics and wheelset slide protection.

- ➡ No pneumatic pipes for brakes management -> LCC
- ➡ Braking distance reduction in poor adherence, from +25% to 15%

IP2: Advanced Traffic Management and Control System



IP2: key achievements and ongoing activities

- ✓ **ATO for mainline railways;** GoA4 will reduce human error and increase service availability
 - ➔ GoA2 draft specifications available (reviewed by sector + ERA);
 - ➔ Pilot tests in first half of 2019;
 - ➔ Use cases/specifications for GoA4 are ongoing.
- ✓ **Moving Block** based on ERTMS/ETCS specifications and opportunity to remove trackside fixed signalling systems

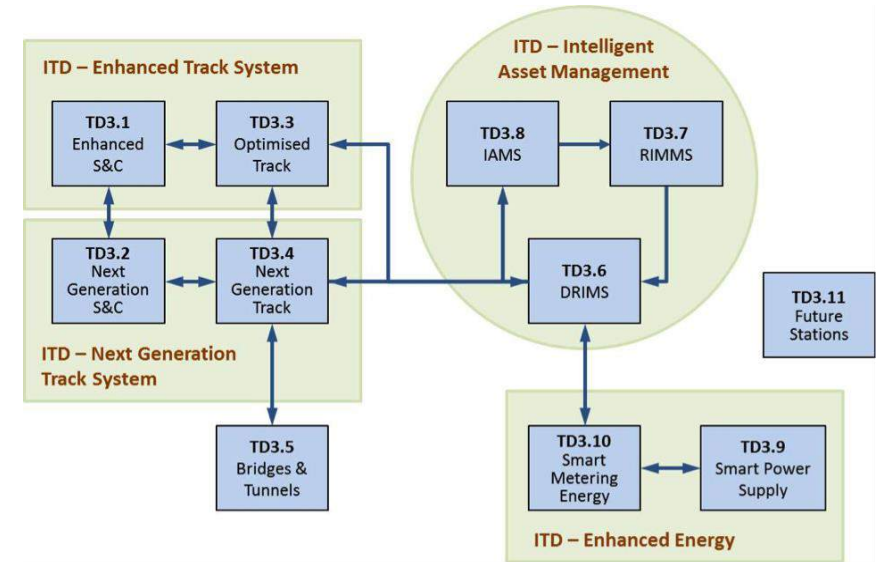
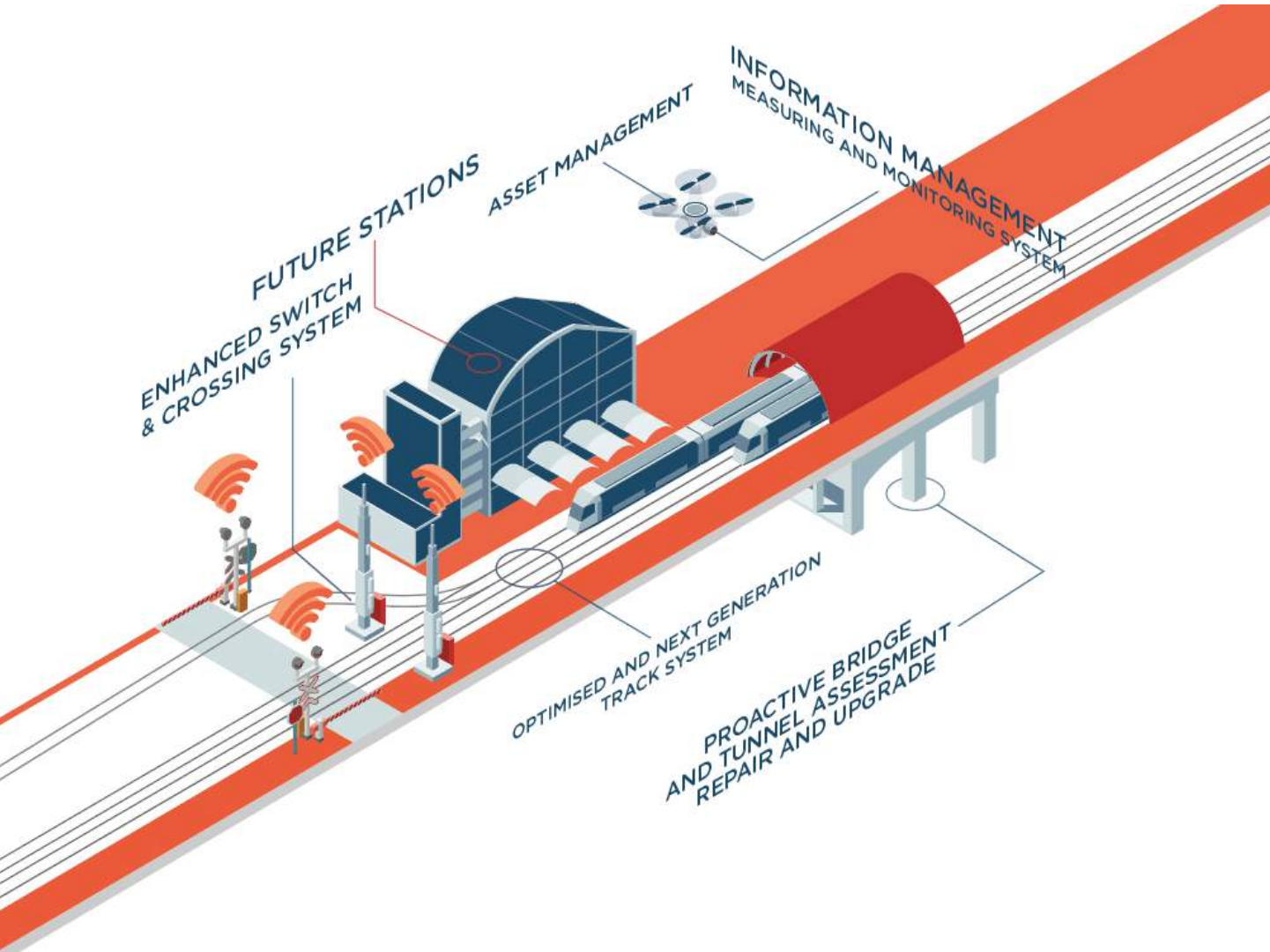


InnoTrans 18 – Moving Block demonstration in urban, suburban, high speed and freight traffic management

IP2: key achievements and ongoing activities

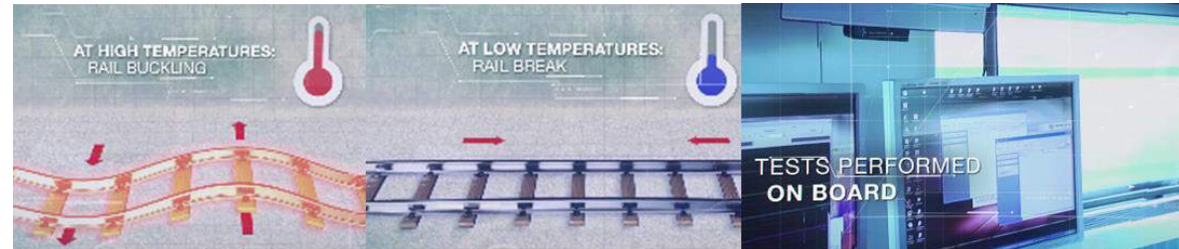
- ✓ **GNSS/positioning systems** applied to rail to remove physical balises and facilitating the application of moving block
 - ➔ System Requirements Specification and system architecture to be delivered
- ✓ **Adaptable communication for railways**, technology and bearer independent
 - ➔ Cooperation UIC FRMCS (+ ERA) on use cases;
 - ➔ Specifications development and prototypes preparation
- ✓ **New and dynamic control of train management** – based on Virtual Coupling and On-board intelligence
- ✓ **A new Railway System Architecture under preparation.**

IP3: Cost Efficient and Reliable High Capacity Infrastructure



IP3: key achievements and ongoing activities

- ✓ **Intelligent Asset Management:** Shift from reactive to proactive maintenance based on innovative monitoring/ measuring & processing technologies
 - ➔ Innovative technologies in asset measuring & monitoring (satellite, drones, robotics), data processing & decision support (IoT, Artificial Intelligence)
 - ➔ Demonstration & evaluation of asset management, maintenance strategies: Thermal Stress Monitoring, and Lean Tamping



- ✓ **Intelligent Energy Management:** mapping of all energy flows in railway system for management strategies. Future traction power supply system in integration with public grid
 - ➔ Proof-of-Concept in light-train environment (tramway)
 - ➔ Design of an intelligent substation, 66% savings on transmission losses, 25% reduction on dimensioning

IP3: key achievements and ongoing activities

✓ Optimized & Future Infrastructure Design:

✓ **Track and S&C System:** Analysis of deformation mechanisms & introduction of advanced capabilities to existing systems. Design of radically new designs & systems

➡ Novel concept for locking & detection capabilities

➡ Conceptual designs for radical switch actuation, locking and detection

✓ **Bridges & Tunnels:** Improved inspection & repair methods → service life extension, disruption time reduction, N&V reduction

➡ Digital Imaging for asset monitoring + BIM-based asset management for remaining life estimation & bridge prediction behavior

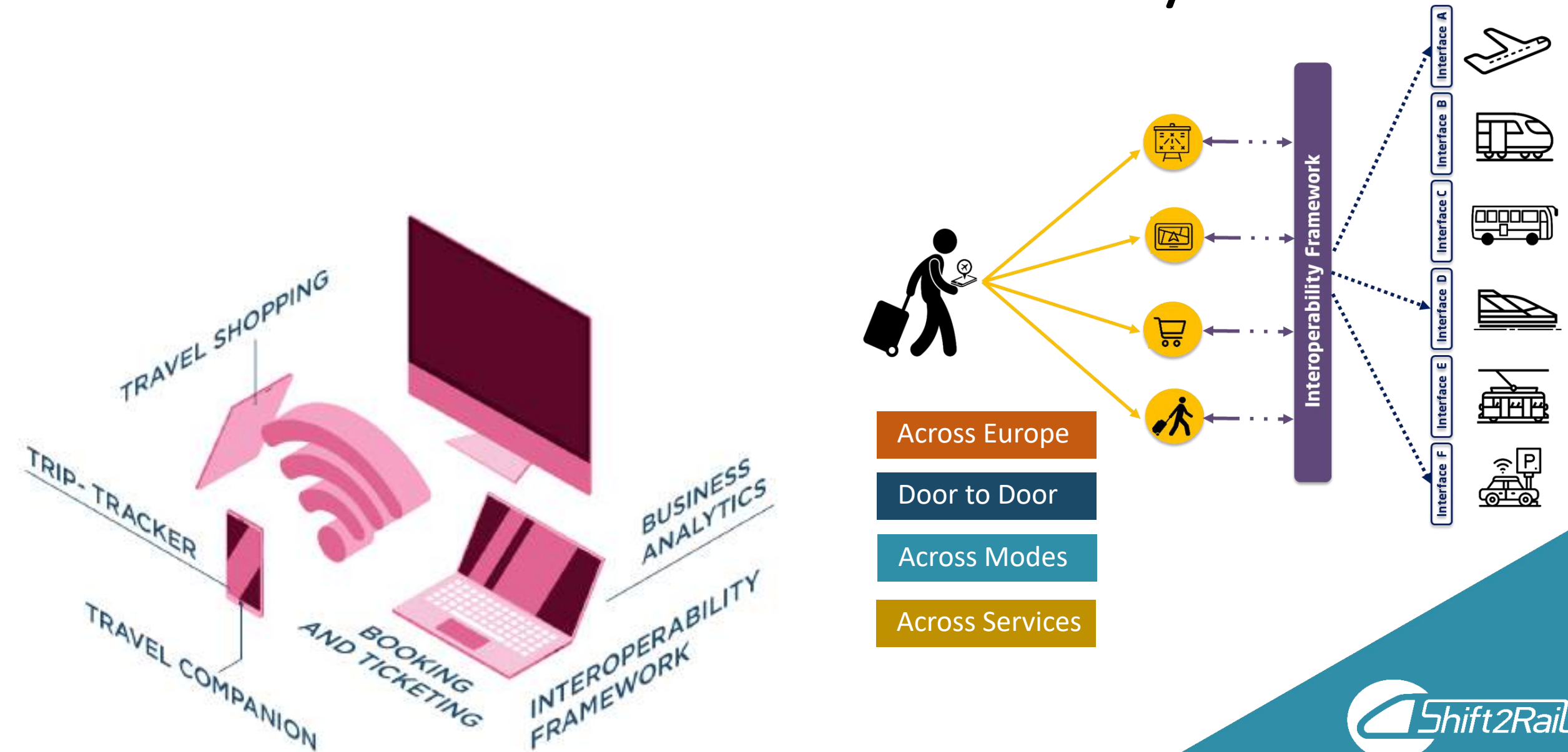
➡ Investigation of bridge-rolling stock interface & contribution to standards

✓ **Stations:** New designs enhancing mobility, accessibility & crowd management

➡ Analysis of the passenger needs and expectations at railway stations

➡ Conceptual design of Platform-Train Interface (PTI) solution

IP4: IT Solutions for Attractive Railways Services



IP4: key achievements and ongoing activities

- ✓ **Interoperable framework:** semantic based IT solution capable of making interoperable different databases using different standards, without the need of changing the legacy systems – creating a multimodal framework

- ➔ First converter demonstrating semantic interoperability using FSM and TAP-TSI
- ➔ Enhance the Interoperability Framework with AI

- ✓ **Multimodal travel services:** providing to the passenger the easy interface, masking the complexity of technical and financial interaction among the several services provider, for shopping, booking and retrieving their right to travel

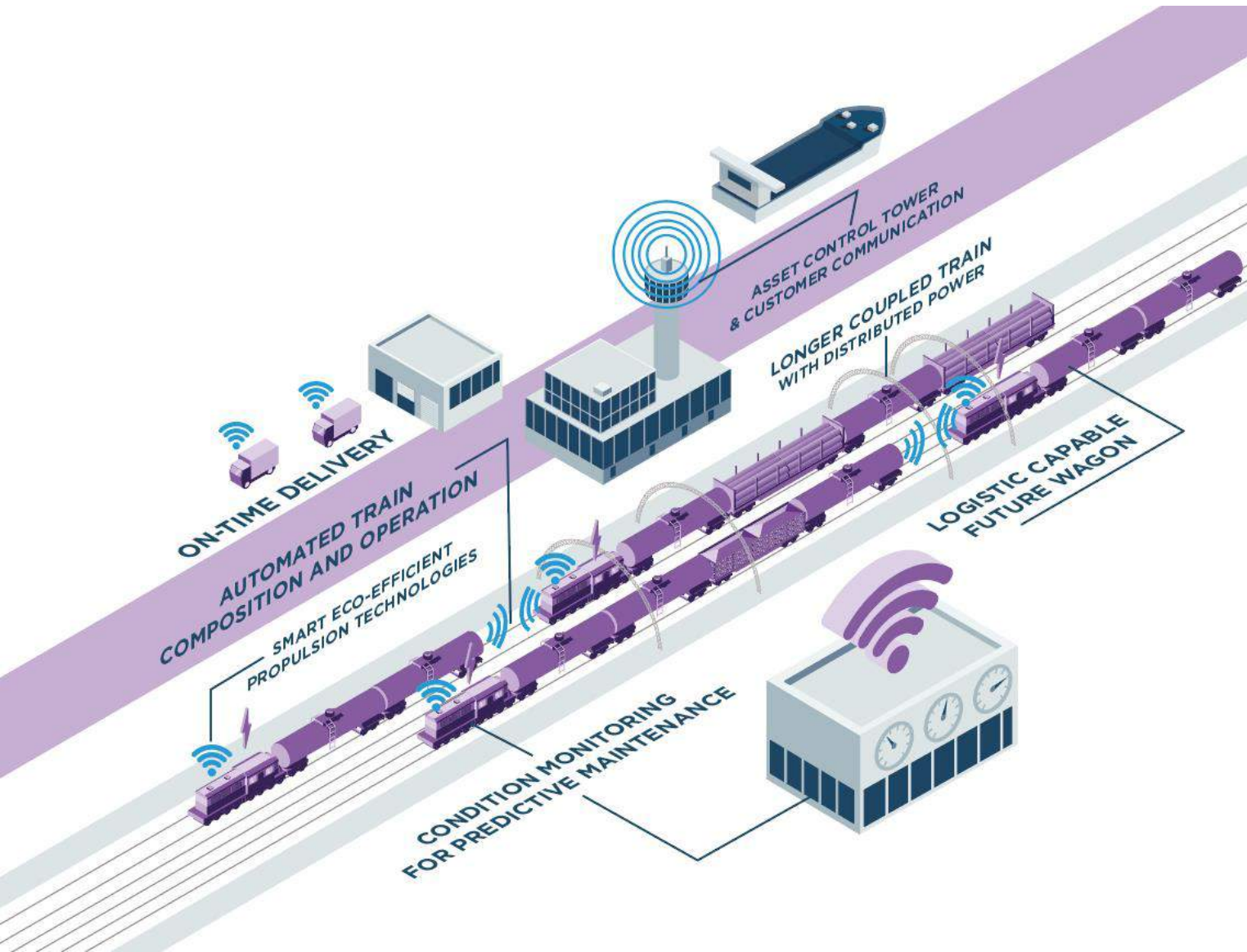
- ➔ First demonstration of the IP4 ecosystem at Innotrans 2018



IP4: key achievements and ongoing activities

- ✓ **Customer experience applications:** providing to the user the engine to search its travel accordingly to his/her specific needs/preferences + providing an useful companions guiding the user across the right platform or across a service disruption through an automatic re-routing, etc.
 - ➔ inclusion of new Mobility Services in the ecosystem
 - ➔ Starting on MaaS, for a European « roaming service »
- ✓ **Business analytics:** providing to the operating companies the means to understand and adapt their offer to a real time multi-modal demand

IP5: Technologies for Sustainable & Attractive European Rail Freight



IP5: key achievements and ongoing activities

- ✓ **Fleet Digitalisation/Automation:** automatic coupling (flexible wagon composition), CBM (data handling, analytics and dashboards), ATO/DAS (testing of ATO developed in IP2)

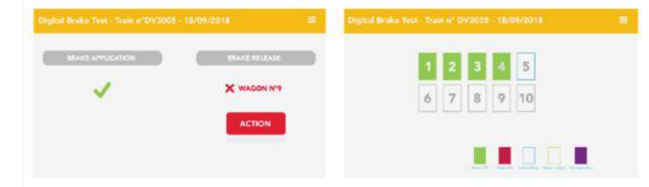
➔ Multi-sensor obstacle detection up to 1km

- ✓ **Transport Management:** IT solutions electronic communication technologies to maximise punctuality and capacity.

➔ Intelligent Video Gate for high speed wagon scan and multi modal dispatching

- ✓ **Freight waggon concepts:** Low-noise, lightweight, high speed & track friendly Freight Running Gear & Modular lightweight freight wagon design

➔ Automatic brake test and a new silence wheelset



- ✓ **Freight Propulsion systems:** New freight locomotives with network independent operation capabilities, supporting increased train lengths up to 1500m, energy reduction

➔ Demo on 740m long train: 2 locos being remotely controlled by the leading one (next step: 4 locos and increased length)

CCA: Cross Cutting Activities



CCA: key achievements and ongoing activities

- ✓ **Long-term needs and socio-economic research:** to what extent rail can be a catalyst in transformational societal changes
 - ➔ Specifications for the 4 S2R System Platform Demonstrators (SPDs) high-speed, regional, urban passenger rail (metro) and rail freight
- ✓ **KPI method development:** based on the 3 quantitative KPIs of the S2R regulation and assessment of the S2R innovation technologies against those
 - ➔ High-level KPI architecture is completed and the first quantification is under assessment
- ✓ **Safety, Standardisation, Smart Maintenance, Smart Materials & Virtual certification**
 - ➔ Standardisation Rolling Development Plan lists the potential needs and opportunities of the S2R innovations those feeds into standardisation

CCA: key achievements and ongoing activities

- ✓ **Noise & Vibration:** N&V management to be applied on an overall system approach and enable mitigation actions
 - ➔ Auralisation and visualisation technology InnoTrans
 - ➔ 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
- ✓ **Human Capital:** management of technological & demographical Changes from the human factor's aspect
 - ➔ Impacts of the S2R innovations on rail employment and future skills
- ✓ **I2M:** Integration layer for data exchange between traffic management system, freight operations and asset management services
 - ➔ Use-cases and business rules for high-efficient freight operations



Shift2Rail IPx: new railway Capabilities for the next generation of railway system

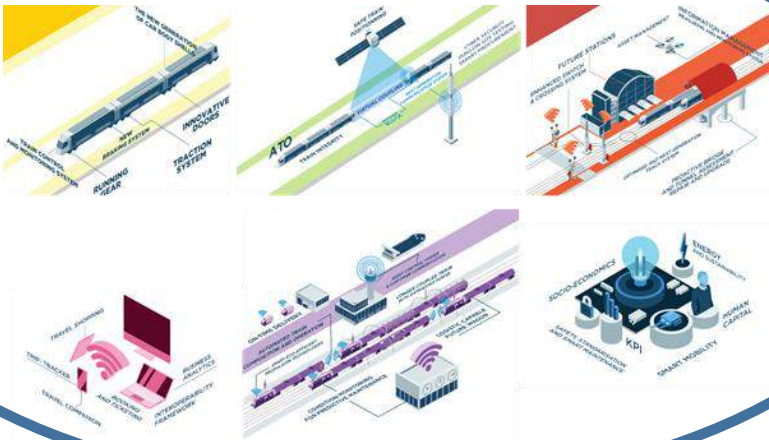
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IPx: looking beyond S2R currently planned technology applications and integrating them with disruptive innovations

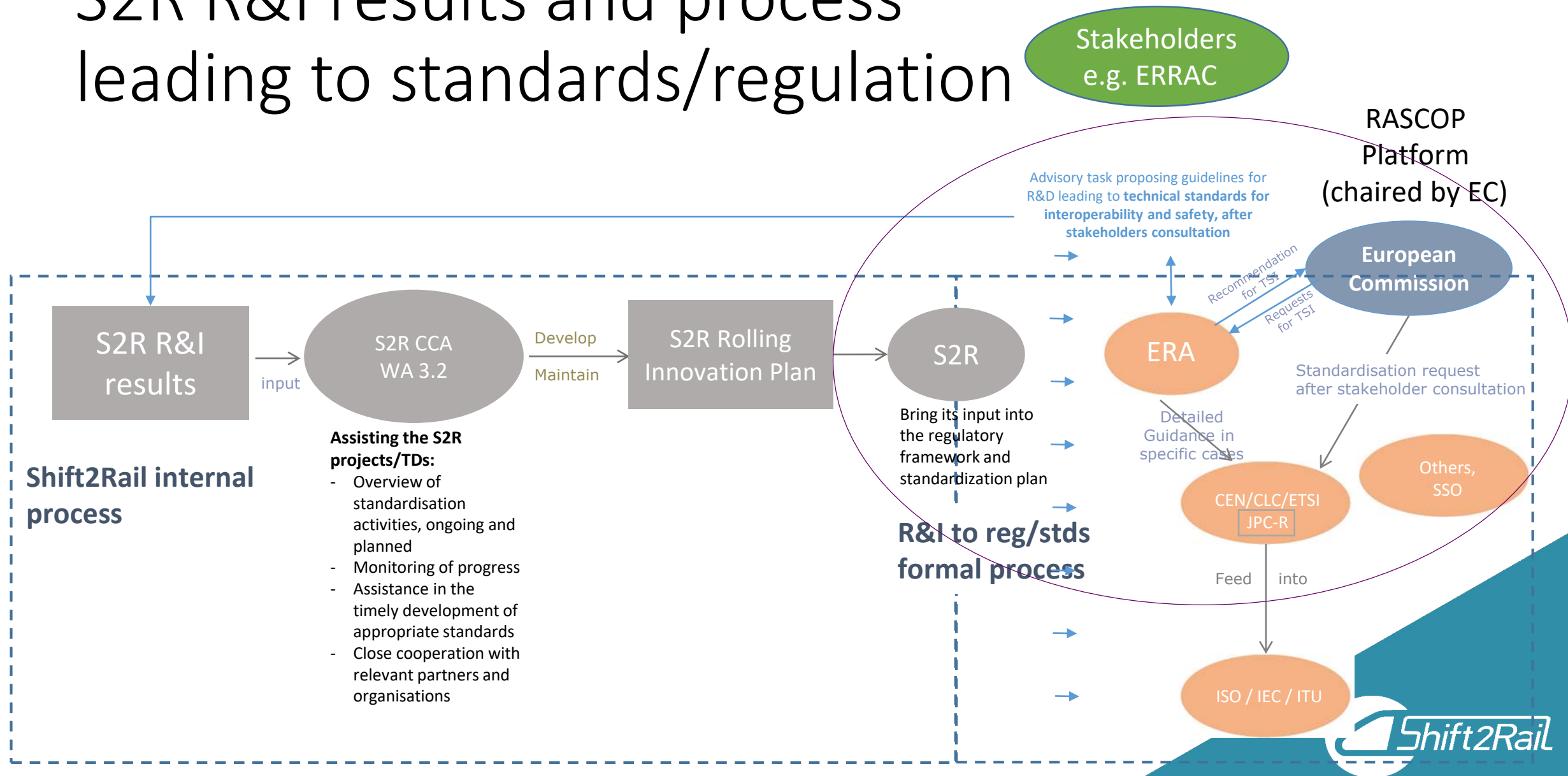
Activities just started or to be started

- ✓ Arising and promising disruptive technologies (e.g. A.I., robotics) :
 1. Concepts for the future **autonomous railway vehicles** “train-centric”
 2. Promising disruptive technologies impacting **automation systems and maintenance concepts**
 3. **Full system** and life-cycle analysis on concepts as mobility as a service (**MaaS**), **industry 4.0** (automated industry and industry as a service), railway clouds and **decentralised** ownership
- ✓ S2R System Architecture and Conceptual Data Model (2019 call):
 1. aligning all ongoing modelling initiatives in terms of modelling principles and digital data exchange format
 2. comprehensive model/architecture, technologies and strategy for implementation of a new comprehensive railway system approach



S2R R&I results and process leading to standards and regulation

S2R R&I results and process leading to standards/regulation



FOUNDING MEMBERS



ALSTOM

Ansaldo STS A Hitachi Group Company

BOMBARDIER

CAF

NetworkRail

SIEMENS

THALES

TRAFIKVERKET

ASSOCIATED MEMBERS

amadeus



indra

kapsch



KNORR-BREMSE

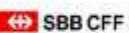
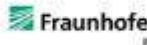


Virtual Vehicle Austria consortium+
(VVAC+)

European Rail Operating
community Consortium (EUROC)

SwiTracken consortium

Smart DeMain (SDM) consortium



AERFITEC

Competitive Freight Wagon
Consortium (CFW)

Smart Rail Control
(SmartRaCon) consortium

