EU Brokerage Event Shift2Rail - Calls 2019

@Shift2Rail_JU
#Horizon2020

Shift2Rail

S2R OBJECTIVES

+50% **INCREASE** RELIABILITY & PUNCTUALITY **BY 50%**

x2 **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

28
MEMBERS

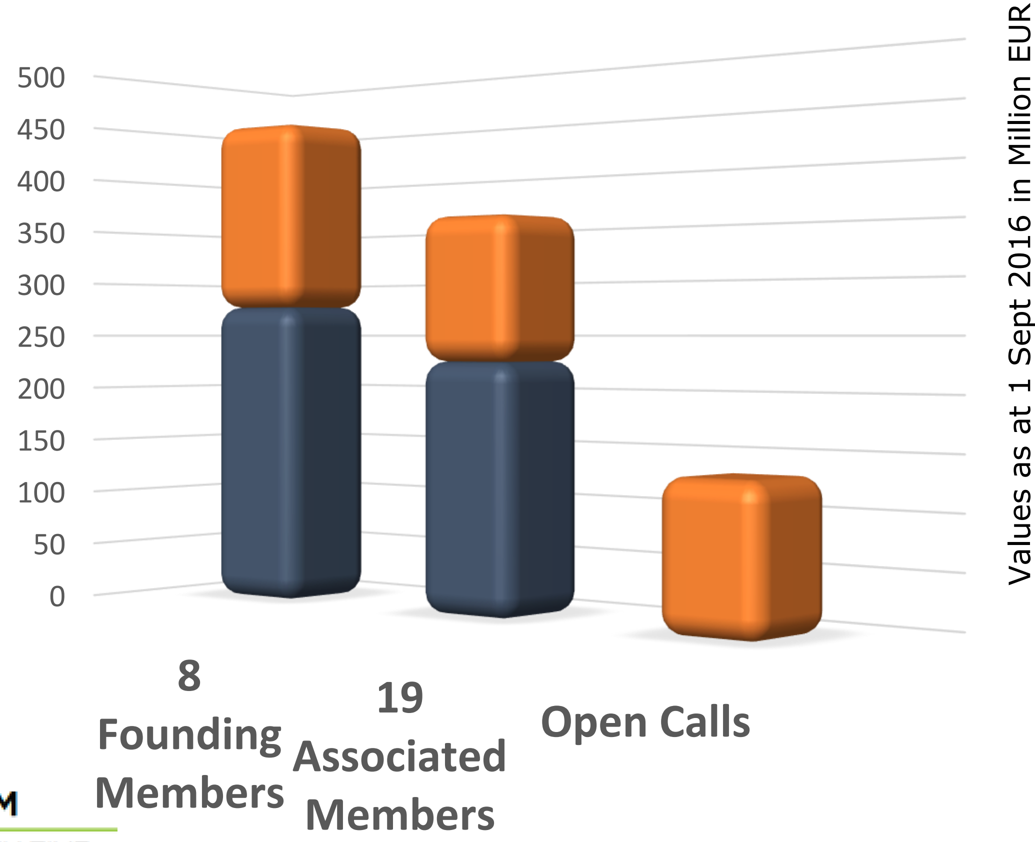
343
PARTICIPANTS INVOLVED
FROM **27** COUNTRIES

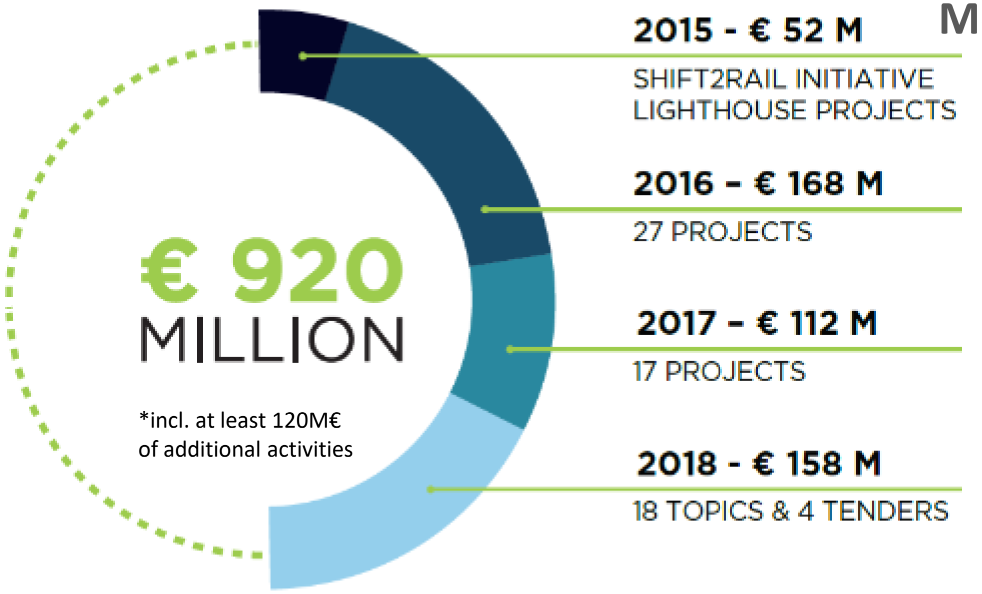
92
SMEs

84
RESEARCH CENTRES
AND UNIVERSITII

[1]Data extracted from CORDA database in April, 2018

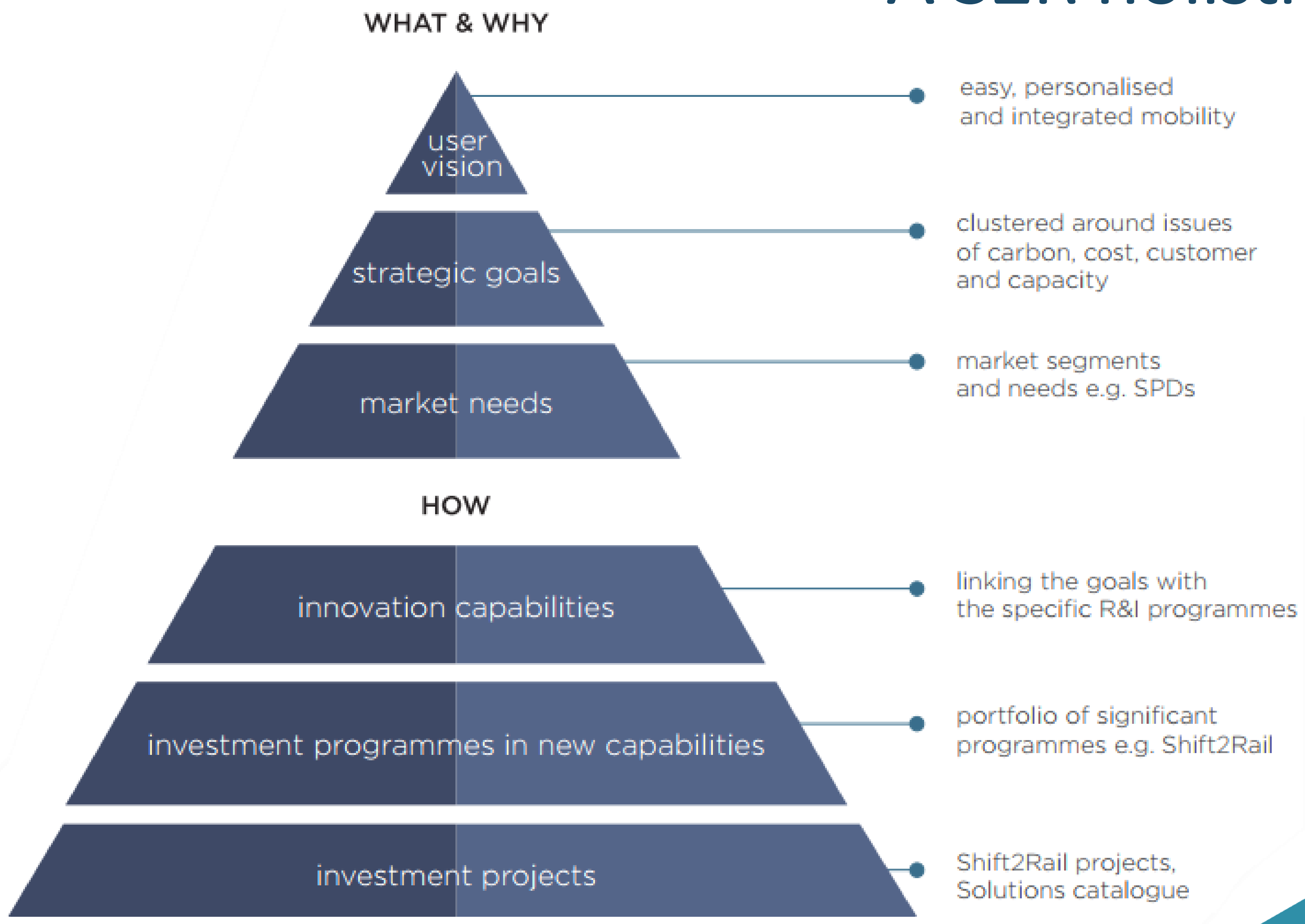
AN OPEN and ACTIVE ORGANISATION

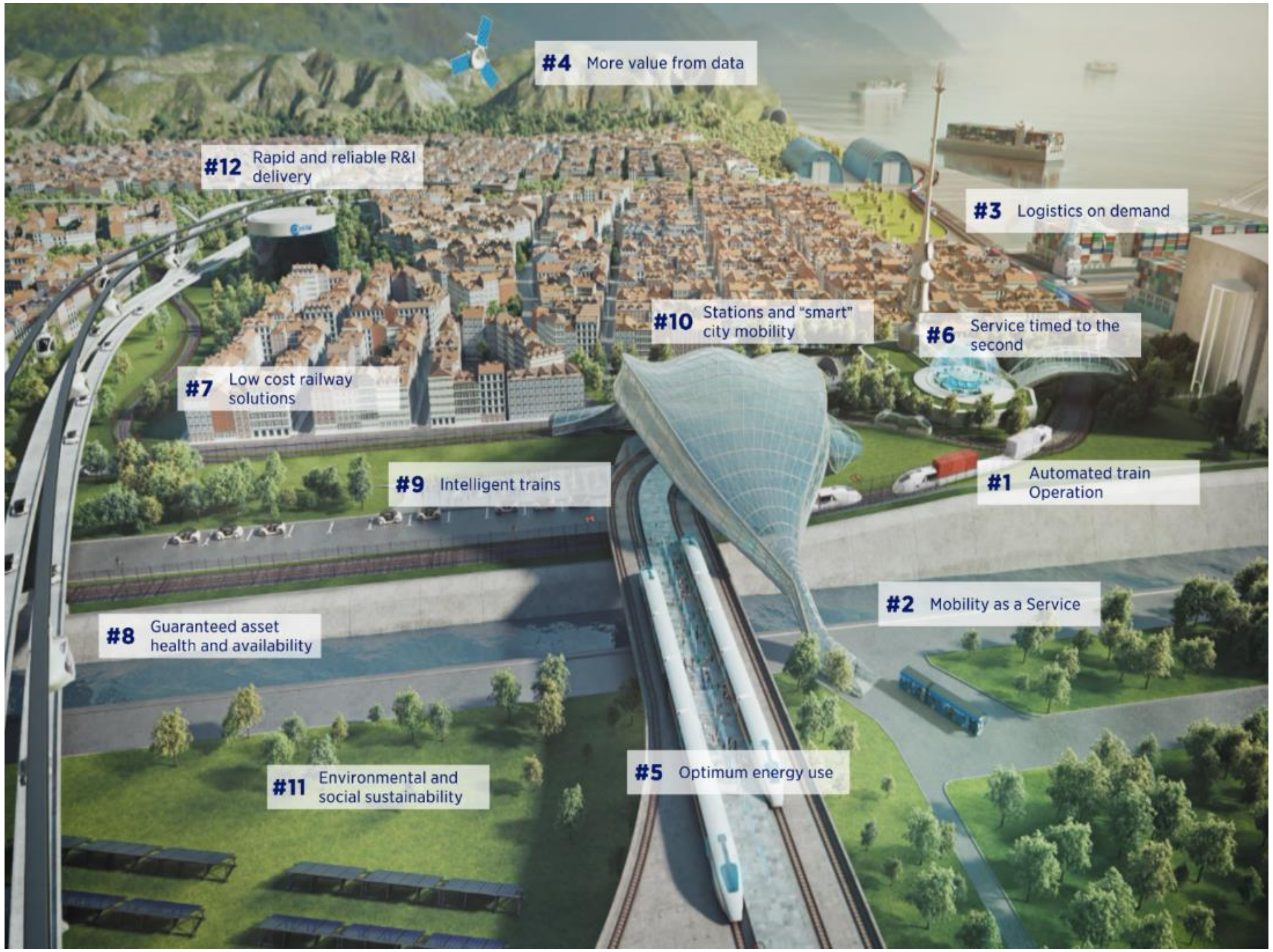




USER FIRST

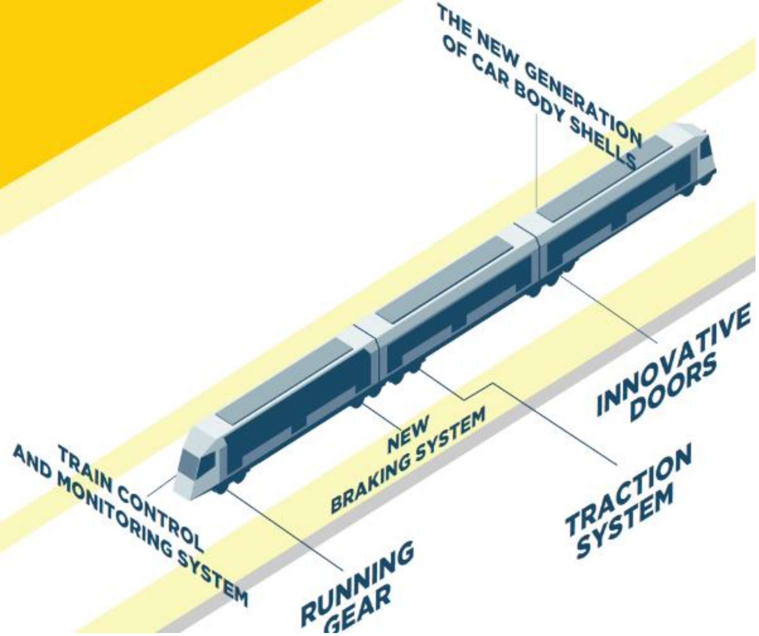
A S2R holistic approach…

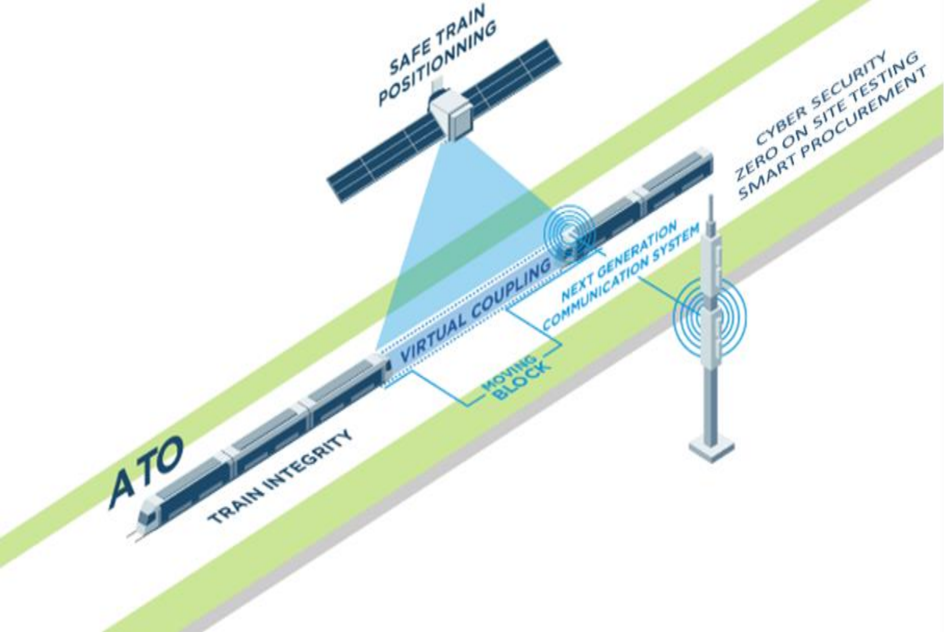


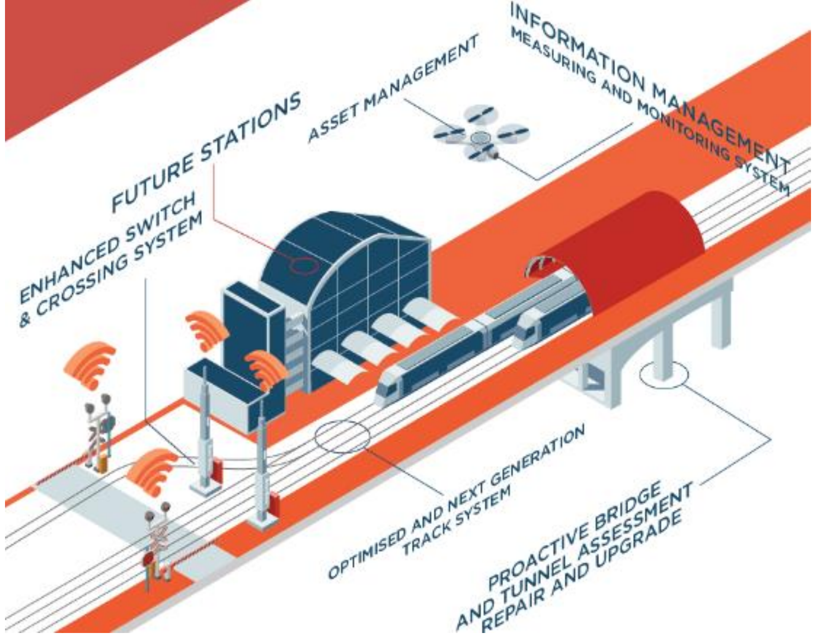


…opening up new Capabilities coming from emerging technologies or concepts!

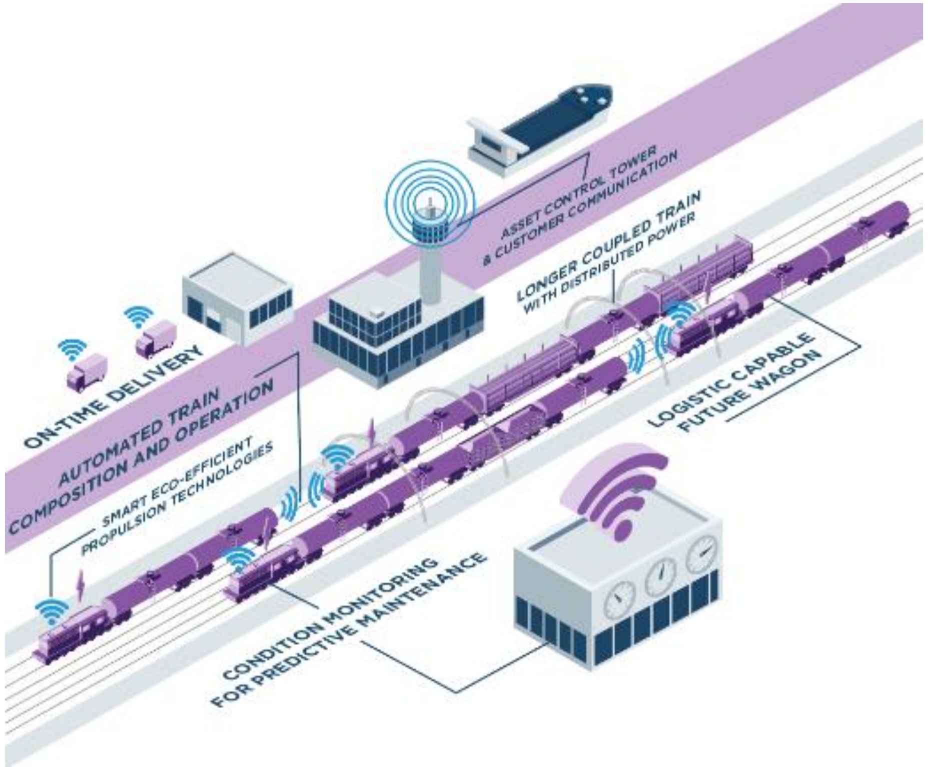
IPs and CCA

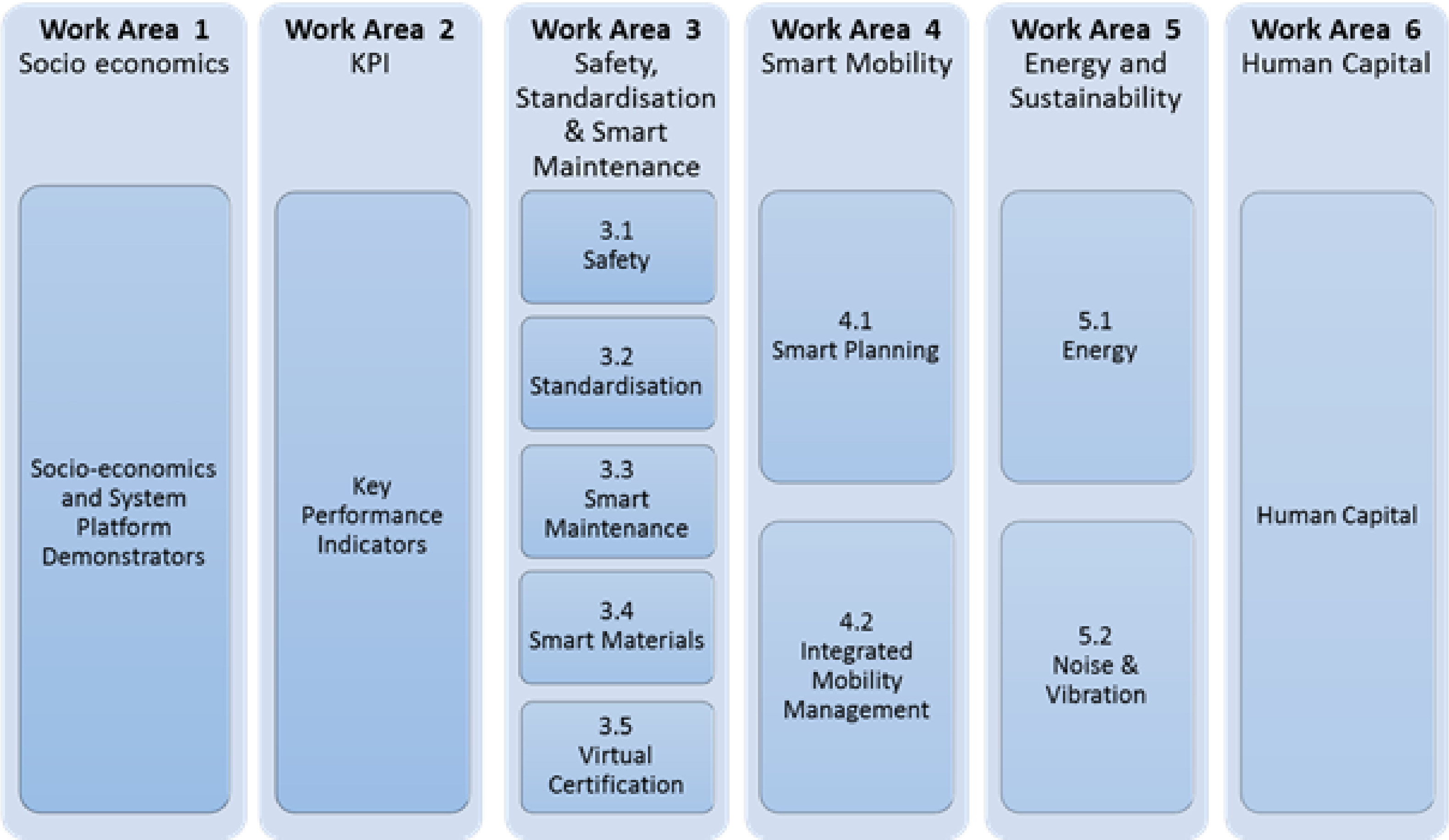

THE NEW GENERATION OF CAR BODY SHELLS
INNOVATIVE DOORS
NEW BRAKING SYSTEM
TRACTION SYSTEM
TRAIN CONTROL AND MONITORING SYSTEM
RUNNING GEAR


SAFE TRAIN POSITIONNING
CYBER SECURITY
ZERO ON SITE TESTING
SMART PROCUREMENT
VIRTUAL COUPLING
NEXT GENERATION COMMUNICATION SYSTEM
MOVING BLOCK
ATO
TRAIN INTEGRITY


INFORMATION MANAGEMENT
MEASURING AND MONITORING SYSTEM
ASSET MANAGEMENT
FUTURE STATIONS
ENHANCED SWITCH & CROSSING SYSTEM
OPTIMISED AND NEXT GENERATION TRACK SYSTEM
PROACTIVE BRIDGE AND TUNNEL ASSESSMENT REPAIR AND UPGRADE


TRAVEL SHOPPING
TRIP- TRACKER
BUSINESS ANALYTICS
TRAVEL COMPANION
BOOKING AND TICKETING
INTEROPERABILITY FRAMEWORK


ASSET CONTROL TOWER & CUSTOMER COMMUNICATION
LONGER COUPLED TRAIN WITH DISTRIBUTED POWER
ON-TIME DELIVERY
AUTOMATED TRAIN COMPOSITION AND OPERATION
SMART ECO-EFFICIENT PROPULSION TECHNOLOGIES
LOGISTIC CAPABLE FUTURE WAGON
CONDITION MONITORING FOR PREDICTIVE MAINTENANCE


Work Area 1
Socio economics
Socio-economics and System Platform Demonstrators
Work Area 2
KPI
Key Performance Indicators
Work Area 3
Safety, Standardisation & Smart Maintenance
3.1 Safety
3.2 Standardisation
3.3 Smart Maintenance
3.4 Smart Materials
3.5 Virtual Certification
Work Area 4
Smart Mobility
4.1 Smart Planning
4.2 Integrated Mobility Management
Work Area 5
Energy and Sustainability
5.1 Energy
5.2 Noise & Vibration
Work Area 6
Human Capital
Human Capital

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Draft AWP 2019 and S2R Call

Draft AWP 2019 and Call for proposals 2018

Million of EUR	Total	Members only (and affiliated entities)	Open to non-Members
Value of the Call for Proposals R&I	150.3	134.1	21.1
S2R Maximum Co-funding	*76.8*	*57.5*	*19.3*
In-Kind Contribution	*73.4*	*71.9*	*1.5*
No of topics	18	6	12
Value of Call for tender R&I	1.9	N/A	N/A
No of topics	3	N/A	N/A

Follow S2R website under Participate: www.shift2rail.org

Any question related to the call must be address through the functional mailbox
info-call@s2r.europa.eu

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Draft AWP2019 S2R Programme specificities

How to read the topics acronyms

Topic number – IP	Topic name *(*) indicative figures in EUR*	Action Type and expected Technical Readiness Level (TRL)	Maximum S2R co-funding (*)	Complementarity
S2R-OC-IPX-01-2019	What AI can do for the railway sector	RIA, up to TRL 2/3	xxxxx	xxxxx

Number	IP1	IP2	IP3	IP4	IP5	CCA	IPX
CFM topic	1	1	1	0	1	1	1
OC topic	3	2	1	1	2	1	2
Linked tender topic		*1*		*(1)*	*(1)*		*(1)*

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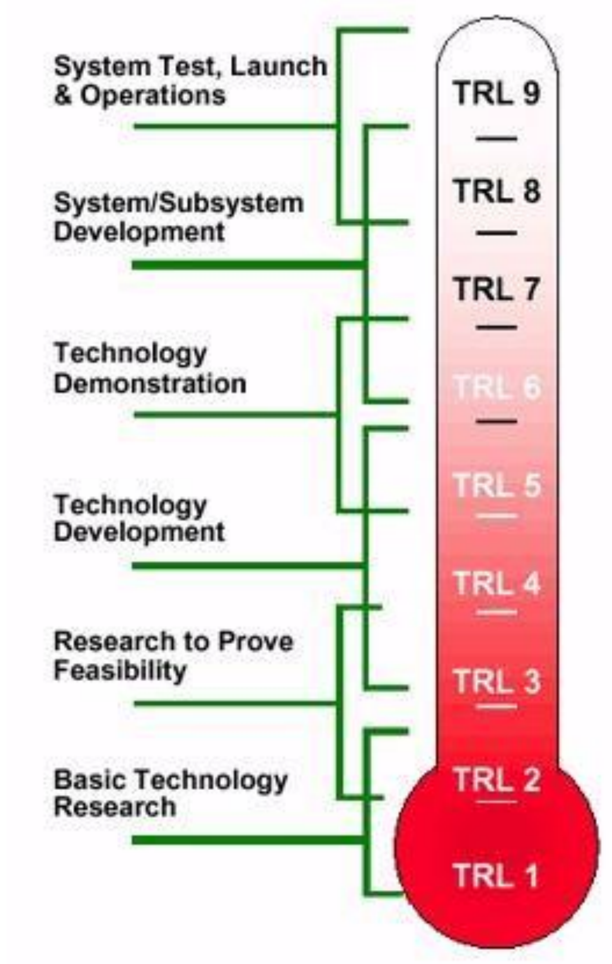
Technology Readiness Levels definition



HORIZON 2020 – WORK PROGRAMME 2018-2020
General Annexes

Where a topic description refers to a TRL, the following definitions apply, unless otherwise specified:

- TRL 1 – basic principles observed
- TRL 2 – technology concept formulated
- TRL 3 – experimental proof of concept
- TRL 4 – technology validated in lab
- TRL 5 – technology validated in relevant environment (industrially relevant environment in the case of key enabling technologies)
- TRL 6 – technology demonstrated in relevant environment (industrially relevant environment in the case of key enabling technologies)
- TRL 7 – system prototype demonstration in operational environment
- TRL 8 – system complete and qualified
- TRL 9 – actual system proven in operational environment (competitive manufacturing in the case of key enabling technologies; or in space)

Programme approach and future/current projects

Programme approach, future/current projects

- EACH PROJECT contributes to the **achievement of the Master Plan and the MAAP objectives**
- EACH PROJECT is part of a programme and **cooperation with other projects** must be ensured

  → Through the **collaboration and input to the JU Members,** EACH PROJECT will support the realization of **long-term S2R technological demonstrations or innovative break-through**

- Particular attention is given to ensure that there is **no duplication of work** between EACH PROJECT and current/future R&I activities
- EACH PROJECT results are taken into consideration for the next annual work plans to ensure sufficient **complementarity** and **coherence**

Complementarity & Collaboration Agreement

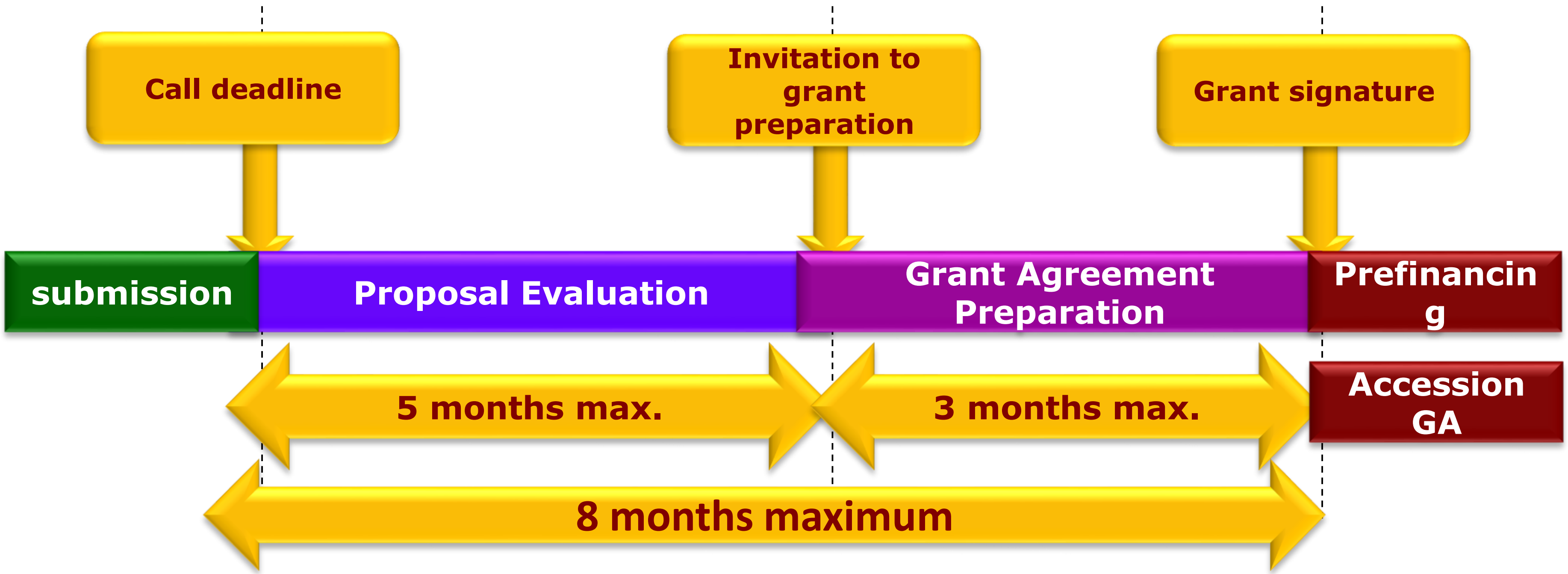
1. Complementary is **defined at topic level**
2. Complementarity between topics is **compulsory established in the Grant Agreement** (need for a Collaboration Agreement)
3. IP/CCA SteCos, high level synchronization points: Project Coordinators may attend the SteeCo meetings as observer and IP Coordinators cooperate with project coordinator to **foster/promote synergies**
4. S2R Programme Managers: Central Contact Point for both projects

Complementarity & Collaboration Agreement

Issues to be tackled in the Collaboration Agreement (COLA) (examples/non-exhaustive list)

- Rules for collaboration, “who does what?”; Point of Contacts etc.
- Handling review of documents
- Agreement on action to be performed by both sides + linked timing (e.g. project A provides “user requirements” by M6 to project B; project B provides input by M18 to project A → project A uses input for deliver their deliverable 2.3).
- Participation to restricted meetings (for specific purpose) or to public meetings (including Advisory Groups, etc…).

Overview of the standard call process



H2020 max. duration to Grant signature:

- Maximum **five months** from call closure date to end of evaluation - until the date of informing applicants
- Maximum **three months** to prepare grant agreement from the date of inviting (informing) applicants until the signature of the grant agreement
- Maximum **eight months** from call closure - until the signature of the grant agreement

who can participate?

- **Standard H2020 eligibility conditions**:
  - 'Research and Innovation Actions' (**RIA**) and 'Innovation Actions' (**IA**): **Minimum three** legal entities established in **minimum three different Member States or an Associated Countries**
  - 'Coordination and Support Actions' (**CSA**): **one** or more legal entity(ies) established in a Member State or in an Associated Country

  ➔ Other entities from countries outside a Member State or Associated Country may participate to the open calls, but are, in principle, not eligible for funding unless there is a reciprocal agreement in place with that country or the applicant can demonstrate that the entity has unique resources that render its participation essential for the project to go ahead successfully

- **Additional conditions of S2R (Art 9(5) of H2020 RfP & Art. 17 S2R Regulation):**
  - Calls for members: Open only to members of the S2R JU and their affiliated entities
  - Open calls: Open only to entities that are not members or affiliated entities of members of the S2R JU

who can participate?

- **Who are the affiliated entities of the S2R JU members?**
  - Any legal entity that is **under the direct or indirect control** of a member (or, in the case of consortia, a constituent entity of the consortium), or **under the same direct or indirect control** as the member (or constituent entity of the consortium), or that is **directly or indirectly controlling a member** (or constituent entity of the consortium)
  - The control may take in particular either of the following forms:
    - direct or indirect holding of more than 50% of the nominal value of the issued **share capital** in the legal entity concerned, or of a majority of the **voting rights** of the shareholders or associates of that entity or
    - the direct or indirect holding, in fact or in law, of **decision-making powers** in the legal entity concerned.
  - The following relationships between legal entities do not constitute control relationships:
    - the same **public** investment corporation, institutional investor or venture-capital company has a direct or indirect holding of more than 50% of the nominal value of the issued share capital or a majority of voting rights of the shareholders or associates;
    - the legal entities concerned are owned or supervised by the same **public body**.

FOUNDING MEMBERS

ASSOCIATED MEMBERS

Virtual Vehicle Austria consortium+ (VVAC+)	European Rail Operating community Consortium (EUROC)	Swi'Tracken consortium	Smart DeMain (SDM) consortium

AERFITEC	Competitive Freight Wagon Consortium (CFW)	Smart Rail Control (SmartRaCon) consortium

funding rates

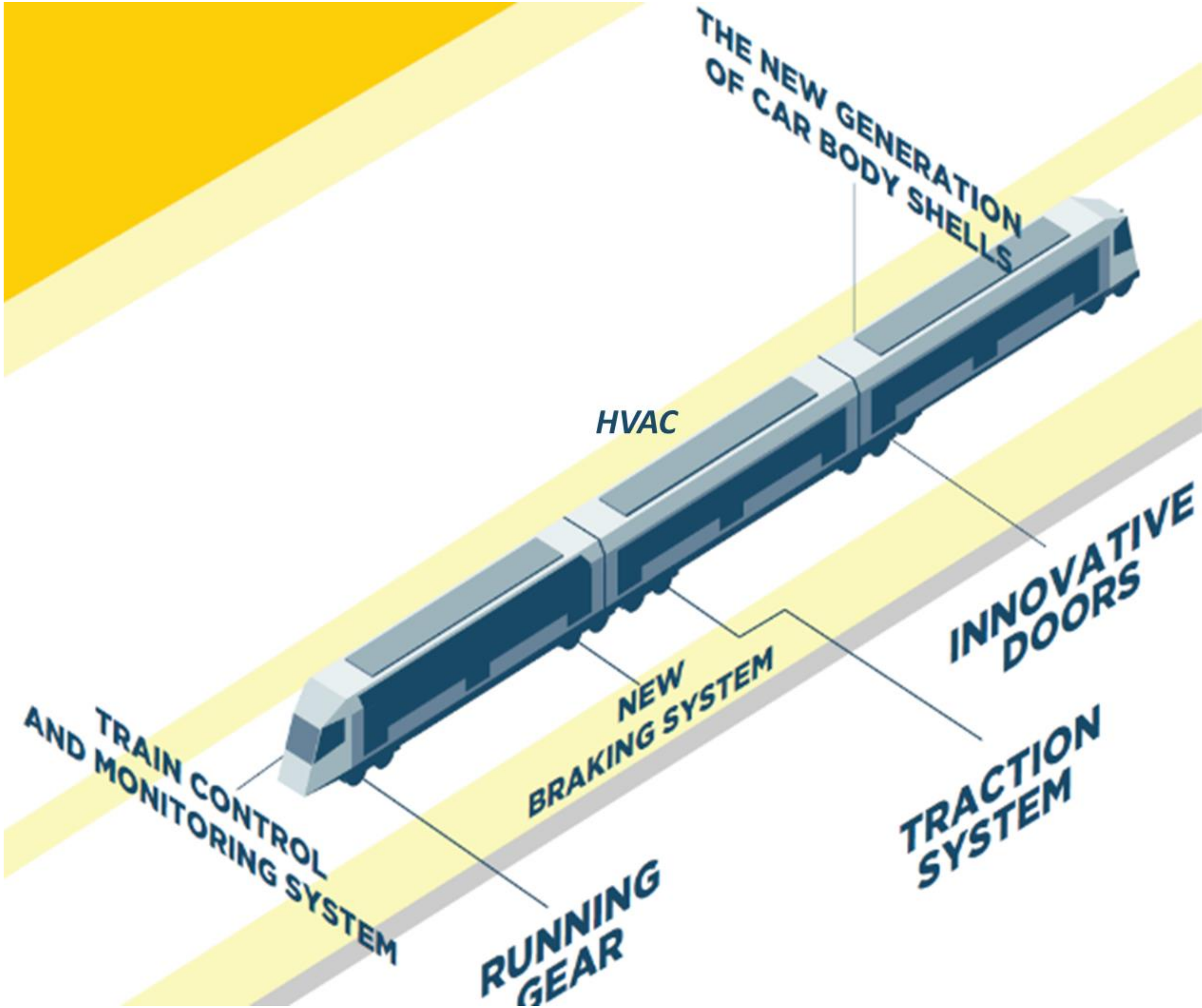
- **Applicable funding rates for the open calls:**
  - Funding rate depending on the type of action:
    - Up to 100% of eligible costs for 'Research and Innovation Actions' (RIA) and for 'Coordination and Support Actions' (CSA)
    - Up to 70% for 'Innovation Actions' (IA), except non-profit organisations (up to 100%)
  - One project = One funding rate for all beneficiaries / activities in the grant*

    *However, if non-profit organisations are in an IA together with for-profit organisations, their eligible costs will be reimbursed according to the different reimbursement rates specified above

The reimbursement rates apply to all forms of costs, including indirect costs (overheads): 25% flat rate (calculated on the basis of eligible direct costs, excluding direct sub-contracting costs)

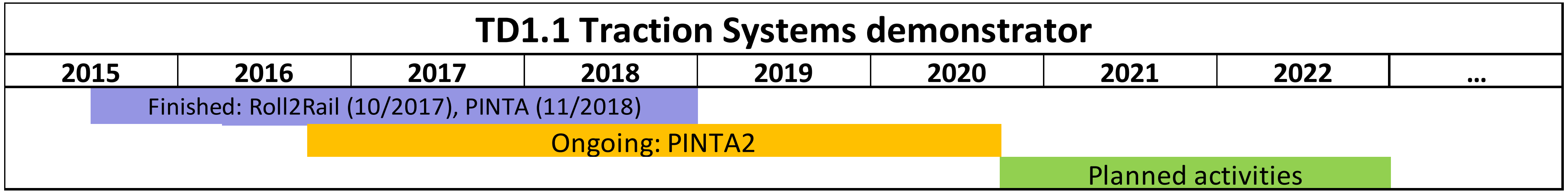
Overview of the different IPs and CCA activities

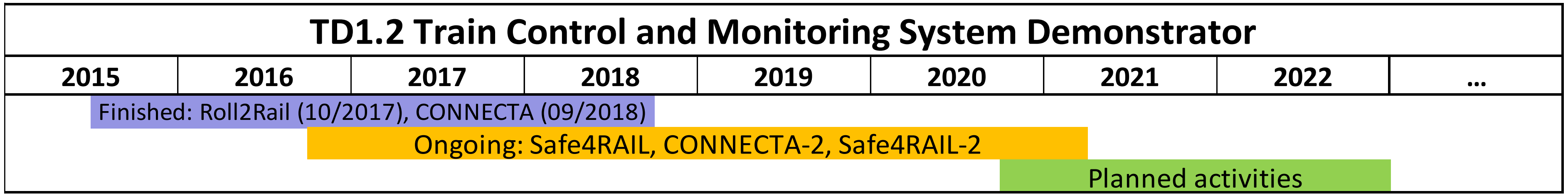
Shift2Rail

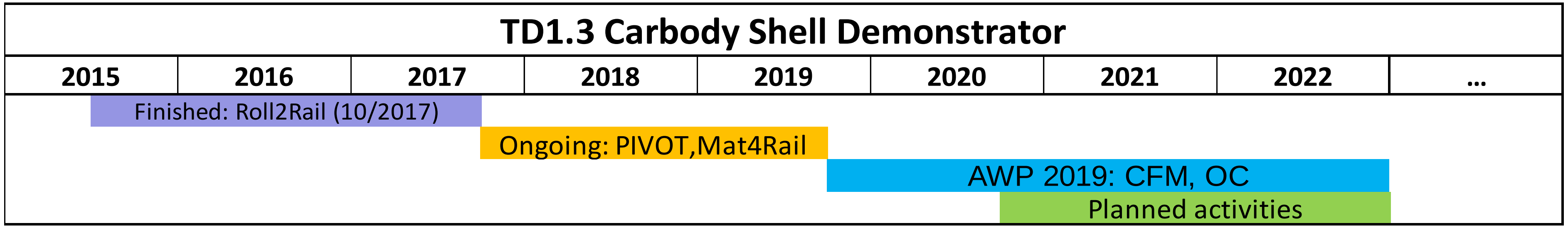


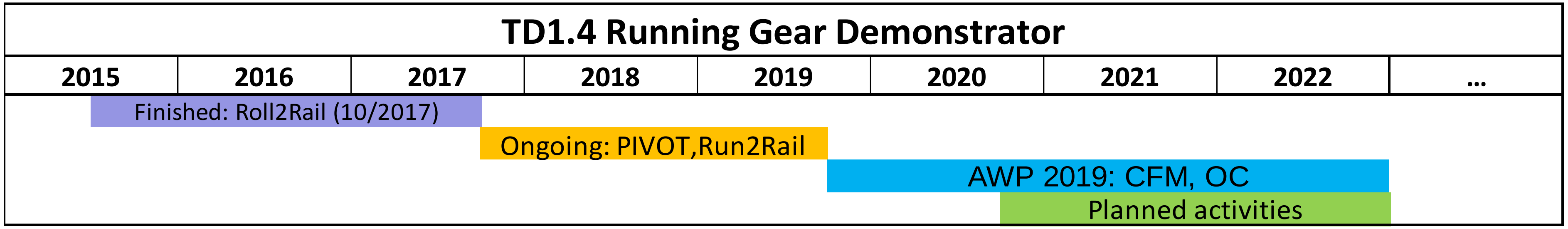
IP1: Cost-efficient and reliable trains, including high-capacity trains and high-speed trains

Shift2Rail


TD1.1 Traction Systems demonstrator
2015
2016
2017
2018
2019
2020
2021
2022
...
Finished: Roll2Rail (10/2017), PINTA (11/2018)
Ongoing: PINTA2
Planned activities


TD1.2 Train Control and Monitoring System Demonstrator
2015
2016
2017
2018
2019
2020
2021
2022
...
Finished: Roll2Rail (10/2017), CONNECTA (09/2018)
Ongoing: Safe4RAIL, CONNECTA-2, Safe4RAIL-2
Planned activities


TD1.3 Carbody Shell Demonstrator
2015
2016
2017
2018
2019
2020
2021
2022
...
Finished: Roll2Rail (10/2017)
Ongoing: PIVOT,Mat4Rail
AWP 2019: CFM, OC
Planned activities


TD1.4 Running Gear Demonstrator
2015
2016
2017
2018
2019
2020
2021
2022
...
Finished: Roll2Rail (10/2017)
Ongoing: PIVOT,Run2Rail
AWP 2019: CFM, OC
Planned activities

TD1.5 Brake Systems Demonstrator

2015	2016	2017	2018	2019	2020	2021	2022	…
Fin: Roll2Rail (10/2017), CONNECTA (09/2018)								
	Ongoing: Safe4RAIL, PIVOT, PINTA-2							
				AWP 2019: CFM, OC				
					Planned activities			

TD1.6: Doors and Access Systems Demonstrator

2015	2016	2017	2018	2019	2020	2021	2022	…
		Ongoing: PIVOT,Run2Rail						
				AWP 2019: CFM, OC				

TD1.7: Train Modularity In Use (TMIU)

2015	2016	2017	2018	2019	2020	2021	2022	…
Finished: Roll2Rail (10/2017)								
		Ongoing: PIVOT,Mat4Rail						
				AWP 2019: CFM, OC				

TD1.8: HVAC

2015	2016	2017	2018	2019	2020	2021	2022	…
				AWP 2019: CFM				
					Planned activities			

S2R-CFM-IP1-01-2019: Development of new technological concepts towards the next generation of rolling stock, applied to major subsystems such as Car body, Running Gear, Brakes, Doors, Modular interiors and HVAC

SPECIFIC CHALLENGE

- A range of key rolling stock technologies oriented at achieving the overall Shift2Rail objectives (high reliability, high capacity, low cost and improved performance) need to be developed to a point that enables the future development of the demonstrators foreseen in Shift2Rail. These high level objectives are influenced by many functional elements of the vehicle, so the fundamental challenge to be addressed is to define the specific solutions at sub-system level which will work together to produce the desired benefits at system level.

S2R-CFM-IP1-01-2019: Development of new technological concepts towards the next generation of rolling stock, applied to major subsystems such as Car body, Running Gear, Brakes, Doors, Modular interiors and HVAC

The following individual challenges relating to the different subsystems can contribute to these objectives:

- **Car body shell**. The activities of this CFM proposal will deal with the detailed design, manufacturing and testing of several composite/hybrid railway car body structure demonstrators as were defined in PIVOT (S2R-CFM-IP1-01-2017) project, they should be focused on High Speed and Urban car bodies. The high-level challenges behind this project are the following:
  - A weight reduction between 15 and 30%.
  - Associated energy savings in operation, resulting from the weight reduction.
  - Improvements of maintainability, coming from new concepts of material and joining methods.
  - Introduction of a specific health monitoring system for the structures coming from S2R-OC-IP1-01-2019, for both monitoring life cycle of the structures and assessing safety coefficients for the design of the structures.
  - The behavior of those composite/hybrid structures in a railway environment is not well known at the moment, mainly because of a lack of experience with those materials in railway application. The activities involved in this CFM will lead to the accumulation of sufficient experience in order to allow the use of these new materials for future car body structures.

S2R-CFM-IP1-01-2019: Development of new technological concepts towards the next generation of rolling stock, applied to major subsystems such as Car body, Running Gear, Brakes, Doors, Modular interiors and HVAC

- **Running Gear.** The next generation of running gear solution needs to deliver reduced infrastructure / wheel wear and damage, whilst providing higher reliability and availability, with lower maintenance costs. This challenge is made greater by the need for increased high-speed stability, excellent curving performance, improved comfort and optimized systems for both airborne and structure-borne noise.

- **Brakes.** The brake system of a train is a mission critical system, which ensures safety of transport of passengers and goods and also safety of humans in the environment. In order to follow the mega trends in the rolling stock development, the brake system has to take the following specific challenges:
  - Introduction of new materials (with contribution of S2R-OC -IP1-03-2019) for friction pairing to comply with the railway market demand for more economical driven solution
  - New solutions for drive-by-wire mechatronics brake system to increase line capacity and improve maintenance performance
  - New solutions for safe braking under all adhesion conditions, especially low adhesion situations (with contribution of S2R-OC -IP1-03-2019)
  - Advanced Brake Control hardware/software solutions compliant with High Safety Integrated Level SIL3-SIL4 that can be integrated in the next generation of TCMS (with contribution of considering the results of S2R-OC -IP1-03-2019)
  - Development and Integration of Virtual Certification methodologies for the brake system

S2R-CFM-IP1-01-2019: Development of new technological concepts towards the next generation of rolling stock, applied to major subsystems such as Car body, Running Gear, Brakes, Doors, Modular interiors and HVAC

- **Accessibility and Doors.** The challenge is to provide seamless and flexible access to the train to persons with reduced mobility, while reducing the weight and the cost, improving the comfort features (noise, thermal, etc.), and adding functionalities of door and access systems with a long-term target of self-managed door. The main target is the Sub-urban / Regional market. Nevertheless, the impact on other markets like Metro, Tramway or High Speed will be measured.
- **Modular interiors in use.** To increase attractiveness to passengers and flexibility to operators, interiors design should follow the needs and be able to evolve easily and quickly without costly process. To prepare for fully autonomous trains, interiors design should include the new use of driver's cabin.
- **HVAC**. Conventional "Heating, Ventilation Air conditioning and Cooling" systems (HVAC) of rail vehicles use artificial refrigerants that have a very high impact on the global warming (e.g. R134a). To limit the climatic impact from HVAC systems, the European Commission adopted in 2014 Regulation No 517/2014 which aims to reduce the use of artificial refrigerants within the EU. Rail service operators and vehicle integrators need to act quickly due to the long lifetime of the rolling stock. Hence new and redesigned trains should be equipped with eco-friendly HVAC systems using natural gases such as air or CO_2.

S2R-OC-IP1-01-2019: Advanced Car body shells for railways and light material and innovative doors and train modularity

SPECIFIC CHALLENGE:

Car Body Shell. Cost is one of the key factors impeding entry to the market for composite technologies. An investigation on new technologies able to address this challenge is needed, e.g. 3D additive technologies that allows quick and cheap tool manufacturing to successfully introduce the composite in the Rail Industry, especially for large dimensions tools. 3D printer technology is considered very promising, although any other technology covering the same requirements could also be considered.

The potential benefits that structural health monitoring systems could offer are the cost reductions regarding maintenance and operation, Reduction of inspection time, early damage detection to enhance safety and allow for less drastic and less costly repairs.

S2R-OC-IP1-01-2019: Advanced Car body shells for railways and light material and innovative doors and train modularity

Doors. Also for doors, cost is one of the key factors impeding entry into the market for composite technologies. Special emphasis is needed on cost reduction technologies to make the composite technologies affordable for Rail industry. For that purpose, a specific focus on manufacturing tools is necessary.

Due to the characteristics of door leaves which shall have low thickness (mainly between 32 mm till 50 mm), low weight, relatively low tightness, they are on the weak point to allow important comfort in the vestibule or in the vicinity of the door. As a consequence, other solutions than strictly door solutions should be studied in order to improve passenger comfort and allow phone conversation in the door vicinity.

Solutions have to be provided for the accessibility of trains to all users. A significant challenge is to improve train services and create a real universal service, allowing independent and easy access to all passenger categories, including passengers with reduced mobility.

S2R-OC-IP1-01-2019: Advanced Car body shells for railways and light material and innovative doors and train modularity

Interiors. The challenge is to propose new low cost, modular and aesthetic interiors designs (passengers room) matching the concepts of new fixation systems developed during the S2R-CFM-IP1-01-2019 call.

A further challenge is to be able to decide which interiors and cabin layout use before building a mock-up demonstrating the modularity allowed by the new concept of plug & play fixation systems.

Cost is one of the key factor preventing the entry into the market of composite technologies. For that purpose, a specific focus on manufacturing tools is necessary.

Following the results of PIVOT (S2R-CFM-IP1-01-2017) work around innovative driver cabin and new HMI are one of the challenges to address. Gesture, sound and voice control are the new technologies to master in the cabin of the future. For this, human factors, cognition and cultural differences impacts have to be taken into account to design the most efficient cabin commands.

One of the most interesting could be the integration of the low volt circuit as a way to reduce assembly time and the associated cost. Currently, an industrial application with this functionality does not exist.

S2R-OC-IP1-02-2019: Tools, methodologies and technological development of next generation of Running Gear

SPECIFIC CHALLENGE:

Universal Cost Model 2.0. The penetration of innovative running gear solutions into the market has often been limited by the lack of evidence of economic benefits. What is missing is a cost modelling methodology which is valid and accepted widely throughout Europe and which can reflect and quantify the global impact of running gear performance on the rail system economics. This issue was tackled during the development of the Universal Cost Model (UCM) in the ROLL2RAIL (GA 636032) project in providing a methodology to quantify the value of a global life cycle cost by innovative vehicles and ultimately ensuring the market uptake of the newly developed running gear technologies.

The challenge is to improve the UCM, which targets the development of a user friendly and public UCM2.0 software tool for the use of European rail stakeholders.

S2R-OC-IP1-02-2019: Tools, methodologies and technological development of next generation of Running Gear

Contribution of high-end solutions to develop Running Gear Innovations. This topic seeks to address the challenge linked to developing novel and ground-breaking tools, methodologies and technology for running gear applications. Historically, it has not been easy to introduce innovation in running gear because often preference was given to technology which has proved to be robust enough to survive the heavy loads, but not innovative enough. New technological solutions for running gear need to have sufficient durability to operate between overhauls or even through the entire vehicle design life of up to 40 years.

The challenge is to develop and combine suitable technologies to produce light, silent, track-friendly, reliable, low life-cycle-cost costs (LCC) running gear. This multi-technology approach will have to address several functions (comfort, curving, structural function, rolling components, health monitoring, etc.).

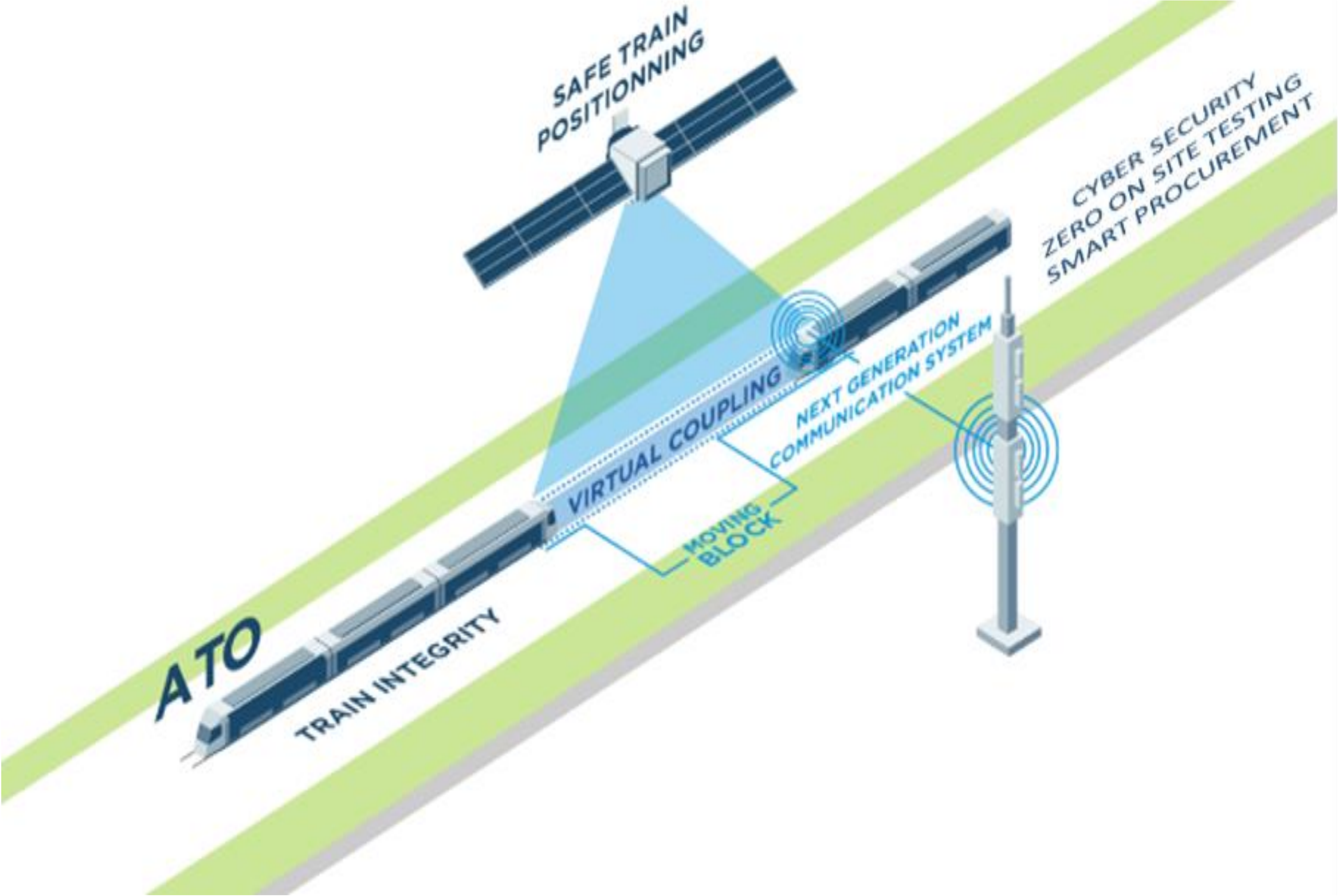
Wheel set of the future. The challenge is to inspire and convince the rail stakeholders to open a path for non-conservative approach in wheelsets, having a regard to the framework (loads, life time, etc.) described in the current standards and regulations.

S2R-OC -IP1-03-2019: Support to the development of technical demonstrators for the next generation of brake systems

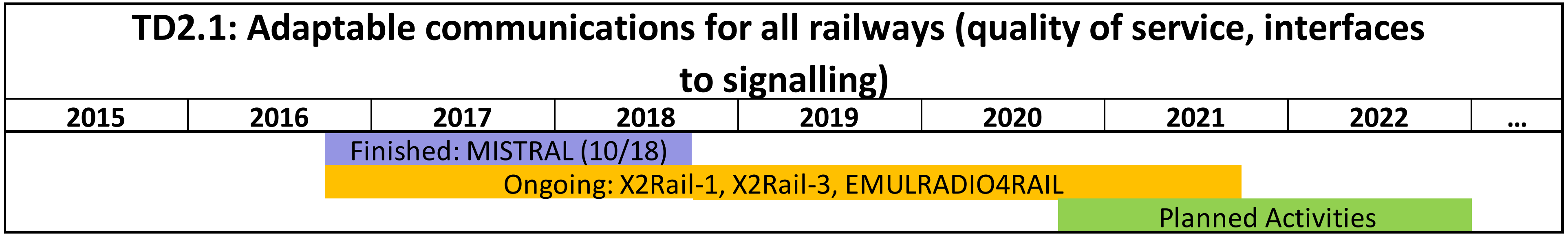
SPECIFIC CHALLENGE:

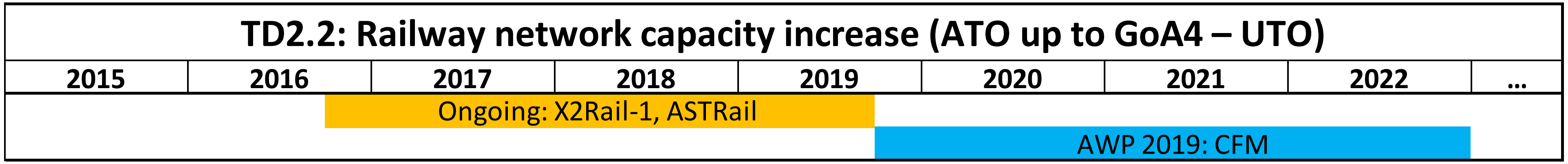
In the first phase of Shift2Rail, the projects PINTA (GA730668), CONNECTA (GA730539) and PIVOT (GA777629) put their focus on the analysis of the status quo and approaches to cope with the new development challenges and comply with the new requirements for the railway subsystems and components. These activities resulted in specifications, design of new and more standardized brake components, as well as new methods and tools to improve maintenance and certification processes.

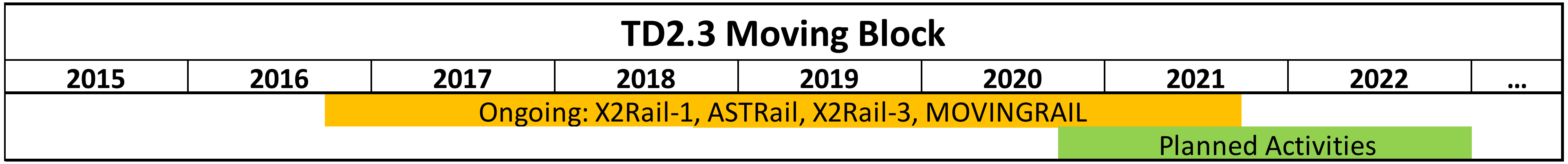
Based on this, the challenge of the technical demonstrator brake system (TD1.5) is to perform the development and implementation of brake systems with higher brake performance (e.g. in low adhesion condition), lower life cycle costs and noise levels. The development of the new generation of more compact and environmentally friendly brake components with enhanced diagnosis systems and electronics requires considerable analysis and test work.

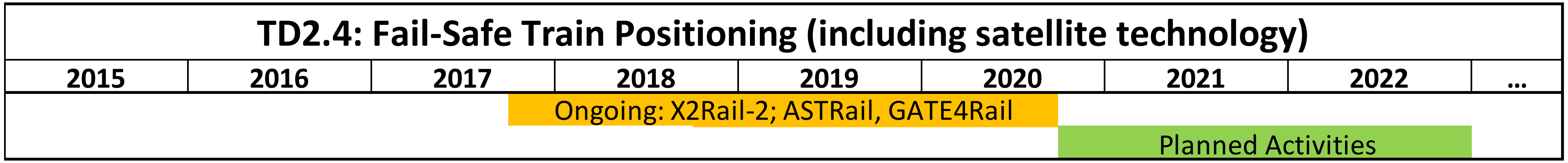


IP2: Advanced Traffic Management and Control Systems


TD2.1: Adaptable communications for all railways (quality of service, interfaces to signalling)
2015
2016
2017
2018
2019
2020
2021
2022
...
Finished: MISTRAL (10/18)
Ongoing: X2Rail-1, X2Rail-3, EMULRADIO4RAIL
Planned Activities


TD2.2: Railway network capacity increase (ATO up to GoA4 – UTO)
2015
2016
2017
2018
2019
2020
2021
2022
...
Ongoing: X2Rail-1, ASTRail
AWP 2019: CFM


TD2.3 Moving Block
2015
2016
2017
2018
2019
2020
2021
2022
...
Ongoing: X2Rail-1, ASTRail, X2Rail-3, MOVINGRAIL
Planned Activities


TD2.4: Fail-Safe Train Positioning (including satellite technology)
2015
2016
2017
2018
2019
2020
2021
2022
...
Ongoing: X2Rail-2; ASTRail, GATE4Rail
Planned Activities

TD2.5: On-board Train Integrity

2015	2016	2017	2018	2019	2020	2021	2022	…

- Ongoing: X2Rail-2; ETALON
- AWP 2019: CFM

TD2.6: Zero on-site testing (control command in lab demonstrators)

2015	2016	2017	2018	2019	2020	2021	2022	…

- Finished: VITE (10/18)
- Ongoing: X2Rail-1, X2Rail-3, GATE4Rail
- Planned activities

TD2.7: Formal methods and standardisation for smart signalling systems

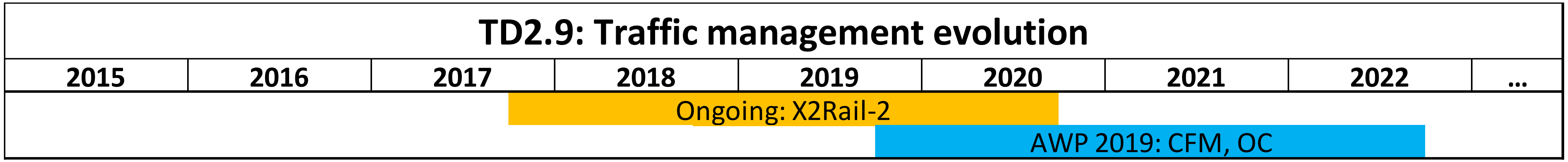
2015	2016	2017	2018	2019	2020	2021	2022	…

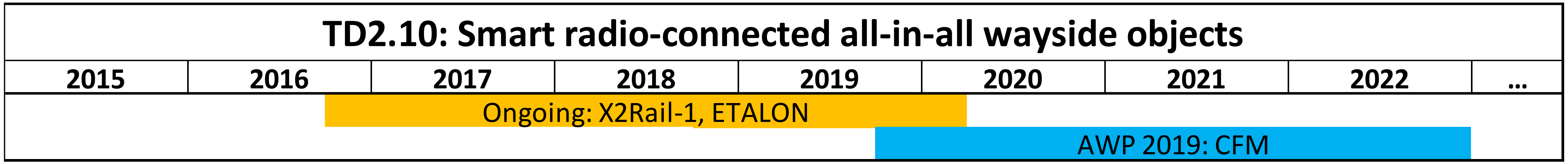
- Ongoing: X2Rail-2; ASTRail
- AWP 2019: CFM,OC
- Planned activities

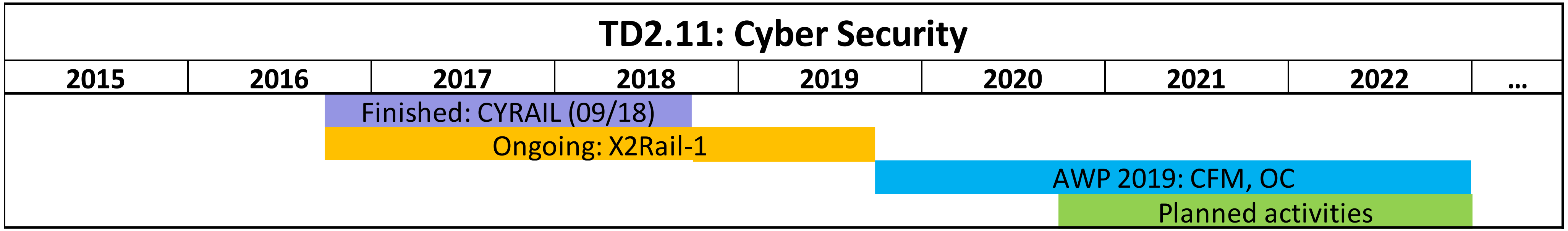
TD2.8: Virtually – Coupled Train Sets (VCTS)

2015	2016	2017	2018	2019	2020	2021	2022	…

- Ongoing: X2Rail-3, MOVINGRAIL


TD2.9: Traffic management evolution
2015
2016
2017
2018
2019
2020
2021
2022
...
Ongoing: X2Rail-2
AWP 2019: CFM, OC


TD2.10: Smart radio-connected all-in-all wayside objects
2015
2016
2017
2018
2019
2020
2021
2022
...
Ongoing: X2Rail-1, ETALON
AWP 2019: CFM


TD2.11: Cyber Security
2015
2016
2017
2018
2019
2020
2021
2022
...
Finished: CYRAIL (09/18)
Ongoing: X2Rail-1
AWP 2019: CFM, OC
Planned activities

S2R-CFM-IP2-01-2019: Completion of activities for enhanced automation systems (including Freight ATO GoA4), train integrity, object controller

SPECIFIC CHALLENGE

- The challenge is to contribute to developing an advanced signaling and automation system able to apply the highest grade of automation, to enable trains to self-detect their integrity, to improve and standardize traffic management services, to provide smart radio connected signaling wayside object controllers achieving the requested targets in terms of reliability, enhanced capacity, lower investments, reduced operating costs, improved standardization and therefore simplified certification and authorization needs. Additionally, the Freight ATO activities will validate the applicability of the work for freight operation. The proposals will build and take further work started in X2RAIL-1 (GA 730640) and X2RAIL-2 (GA 777465).

S2R-OC-IP2-01-2019: Demonstrator development for the use of Formal Methods in railway environment - Support to implementation of CSIRT to the railway sector

SPECIFIC CHALLENGE:

Shift2Rail has identified the use of formal methods and standard interfaces as two key concepts to enable reducing the time it takes to develop and deliver railway signaling systems, and to reduce high costs for procurement, development and maintenance. Formal methods are needed to ensure correct behavior, interoperability and safety, and standard interfaces are needed to increase market competition and standardization, reducing long-term life cycle costs. To widen industry take-up of these key aspects, Shift2Rail plans demonstrating technical and commercial benefits of formal methods and standard interfaces, applied on select applicationsThe industry survey performed in TD2.7 has identified the learning curve and uncertain cost/benefit ratio as obstacles: the decision to start using formal methods is deemed too risky by management. Shift2Rail proposes to define and prototype a demonstrator of state-of-the-art formal methods, including the use of standard interfaces, to address obstacles of learning curve and lack of clear cost/benefit analysis. The dramatic rise in the cybercrime targeting Industrials Control Systems (ICS) over the past years and the development of Intelligent Public Transport requiring a high level of integration of transport systems highlighted the need of cyber-security coordination between railway operators. Such coordination will require, in most of the cases, system integrator and railway manufacturer involvement. In order to face such challenge, a network of cyber security experts dedicated to railway sector is to be developed. In order to create and coordinate this network, Shift2Rail proposes to define and prototype a CSIRT (Computer Security Incident Response Team) collaboration tool fulfilling the specific needs of the railway sector. The need of such collaborative tool has been emphasised over the time by the publication of the NIS Directive that requires coordinated cyber security incident reporting for critical infrastructures.

S2R-OC-IP2-02-2019: Support to development of demonstrator platform for Traffic Management

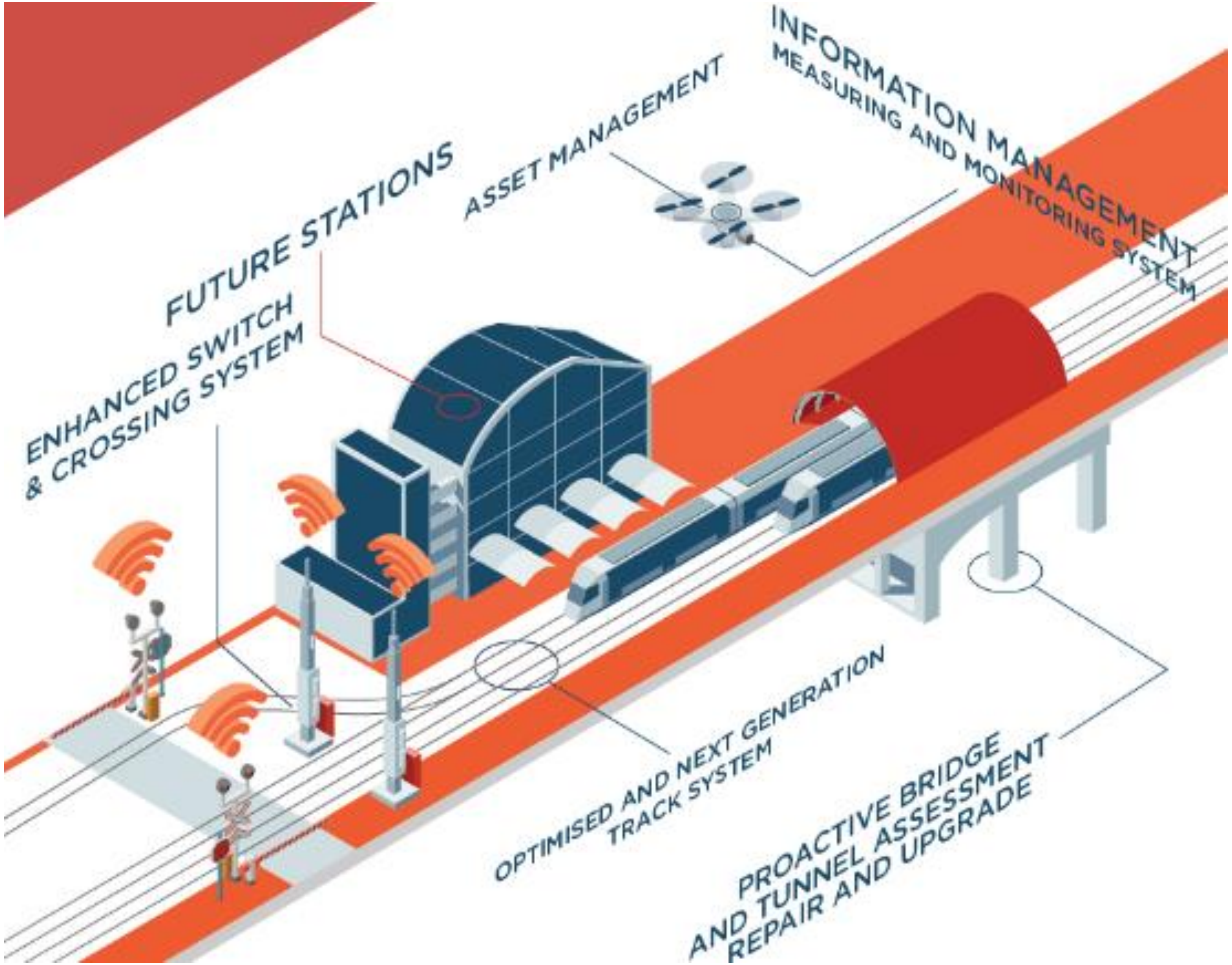
SPECIFIC CHALLENGE:

Innovation Programme 2 includes, as a key innovation, the specification and design of a communication platform (Integration Layer) using standardized data structures and processes to manage the Communication/Data exchange between different services/clients and supporting TMS applications connected to other multimodal operational systems.

This Integration Layer links in a first step, Traffic Management, Traffic Control, Asset and Energy Management systems and signalling field infrastructure. It also provides a gateway for the communication with external clients such as traffic status update and management of traffic demands from external services.

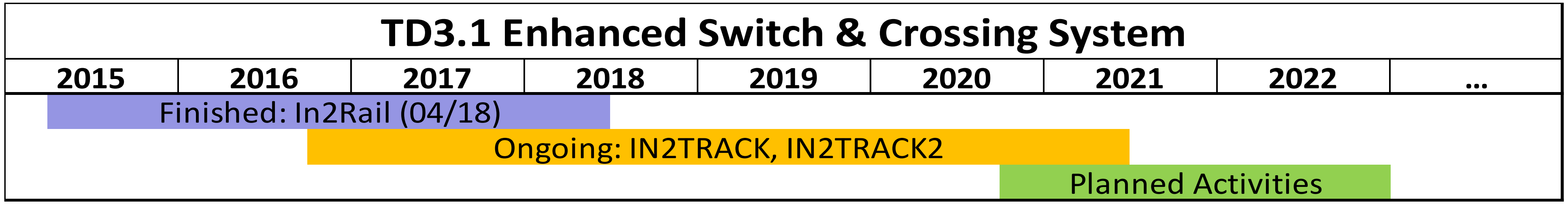
Public documents describing the proposed architecture, interfaces and the data model are available as deliverables from the project IN2RAIL. X2RAIL-2 is continuing to enhance the specifications and will supply updated drafts for the action.

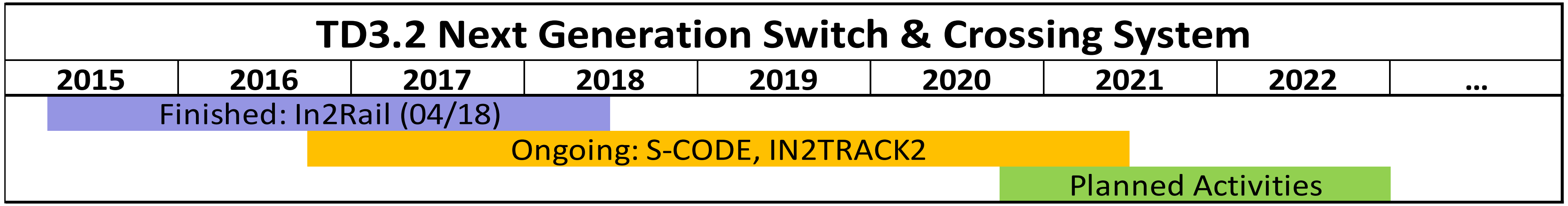
It is required that consortia applying for this call include an Infrastructure Manager (IM) to host the installation and provide real data from trackside assets and trains to be integrated into the communication network allowing the test and validation of business service application for Traffic Management and Traffic Control developed from different partners of the S2R programme. It is preferable that the involved IM is actively performing Traffic management and traffic Control in dedicated Control centres.

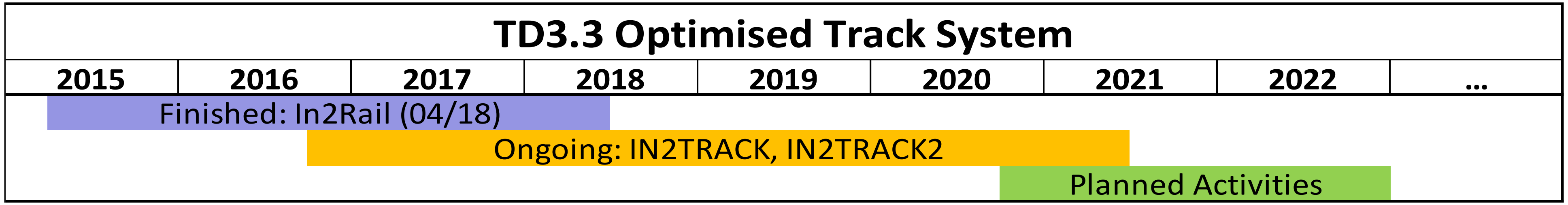


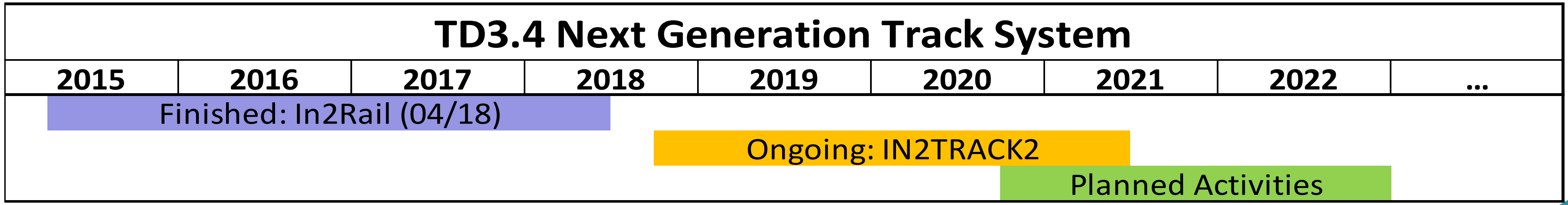
IP3: Cost-Efficient and Reliable High-Capacity Infrastructure

Shift2Rail


TD3.1 Enhanced Switch & Crossing System
2015
2016
2017
2018
2019
2020
2021
2022
...
Finished: In2Rail (04/18)
Ongoing: IN2TRACK, IN2TRACK2
Planned Activities


TD3.2 Next Generation Switch & Crossing System
2015
2016
2017
2018
2019
2020
2021
2022
...
Finished: In2Rail (04/18)
Ongoing: S-CODE, IN2TRACK2
Planned Activities


TD3.3 Optimised Track System
2015
2016
2017
2018
2019
2020
2021
2022
...
Finished: In2Rail (04/18)
Ongoing: IN2TRACK, IN2TRACK2
Planned Activities


TD3.4 Next Generation Track System
2015
2016
2017
2018
2019
2020
2021
2022
...
Finished: In2Rail (04/18)
Ongoing: IN2TRACK2
Planned Activities

TD3.5 Proactive Bridge and Tunnel Assessment, Repair and Upgrade

2015	2016	2017	2018	2019	2020	2021	2022	...

Finished: In2Rail (04/18)

Ongoing: IN2TRACK, IN2TRACK2

Planned Activities

TD3.6 Dynamic Railway Information Management System (DRIMS)

2015	2016	2017	2018	2019	2020	2021	2022	...

Ongoing: IN2SMART, IN2DREAMS

AWP 2019: CFM

Planned Activities

TD3.7 Railway Integrated Measuring and Monitoring System (RIMMS)

2015	2016	2017	2018	2019	2020	2021	2022	...

Finished: In2Rail (04/18)

Ongoing: IN2SMART, MOMIT, Assets4Rail

AWP 2019: CFM

Planned Activities

TD3.8 Intelligent Asset Management Strategies (IAMS)

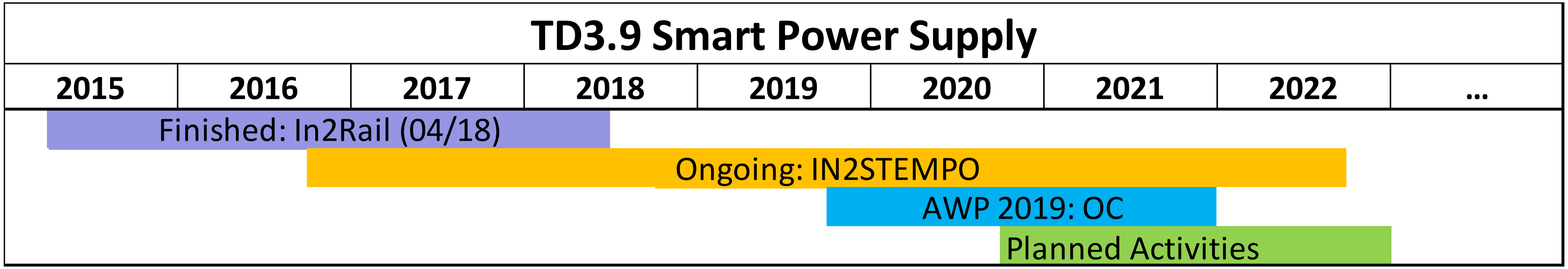
2015	2016	2017	2018	2019	2020	2021	2022	...

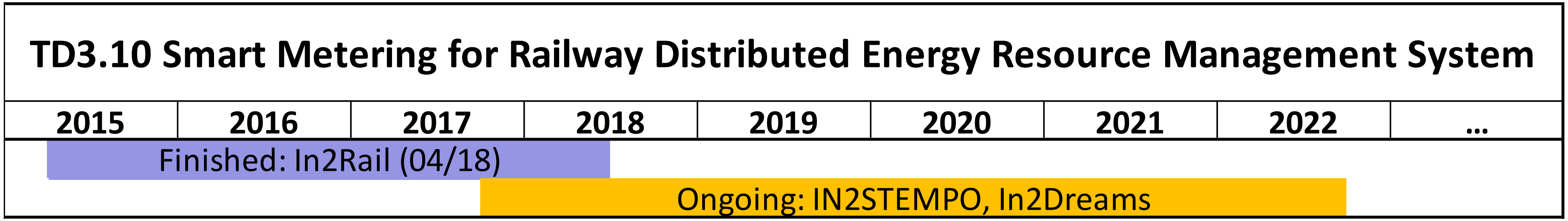
Finished: In2Rail (04/18)

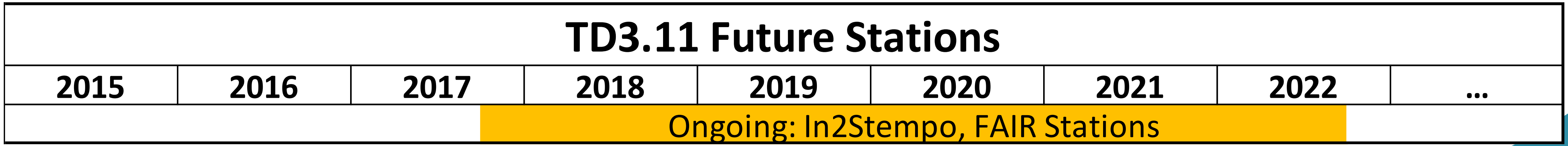
Ongoing: IN2SMART

AWP 2019: CFM

Planned Activities


TD3.9 Smart Power Supply
2015
2016
2017
2018
2019
2020
2021
2022
…
Finished: In2Rail (04/18)
Ongoing: IN2STEMPO
AWP 2019: OC
Planned Activities


TD3.10 Smart Metering for Railway Distributed Energy Resource Management System
2015
2016
2017
2018
2019
2020
2021
2022
…
Finished: In2Rail (04/18)
Ongoing: IN2STEMPO, In2Dreams


TD3.11 Future Stations
2015
2016
2017
2018
2019
2020
2021
2022
…
Ongoing: In2Stempo, FAIR Stations

S2R-CFM-IP3-01-2019: Intelligent asset management finalisation

SPECIFIC CHALLENGE

Approximately 25% of the annual operational cost of High Speed infrastructure is generated by maintenance, due to different causes: the age of the current rail infrastructure, accelerated deteriorations, inspection activities done manually or with a series of heterogeneous monitoring tools and systems.

The challenge is to move forward the research activities currently under development in the IN2SMART project, by finalizing, testing and validating the Intelligent Asset Management System, in order to optimize railway infrastructure maintenance. Using a limited budget, it is possible to contribute to the S2R objectives, through the usage of new technologies concerning data acquisition (preferably COTS monitoring), data analysis (big data analytics) and maintenance decision making, logistics and execution. This has to be demonstrated in some selected use cases context, but also in a more comprehensive demonstrator.

S2R-OC-IP3-01-2019: Future traction power supply for railways and public transport

SPECIFIC CHALLENGES:

The currently running projects under TD3.9 “Smart Power Supply Demonstrator” explore Rail Power Supply Systems by optimizing the existing solutions for traction power supply for maximum capacity and minimum losses with limited investments. Demand for increasing railway network capacity, in combination with a change to electric traction also for other transport modes, makes it necessary to rethink railway power supply under future requests, reflecting the status of different systems. Finally this requires integrated electric power systems connecting the different transport modes. For the power supply system this brings up new requirements:

- Efficiency and environmental impact of electric transport systems become more important requiring integration of “green” energy sources
- Energy grids become more and more decentralised with new possibilities and requirements for interaction
- The limited capacity of existing power supply systems, especially for the DC Rail Power systems, requires for step changing improvements
- Electrical traction will become standard also for no rail bound systems, requiring for combined traction power systems integrating permanent supply by contact lines and punctual supply for charging points.
- More complex power grids require for proper operation faster reaction for control of the systems e.g. by digital twins.

The extended targets for future solutions ask for a wider view to the rail power supply systems.

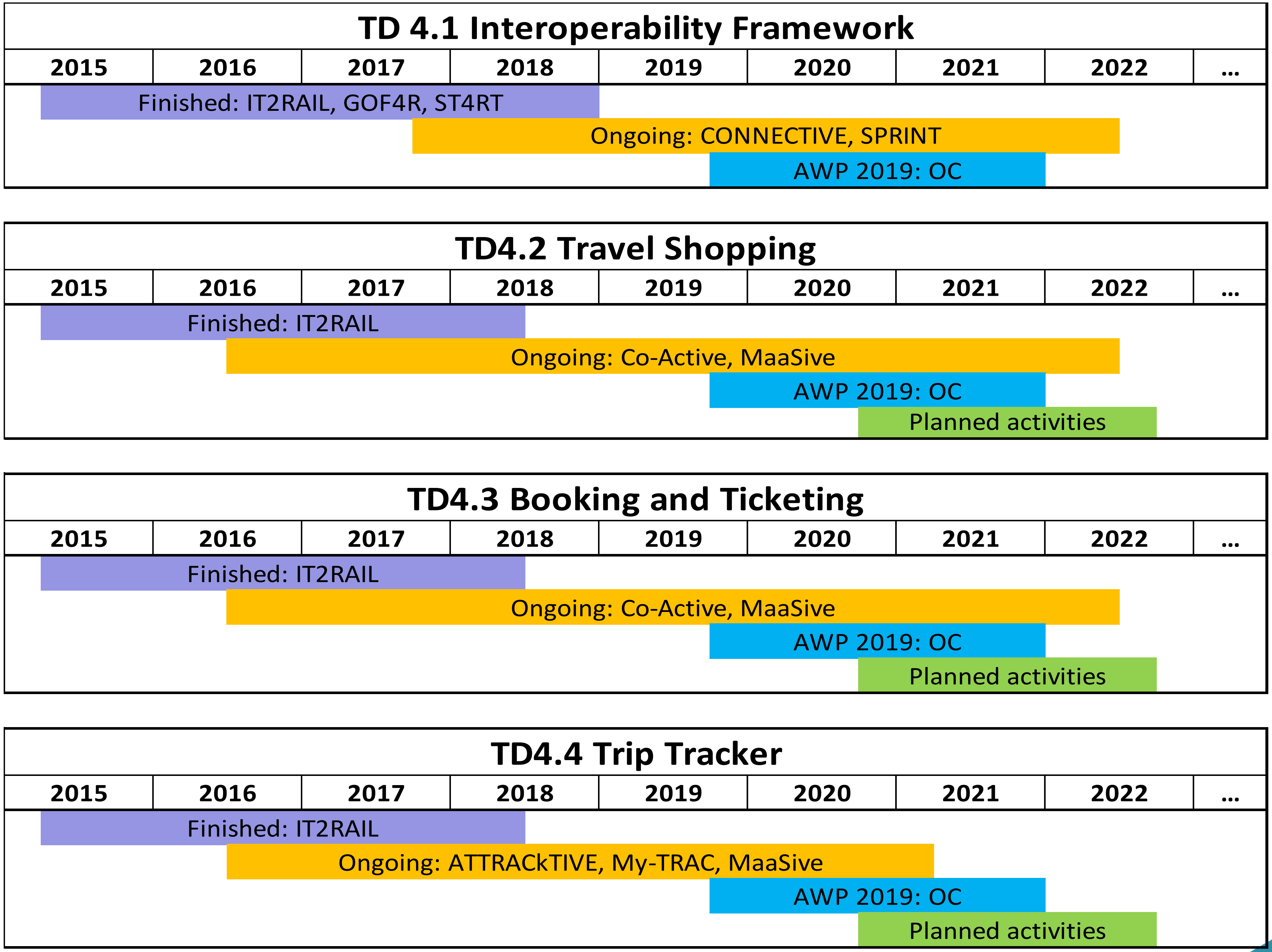
S2R-OC-IP3-01-2019: Future traction power supply for railways and public transport

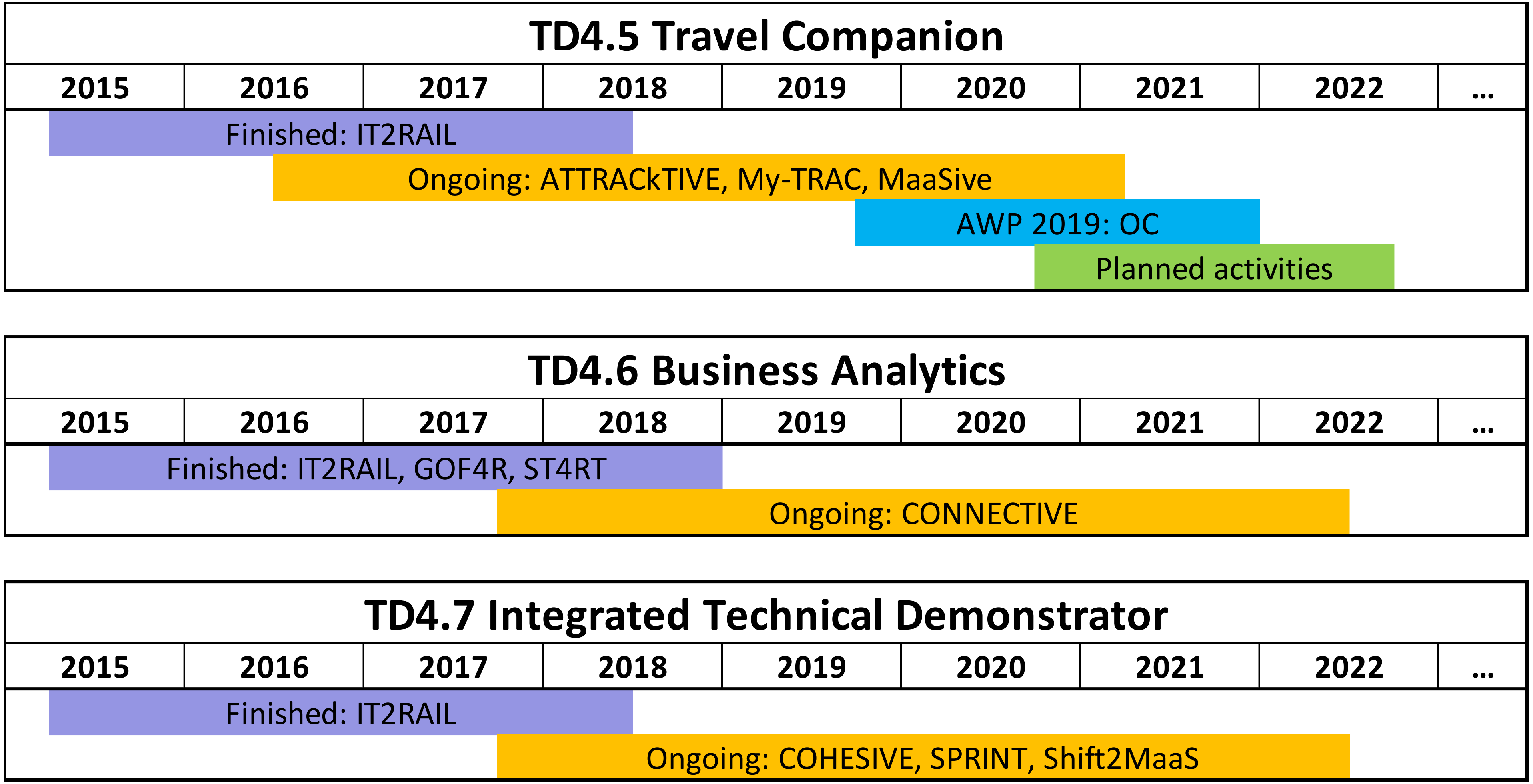
Specific challenges:

- Improvement of capacity of Railway Power Supply System for future transport demand
- Upgrade of DC power supply systems for increase of capacity
- Use of renewable (“green”) energy sources in the Railway power supply
- Interaction between Railway power grids and feeding networks under the view of decentralized power systems
- Integration of other transport modes as energy and power consumer in Railway Power Grids (E-Bus, E-Car, …)
- Fast and easy adjustability of Railway Power Grids for the volatile demand of power and energy

Consideration of all challenges requires a wider approach for the Railway Power Supply System. This call aim to challenge the traditional rail approach with innovative and breakthrough concepts from a non-linear approach to existing technological evolution.

IP4: IT Solutions for Attractive Railway Services


TD 4.1 Interoperability Framework
2015 2016 2017 2018 2019 2020 2021 2022 …
Finished: IT2RAIL, GOF4R, ST4RT
Ongoing: CONNECTIVE, SPRINT
AWP 2019: OC
TD4.2 Travel Shopping
2015 2016 2017 2018 2019 2020 2021 2022 …
Finished: IT2RAIL
Ongoing: Co-Active, MaaSive
AWP 2019: OC
Planned activities
TD4.3 Booking and Ticketing
2015 2016 2017 2018 2019 2020 2021 2022 …
Finished: IT2RAIL
Ongoing: Co-Active, MaaSive
AWP 2019: OC
Planned activities
TD4.4 Trip Tracker
2015 2016 2017 2018 2019 2020 2021 2022 …
Finished: IT2RAIL
Ongoing: ATTRACkTIVE, My-TRAC, MaaSive
AWP 2019: OC
Planned activities


TD4.5 Travel Companion
2015
2016
2017
2018
2019
2020
2021
2022
...
Finished: IT2RAIL
Ongoing: ATTRACkTIVE, My-TRAC, MaaSive
AWP 2019: OC
Planned activities
TD4.6 Business Analytics
2015
2016
2017
2018
2019
2020
2021
2022
...
Finished: IT2RAIL, GOF4R, ST4RT
Ongoing: CONNECTIVE
TD4.7 Integrated Technical Demonstrator
2015
2016
2017
2018
2019
2020
2021
2022
...
Finished: IT2RAIL
Ongoing: COHESIVE, SPRINT, Shift2MaaS

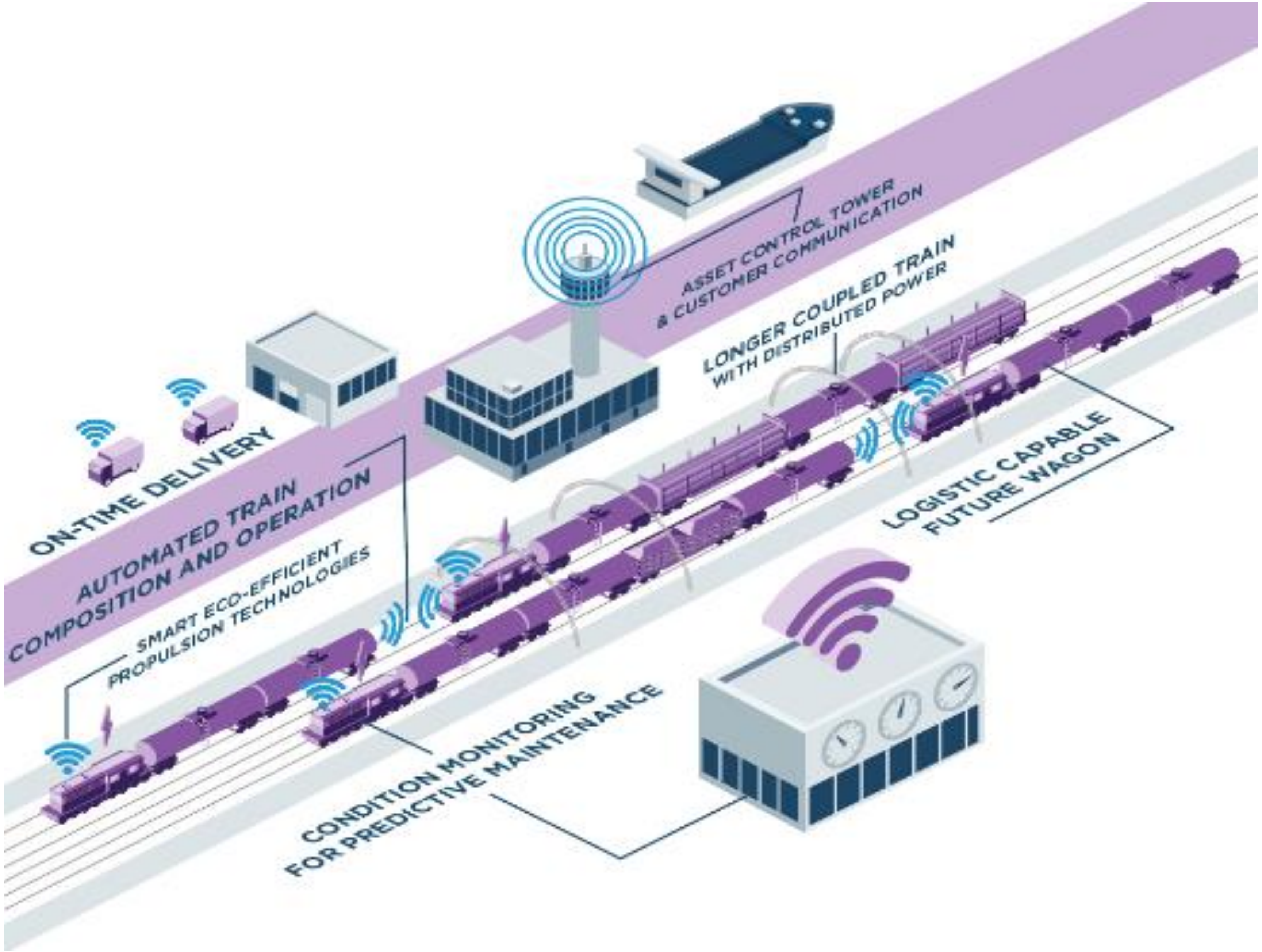
S2R-OC-IP4-01-2019: Complementary Travel Expert Services

SPECIFIC CHALLENGE:

People are traveling around daily for business trips, on holiday, weekend travel or other private purposes. They want to get a large choice of multi-modal offers adapted to their preferences, and they need additional information to make an informed choice before selecting a proposal.

One of the specific challenges of this call is to classify complete itineraries with respect to different categories, including but not restricted to, the environmental impact (e.g. energy consumption, NOx emission, carbon footprint), the waiting time between legs, the accessibility of the modes for disabled people, the overcrowded legs in peak hours.

The second challenge, contributing also to the environmental impact, is to increase the occupancy rate of private cars when used in combination with public transport, with the main objective to ease the access to the rail mode. This is specifically the case for the first and last mile in rural areas.



IP5: Technologies for Sustainable & Attractive European Rail Freight

IP5 brings together essential players from rail freight sector and is strucured in five TDs

TD 5.1	TD 5.2	TD 5.3	TD 5.4	TD 5.5
DB Digitization and Automation Rail System	**TRV** Digital Network Management	**CFW** Smart Freight Wagon Concepts	**BT** New Freight Propulsion Concepts	**TRV** Business analytics & implementation strategies
TD 5.1.1 DB Condition based maintenance	TD 5.2.1 TRV Impr. methods for timetable planning	TD 5.3.1 VVAC Running gear	TD 5.4.1 BT Last Mile propulsion Systems	TD 5.5.1 CFW Identification of market segments
TD 5.1.2 CAF Automatic coupling	TD 5.2.2 DB Real time yard mgmt & SWL syst.	TD 5.3.2 VVAC Core market wagon	TD 5.4.2 DB Long Trains up to 1500m	TD 5.5.2 CFW Development of Specs and KPIs
TD 5.1.3 DB Freight ATO	TD 5.2.3 TRV Real-time Network Management	TD 5.3.3 CFW Extended market wagon	TD 5.4.3 BT Freight Loco of the future	TD 5.5.3 CFW Migration Plan
TD 5.1.4 DB Connected DAS	TD 5.2.4 DB Intelligent Video Gate Terminals	TD 5.3.4 CFW Telematics and electrification	TD 5.4.4 DB Hybridization of legacy shunters	

TD 5.0 – Business analytics and implementation strategies

2015	2016	2017	2018	2019	2020	2021	2022	...
Finished: SMART-RAIL (04/18)								
	Ongoing: FR8RAIL, INNOWAG, FR8HUB							

TD5.1 Freight electrification, brakes and telematics

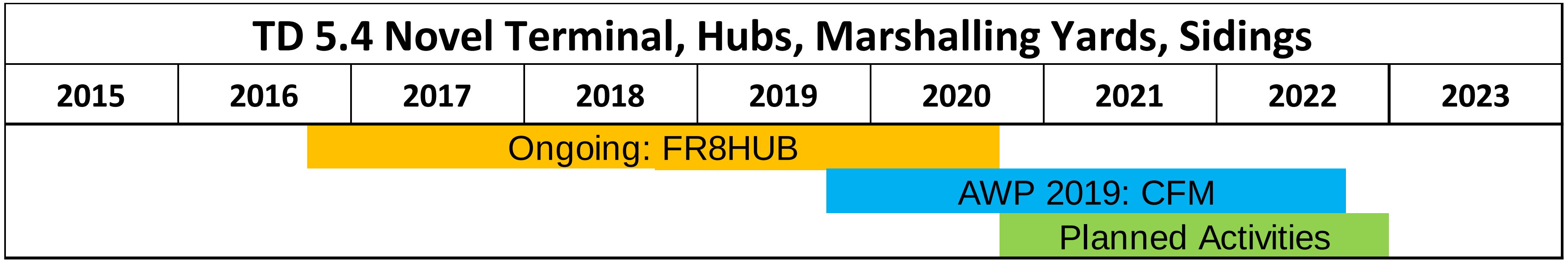
2015	2016	2017	2018	2019	2020	2021	2022	...
	Ongoing: FR8RAIL, INNOWAG, FR8HUB, FR8RAIL II							
				AWP 2019: CFM, OC				
					Planned Activities			

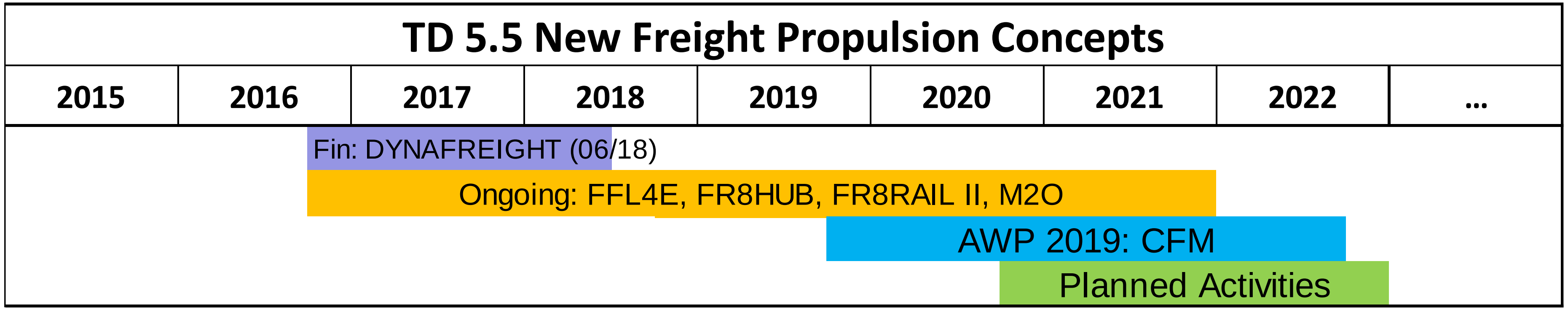
TD5.2 Access and Operation

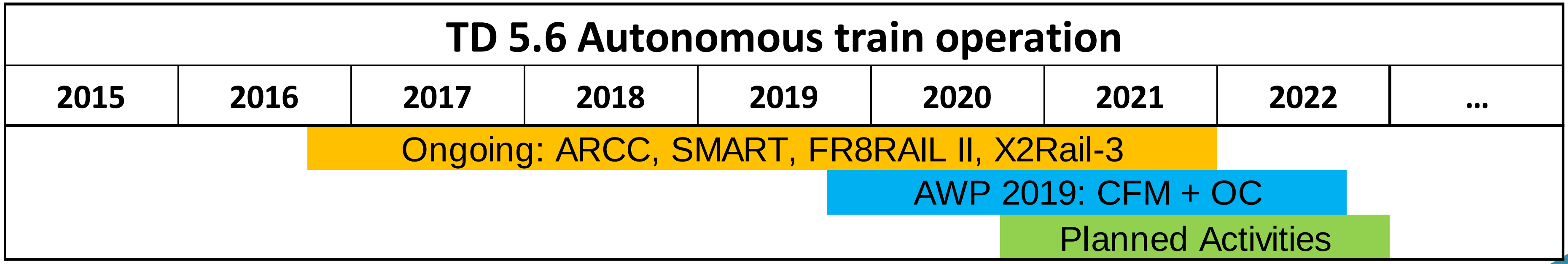
2015	2016	2017	2018	2019	2020	2021	2022	...
	Ongoing: ARCC, SMART, OPTIYARD, FR8HUB, FR8RAIL II							
				AWP 2019: CFM				

TD5.3 Wagon design

2015	2016	2017	2018	2019	2020	2021	2022	...
	Ongoing: FR8RAIL, INNOWAG, FR8RAIL II							
				AWP 2019: CFM				
					Planned Activities			


TD 5.4 Novel Terminal, Hubs, Marshalling Yards, Sidings
2015
2016
2017
2018
2019
2020
2021
2022
2023
Ongoing: FR8HUB
AWP 2019: CFM
Planned Activities


TD 5.5 New Freight Propulsion Concepts
2015
2016
2017
2018
2019
2020
2021
2022
…
Fin: DYNAFREIGHT (06/18)
Ongoing: FFL4E, FR8HUB, FR8RAIL II, M2O
AWP 2019: CFM
Planned Activities


TD 5.6 Autonomous train operation
2015
2016
2017
2018
2019
2020
2021
2022
…
Ongoing: ARCC, SMART, FR8RAIL II, X2Rail-3
AWP 2019: CFM + OC
Planned Activities

S2R-CFM-IP5-01-2019: Smart data-based assets and efficient rail freight operation

In the framework of the general challenges highlighted in the IP5 part of the S2R Master Plan, the following specific challenges should be addressed by the proposal in answer to this topic:

1) Condition based maintenance (CBM): Rail operators are facing an increasing complexity of influencing factors on their competitiveness. The required flexibility and agility for adaption can only be granted, if digital technologies are used globally – which is today often not the case. Condition Based and Predictive Maintenance need to transform from a support function of rail freight and asset operation to a source of innovation. In the future, CBM plays a key role in identifying additional revenue and profitability potentials using current freight locomotives and wagons. Nowadays each European country is using its own maintenance rulebook with individual thresholds which indicates required maintenance activities. This will affect the roll-out of the defined condition monitoring thresholds tremendously. CBM use cases need to be defined for rail freight, resulting in user-centric specification and design of CBM dashboards with the objective of being used all over Europe with their individual specifications. In this manner, CBM use cases would be aligned with the European rail traffics. The challenge is to create an advanced monitoring solution of locomotive and wagon components to monitor the conditions in different rolling stock types across Europe in a centralised way. Central collection of performance metrics for development of digital maintenance rules is essential.

S2R-CFM-IP5-01-2019: Smart data-based assets and efficient rail freight operation

2) Real-time Network Management: It is a complex task to manage yards and to interact traffic operations at lines and network with the yard. Today operational traffic in yards is handled manual with much oral communication and the interaction between yards and the network planning and dispatching at infrastructure manager level is poor. This leads to long lead times and manual sequential processes when there are disturbances. The connection between timetable and operational traffic is low. The freight trains are not following their planned train path between yards. This problem has a huge impact on overall system punctuality. The challenges can be described as follows: i) the challenge to improve manual process at yards with better decision support for the personal; ii) The challenge to improve the interaction between the yard manager and the infrastructure manager; iii) the challenge of automation in traffic operation and dispatching processes. These challenges will generate changes in the work for different actors.

S2R-CFM-IP5-01-2019: Smart data-based assets and efficient rail freight operation

3) Intelligent Video Gate Terminals (IVG): Lack of information and thereby lack of optimal terminal processes with problems in reliability and poor lead times represent a problem in terminals. Therefore, definition of relevant use cases enabling better data capture and information flow for rail freight terminals is important. User-centric specification and design of Intelligent Video Gate Terminals are also affected and are currently suboptimal. It is therefore essential to select a relevant pilot site and performance of a demonstrator for IVG-Terminal Operation tackling the involved challenges. Freight wagon availability and flexibility is a key factor for success in today's rail freight transport market. The market is highly under pressure from road freight transport alternatives which are often more competitive and flexible. This hinders a shift traffic flows from road to rail. Efficiency improvements during the inbound and outbound trains operations at terminal gates and improved data exchange of relevant information between terminals will speed up the process gaining in efficiency (e.g. saving time in terminal operation, increasing punctuality in delivering, etc.) and reducing costs. A collateral benefit that is expected with IVG technology is related the support to wagon inspection useful in maintenance and automatic damaging detection.

S2R-CFM-IP5-01-2019: Smart data-based assets and efficient rail freight operation

4) Core Market Wagon: Definition of validation scenarios for the novel designs following the 5L-Wagon designs are required in order to accelerate the market-uptake. Enhancing the function of the Core-Market Wagon Design putting it in the context of connected asset by established and affordable add-ons such as Wagon on-Board unit (WoBu) with energy harvesters shall address the challenge of fast and practical deployment of packages. Providing mechanical solutions and interfaces for future solutions such as automatic couplers shall enable modular and scalable system.

S2R-CFM-IP5-01-2019: Smart data-based assets and efficient rail freight operation

5) Extended Market Wagon: Final specification of the wagon structure and the wagon equipment, the integration of mechanical and electrical components in the wagon design will create the basis for the prototype manufacturing in future projects. This work will include the preparation of the authorisation process for the extend market wagon in TSI Wagon. The main challenges in this area are related to the structural integrity of the wagon and the safety of its technical equipment, especially for the supervision of the wagon. The energy efficiency of rail freight transport in terms of aerodynamic drag can be significantly increased by technical and operational measures. The requirements for a successful optimization of the numerical tools differ greatly from the methods used for passenger trains. The numerical methods must be adapted to these complex flow conditions and validated accordingly in order to be able to carry out loadable resistance predictions.

S2R-CFM-IP5-01-2019: Smart data-based assets and efficient rail freight operation

6) Telematics & Electrification: Nowadays, digitalisation is changing processes in many sectors, improving competitiveness and offering new innovative services. Rail freight transport is not an exception and it needs to take advantage of digitalisation, i.e. by introducing IoT by means of telematics, sensors and electrification leading to the intelligent wagon. This should fill the gap with respect to other means of freight transport and increase the reliability, trustability and efficiency of the rail freight transport. However, there is a need to clearly develop the required systems and services according to the demand of each operator i.e. cargo monitoring for logistics, wagon monitoring for maintenance, exact weighing, etc. These services make use of other services such as positioning and communication with standardize interfaces. The intelligent wagon will be, among others, one of the enablers of CBM, which will make use of the information provide; or the automatic coupler which could be controlled by the intelligent wagon. The challenge is to develop the required systems and services for the intelligent wagon as enabler for further services.

S2R-CFM-IP5-01-2019: Smart data-based assets and efficient rail freight operation

7) Freight Loco of the future: The challenge is to further improve the high-power propulsion system of mainline freight locomotive (including the auxiliary network) to lower significantly the LCC and TCO of the traction chain.

S2R-OC-IP5-01-2019: Condition-based and preventive maintenance for locomotive bogie

SPECIFIC CHALLENGE:

The development of intelligent tools and methods for predictive maintenance are needed to optimize the availability of rolling stock, the quality of service, maintenance costs and return of investment. Condition-based and Predictive Maintenance means predicting when a fault is likely to occur and issuing a warning if the component reaches its lifetime limit or even if an overhaul is required. This information will be distributed automatically to fleet and workshop management systems and trigger actions in accordance to maintenance.

Condition-based and Predictive Maintenance requires sensors and communication boxes for data transmission, but more importantly, data analytics and monitoring tools, an asset management centre and a database with maintenance program and rules. The main driver for current maintenance costs is the locomotive bogie. Therefore, the main focus of this proposal shall be given to the condition-based and predictive maintenance of the locomotive bogie (i.e. motor bogie and trailing bogie), which is at the top of the material costs.

S2R-OC-IP5-02-2019: Advanced obstacle detection and track intrusion system for autonomous freight train

SPECIFIC CHALLENGE

The future of rail freight will be fully automated. For the operation in automation grade GoA 3/4 (attended and non-attended operation), all activities and responsibilities of today's train drivers needs to be taken over by several systems.

Among other things, the GoA 3/4 system must be able to:

- Sense the environment to overlook the scene;
- Detect potentially dangerous objects on the train's path;
- React accordingly and in the right way.

The obstacle detection system will need to monitor an environment according to freight specific and general use cases e.g. EN62267 and/or relevant projects working in the field of automation.

Example for challenging situation:

- System should have the ability to detect very long ranges e.g. up to 2 km;
- Encountering troubling weather conditions, including heavy winter and desert-like situations;
- Being able to detect pathways;
- At large speed ranges from 0km/h up to 180 km/h;
- In line with the achievement of SIL 4 for the entire GoA 3/4 system.

Cross Cutting Activities (CCA)

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WA1 Long-term needs and socio-economic research & SPD's

2015	2016	2017	2018	2019	2020	2021	2022	...

IMPACT-1 (04/18), NEAR2050 (04/18)

Ongoing: IMPACT2

Planned activities

WA2 KPI method and integrated assessment

2015	2016	2017	2018	2019	2020	2021	2022	...

Finished: Roll2Rail (10/17), IMPACT-1 (06/18)

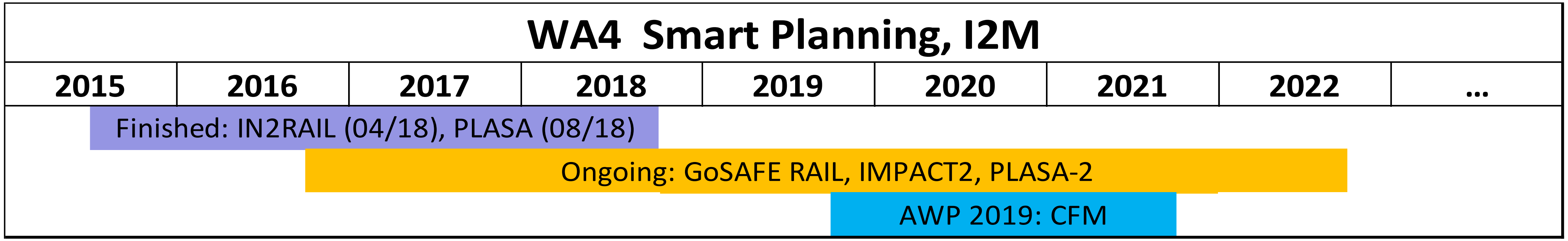
Ongoing: Tender KPIs, IMPACT2

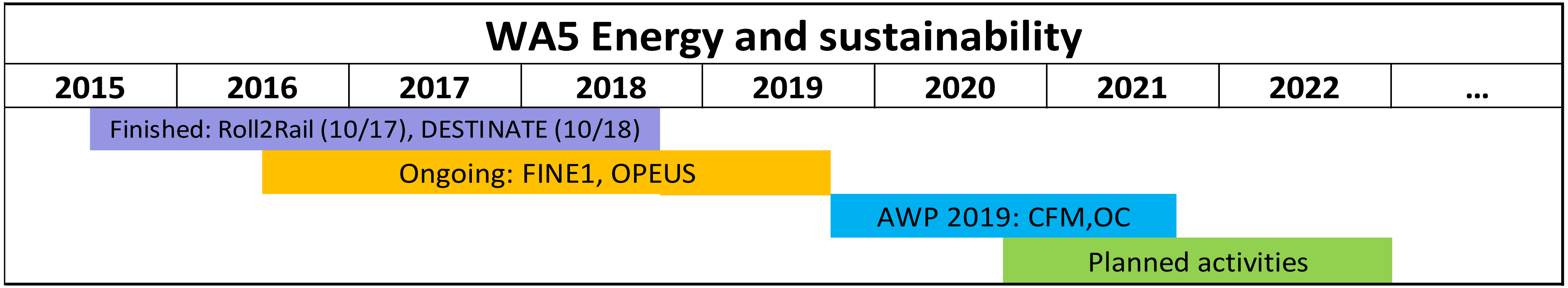
WA3 Safety, Standardisation, Maintanance, Materials, Virtual Certification

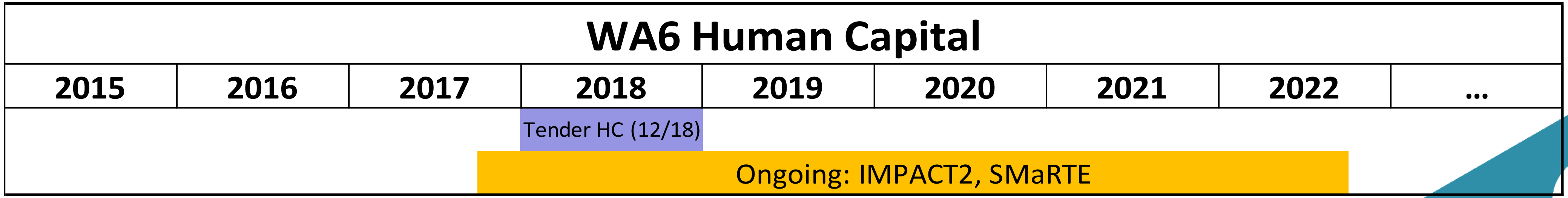
2015	2016	2017	2018	2019	2020	2021	2022	...

Finished: PLASA (08/18)

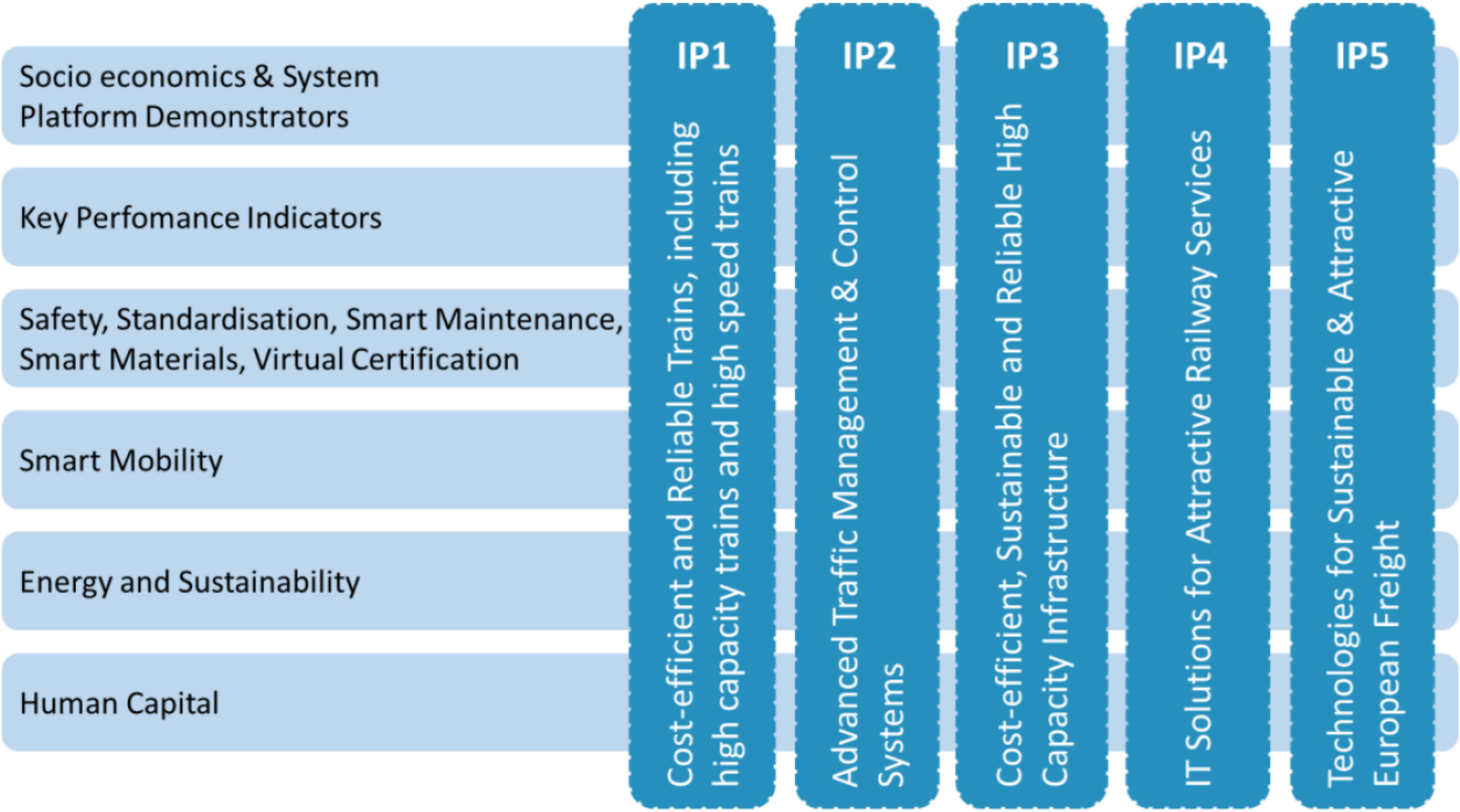
Ongoing: GoSAFE RAIL, IMPACT2, SMaRTE, PLASA-2


WA4 Smart Planning, I2M
2015
2016
2017
2018
2019
2020
2021
2022
...
Finished: IN2RAIL (04/18), PLASA (08/18)
Ongoing: GoSAFE RAIL, IMPACT2, PLASA-2
AWP 2019: CFM


WA5 Energy and sustainability
2015
2016
2017
2018
2019
2020
2021
2022
...
Finished: Roll2Rail (10/17), DESTINATE (10/18)
Ongoing: FINE1, OPEUS
AWP 2019: CFM,OC
Planned activities


WA6 Human Capital
2015
2016
2017
2018
2019
2020
2021
2022
...
Tender HC (12/18)
Ongoing: IMPACT2, SMaRTE

To implement the systems approach, work conducted within the five IPs are supported by cross-cutting activities (CCA)



Shift2Rail

Working Area „Energy and Sustainability“

- **Overall objectives:** To reduce the operational costs of railways and enable an increase of traffic and enhance the attractiveness of the rail as a means of transport through
  - reduction of energy consumption and
  - reduce the annoyance and exposure to noise and vibration related to the railway sector in Europe
- **Achievements:**
  - develop auralisation and visualisation (A&V) techniques of railway related scenarios → Successfully presentated at INNOTRANS 2018
  - Systematically approach to assess the impact of innovative technologies on energy demand and costs in European railway system
  - modular prediction framework for interior noise predictions

S2R-CFM-CCA-01-2019: Integrated mobility management (I2M), Energy and Noise & Vibration

SPECIFIC CHALLENGE

Integrated Mobility Management (I2M)

The project IN2RAIL (GA number 635900) has delivered a first system design for an integrated Communication Infrastructure to link the defined rail operation services and their field assets. This platform (Integration Layer) uses standardized data structures and processes to manage the data exchange between different stakeholders and provides a gateway for data exchange with external clients. The availability of such data will enable analyses to enhance rail traffic management, including improved planning and timetabling, reliable and resilient operations and informed asset investment and maintenance decision making.

The most critical factor to realize the proposed system concept is the maturity of the Canonical Data Model with embedded elements of information required from the different applications of subscribed services/clients. To achieve this goal, applied operational procedures or technical functionalities must be described in such depth that the necessary data to be received or send from/to other clients can be specified. If preceding projects deliver their targeted outputs, the works proposed for WA4.2 in this project will not face significant risk to be completed.

S2R-CFM-CCA-01-2019: Integrated mobility management (I2M), Energy and Noise & Vibration

Energy. The challenge regarding energy is linked to the need to reduce energy consumption within the railway sector in order to ensure that the environmental advantage of railways remains or increases. The necessity to reduce energy costs, an important part of the total Life-Cycle Cost, to contribute to the general S2R objective "Reduced operating costs" is also a priority. Furthermore, reduction energy consumption from HVAC is needed is required, as HVAC accounts for a major part of the energy consumption from the traction.

Noise and Vibration. In order to ease vehicle certification and reduce the associated cost and time expenses without penalising the real vehicles noise performance, virtual certification will play an important role in the near future. Thus, current exterior noise simulation tools require further research and validation in order to ensure that the procedures and methodologies applied, and the results obtained represent the noise performance the real train will have. Additionally, current noise measurement procedures lack the possibility to accurately separate noise sources on pass-by noise tests, and do not cover the common vehicle scenarios (including different track types). Separation of contributions is relevant both for vehicle validation and for source ranking prior to mitigation measure implementation, and the improvement of separation techniques shall finally lead to more flexibility, better comparability and hence a better vehicle characterization in current homologation procedures and for the customers.

S2R-OC-CCA-01-2019: Noise & Vibration

SPECIFIC CHALLENGE

Noise and vibration (N&V) represent one of the biggest environmental challenges for the railway. The target of this work area is to reduce the exposure to noise and vibration related to the railway sector in Europe. Population in the vicinity of railways do not accept the increasing N&V annoyance while on the other hand a shift to rail-traffic is important for environmental reasons.

Exterior Noise: In order to ease vehicle certification and reduce the associated cost and time expenses without penalising the real vehicles noise performance, virtual certification can play an important role in the future. Thus, current exterior noise simulation tools require further research and validation in order to ensure that the procedures and methodologies applied, and the results obtained represent the noise performance the real train will have.

Additionally, current noise measurement procedures lack the possibility to accurately separate noise sources on pass-by noise tests, and do not cover the common vehicle scenarios including different track types. Source separation is relevant both for vehicle validation and for source ranking prior to mitigation measure implementation, and the improvement of separation techniques shall finally lead to more flexibility, better comparability and hence a better vehicle characterization in current homologation procedures.

New Technologies: Noise control of railways is a challenge also from a comfort point view of the passenger. New and innovative solutions are required to match and exceed the development of passenger comfort and acoustic performance in other modes of the transport such as cars, busses and aircraft, in the future.

IPx and tenders

S2R-CFM-IPX and CCA-01-2019: Definition of the S2R Conceptual Data Model

SPECIFIC CHALLENGE:

Digitalization is a reality of the railway sector. In almost all areas of operation, computerized systems are available, ranging from computer-based interlockings to systems for analysing asset diagnostics which have emerged over the last few years. We have computer systems for timetabling, traffic management, energy management, asset maintenance, rolling stock inventory, crew rostering etc.

What is missing is an efficient, automated and standardized/agreed way for these systems to act as **one** ecosystem, sharing and integrating or give meaning/correlate to their data and making use of the sum of this information. Hereby improving existing services, in terms of time-to-market and maintainability, or to offer innovative solutions, new type of services, also taking advantage from integration of not purely railway data source (e.g. intermodality).

The sector needs to overcome its current “data” and “systems” fragmentation, the “silofication”, and produce within S2R one Shift2Rail Conceptual Data Model (S2R-CDM) that, with the commitment of the S2R Members, will become the standardised way for legacy and new systems to interact, thus ensuring interoperability between systems.

Shift2Rail

S2R-CFM-IPX and CCA-01-2019: Definition of the S2R Conceptual Data Model

The S2R-CDM is not meant to model the whole railway system and it should not have the expectation to model everything. Its objective is to define a unified conceptual structure representing the components of the railway system, identify the relations between them and provide a common language and data dictionary to describe them. The S2R-CDM can be used as a foundation for new products or for exchanging/giving interpretation to data between different railway systems (or different components within a railway system).

The challenge consists in defining a Shift2Rail Conceptual Data Model (S2R-CDM) to be used without license fees as free and open standard like LINUX in the world of operating systems. The S2R-CDM structure should allow the inclusion of complementary modelling initiatives in a collaborative effort (e.g. BIM, RTM, Eulynx, railML, TAP/TAF, , IP4 ontology based modelling approach), avoiding competing and overlapping models, and creating new business cases. The core model will be such that no limitations are created related to the implementation of the model, i.e. the model must support different ways of implementing an interface with today well-known formats and protocols but also non-restrictive for future formats and protocols. S2R partnership will have to develop governance in order to ensure the consistency and scalability of the S2R-CDM in the future. Different ongoing S2R projects (IN2SMART, X2RAIL2, CONNECTA, CONNECTIVE, FR8RAIL, IMPACT2) are already dealing with the concept of data standardization and data integration, confirming that a common understanding of data is a need to be addresses more broadly.

S2R-OC-IPX-01-2019: Artificial Intelligence (A.I.) for the railway sector

SPECIFIC CHALLENGE

Arising and promising disruptive technologies (e.g. A.I., robotics) will contribute to shaping the way how future rail automation and maintenance will be organised and the subsequent strategic industrial developments on rolling stock and infrastructure. The more advanced aspects of this approach and technologies can be developed in a potential continuation of the current S2R activities.

Rail is a network, is a system, is predictable, is supervised and the Shift2Rail Joint Undertaking can become the test bed for some A.I. developments.

A.I. could become for example an “add on” for existing and future management systems providing suggestion/action for real time problem solving in order to comply with the basic safety and performance requirements, as well as it can guide the design process (e.g. data preparation and configuration).

S2R-OC-IPX-02-2019: Breaking language barriers

SPECIFIC CHALLENGE:

Linguistic barriers in driving train across countries have been downgrading the efficiency of the railway system.

The European Commission recognizes it ad it is currently exploring through a draft Commission Regulation amending Annex VI to the Directive 2007/59/EC towards alternative options to the current language requirements. The challenge is allowing for greater flexibility but ensuring an equivalent level of safety with the current requirements.

Number	Subject of tender	Indicative scope
1 – contract (call)	Technical solution for intermodal information exchange for freight	Looking at further innovation possibilities than mere standardisation of data proposing a technical solution able to implement TAF and benefit of it beyond the rail freight sector (e.g. last mile with a truck, consignements from harbours). The starting point should be the results of IP4 interoperable IT framework and methodologies, coupled with the work done in IP5 and with the S2R Conceptual Data Model, that would allow multimodality for passenger without a need of imposing common standards.
2 – contract (implementation)	Support to ERTMS European Action Plan tp pave the way for the deployment of the future S2R Innovative Solutions	Implementation of a 4-year framework contract with a total estimated value of EUR 8 million. This activity aims at supporting the implementation of the ERTMS European Action Plan, published by the European Commission in June 2017. Under the supervision of the JU and together with Commission Services (DG Move), inter alia, the contractor will perform tasks such as support the ERA Change Control Management process' and related update of specification documentation (including test specifications); Identification of the existing sets of engineering rules regarding transitions between systems; Contribution to the technical review of trackside deployment of ERTMS in cross-border sections; Contribution to the drafting/updating of technical specifications for upcoming ERTMS communication system set to replace GSM-R and to the appraisal of the impact on interoperability of its roll-out.
3- contract (call and implementation)	Strategic support to the S2R JU (framework contract)	Ad-hoc activities in view of refocusing the programme and integration of a new architecture

Towards Horizon Europe and a potential Shift2Rail 2

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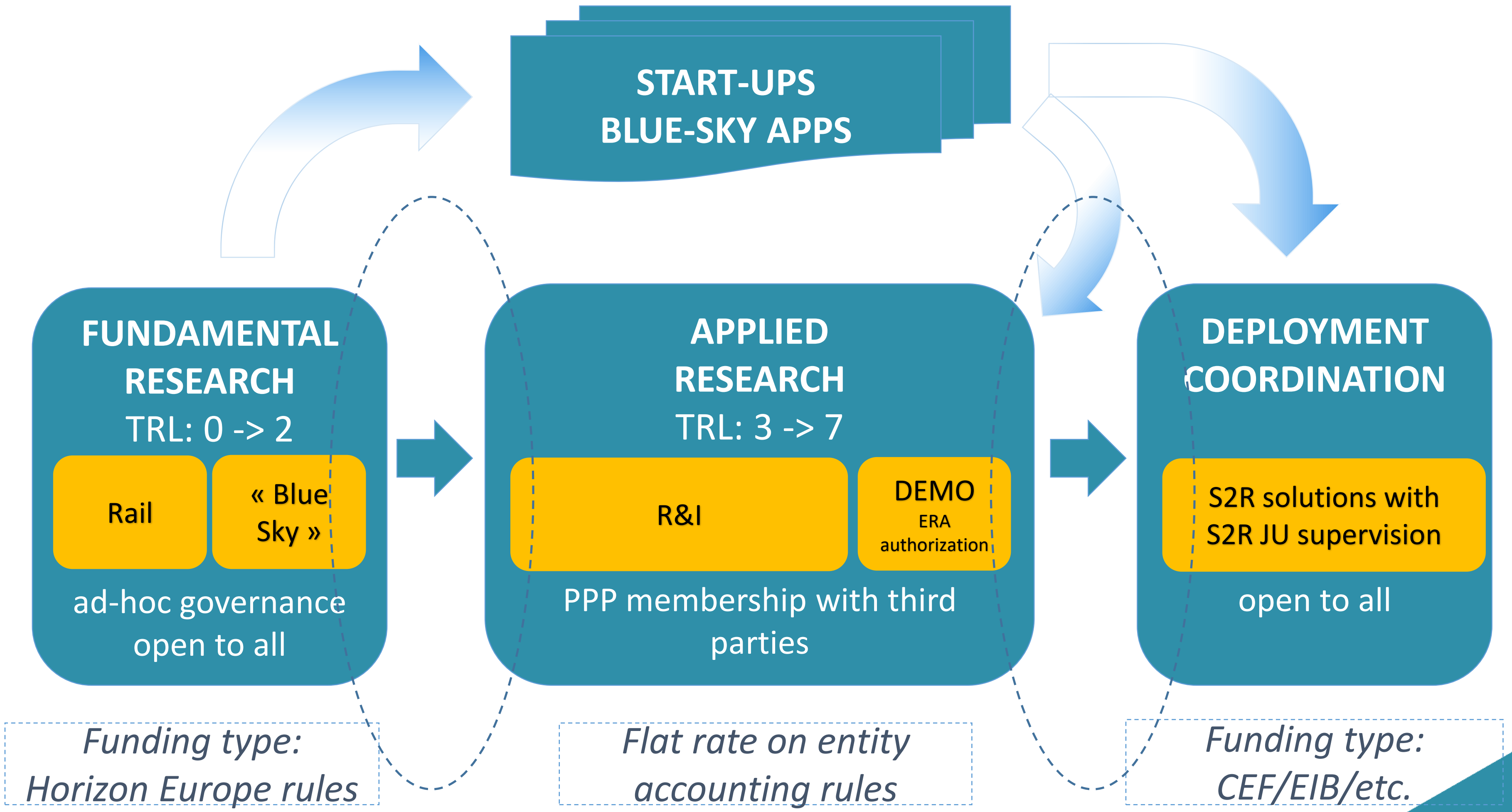
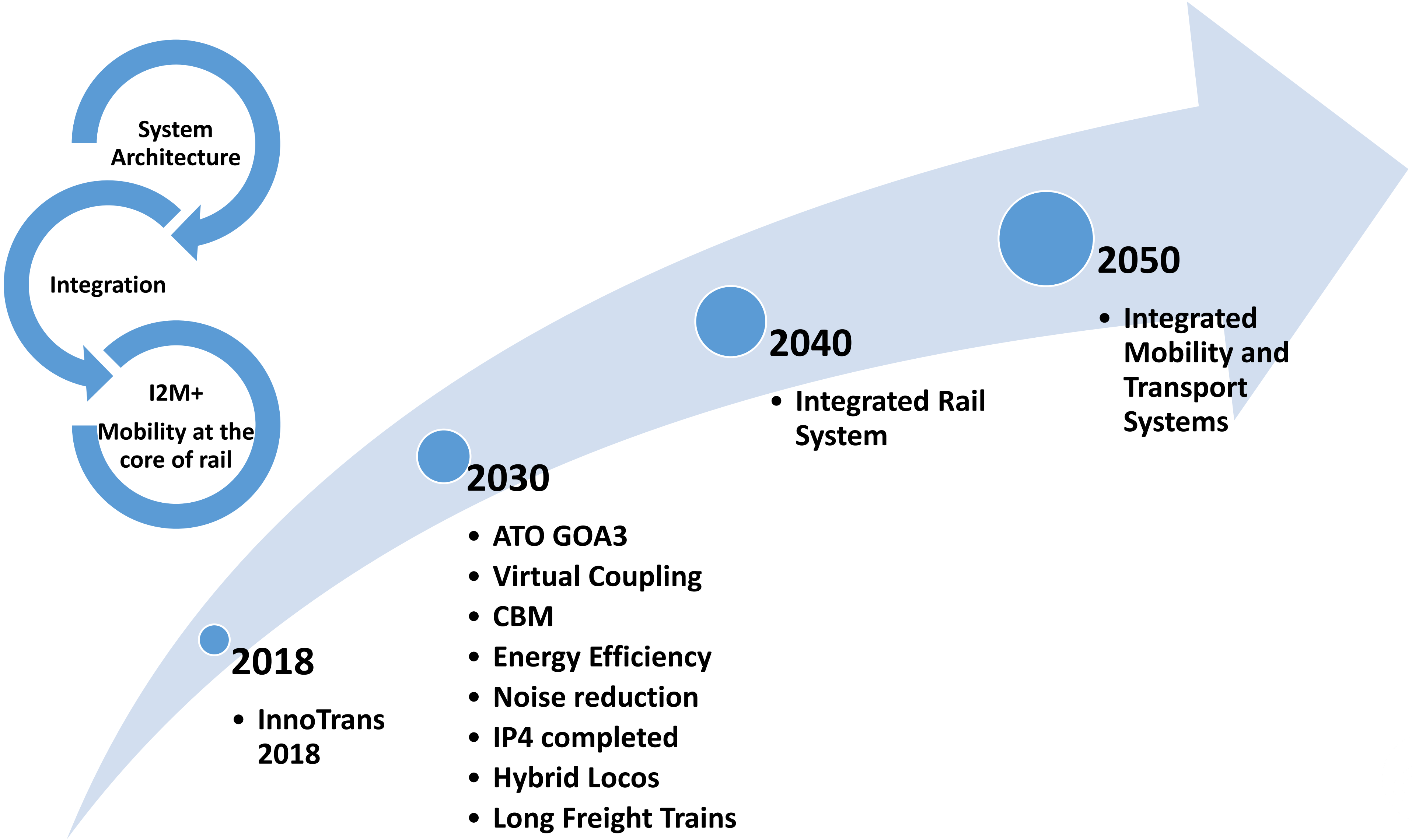
S2R Europe 2030 Research and Innovation beyond 2020



Programme Content: Operations -> Systems -> Innovation Capabilities

RAILWAY	CUSTOMER CENTRIC	SUSTAINABLE
AUTOMATION	6. Services Timed to the Second	1. ATO
DIGITAL	2. MAAS	4. More Value from Data
	3. Logistic on Demand	5. Optimum use of Energy
	10. Stations, Smart City Mobility	8. Guaranteed Assets Health and availability
		9. Intelligent Trains
Other technologies/ Processes	Relation with Air Transport	7. Low Cost Railway
	Concessions (?)	11. Environmental and Social Sustainability
	Energy Efficient Cost Efficient	12. Rapid and reliable R&D delivery

Programme Content: towards an Integrated Rail System



FOUNDING MEMBERS

ASSOCIATED MEMBERS

Virtual Vehicle Austria consortium+ (VVAC+)	European Rail Operating community Consortium (EUROC)	Swi'Tracken consortium	Smart DeMain (SDM) consortium

AERFITEC	Competitive Freight Wagon Consortium (CFW)	Smart Rail Control (SmartRaCon) consortium