FP5 TRANS4M-R

Transforming Europe's Rail Freight

Europe's Rail Information Sessions - Flagship Area 5

02. December 2025

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3	Testing and Demo	Anna Björkman Albrecht Emmerich Cesar Osorio
4	Seamless: Multimodal Booking and European Railway Checkpoints	Jan Bergstrand Yves Sterbak Behzad Kordnejad
5	Q&A	all

FP5 TRANS4M-R

Transforming Europe's Rail Freight

Overview FP5 – Data and Facts

Pravena Sathiyanathan

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Fact Sheet

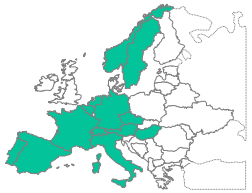
Workstream Seamless

Facilitating **multimodal and intermodal** logistics across borders

Workstream FDFTO

Digitalising and Automating Freight Train Operations

Developing **Sustainable and High-Efficiency** Innovative Freight Assests



Collaboration of 76 european partners from the whole railway sector

30% by 2030

Increasing the modal split for rail freight

The **Digital Automated Coupler (DAC)** is the central enabler of the project

Demonstrating new technology up to **TRL 7-8**

95 Mio. € TPC

Innovation Project for European Rail Freight funded by the EU

European Green Deal

Part of Europe‘s Rail

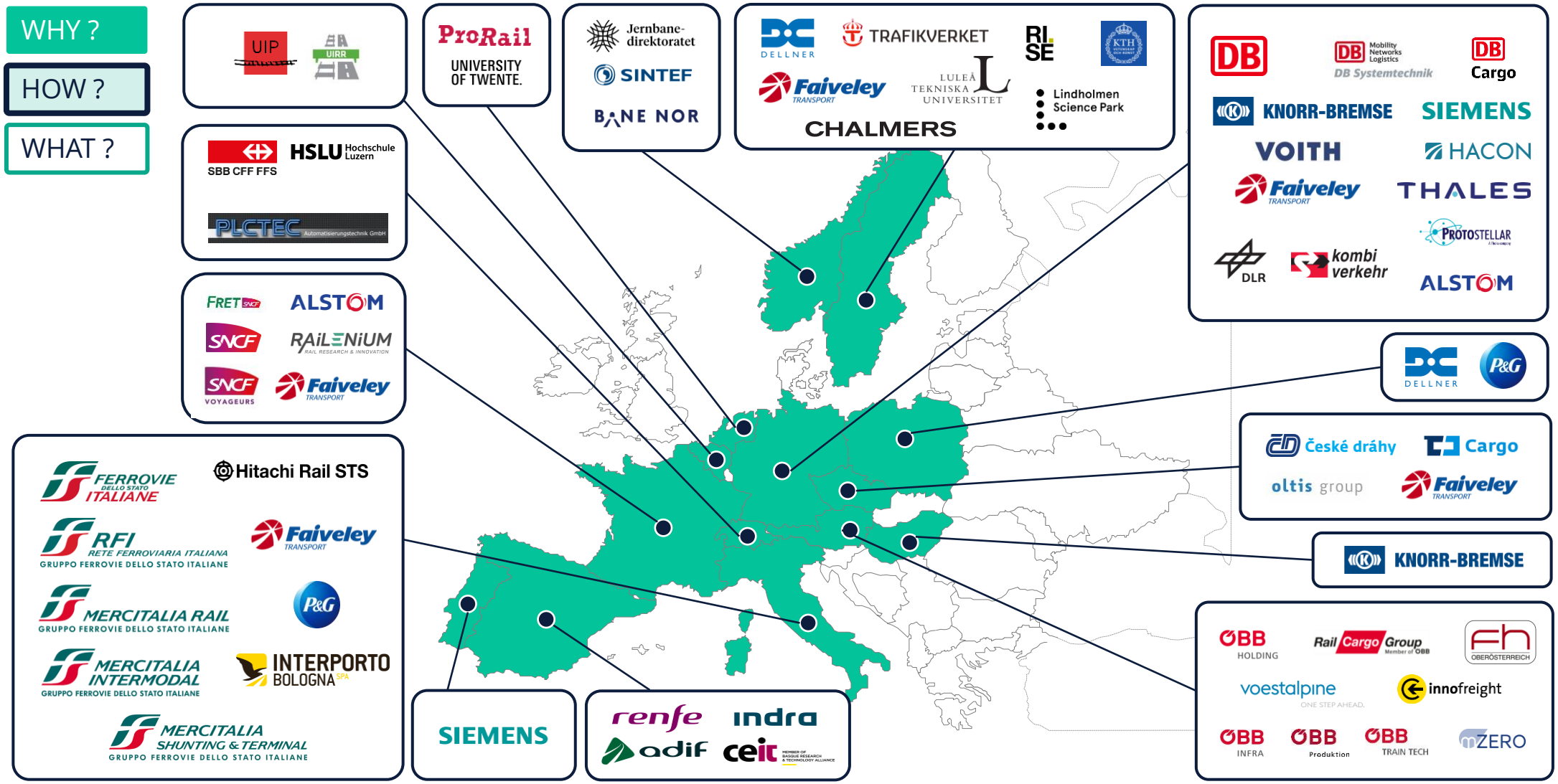
Our approach

76 partners from the whole European railway sector

WHY ?

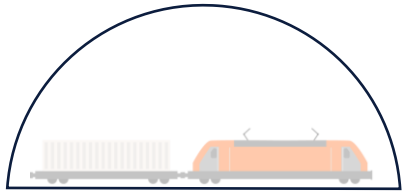
HOW ?

WHAT ?

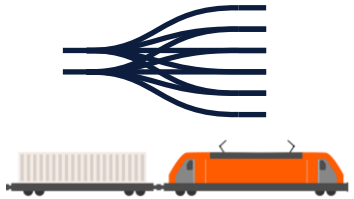


Demonstrators

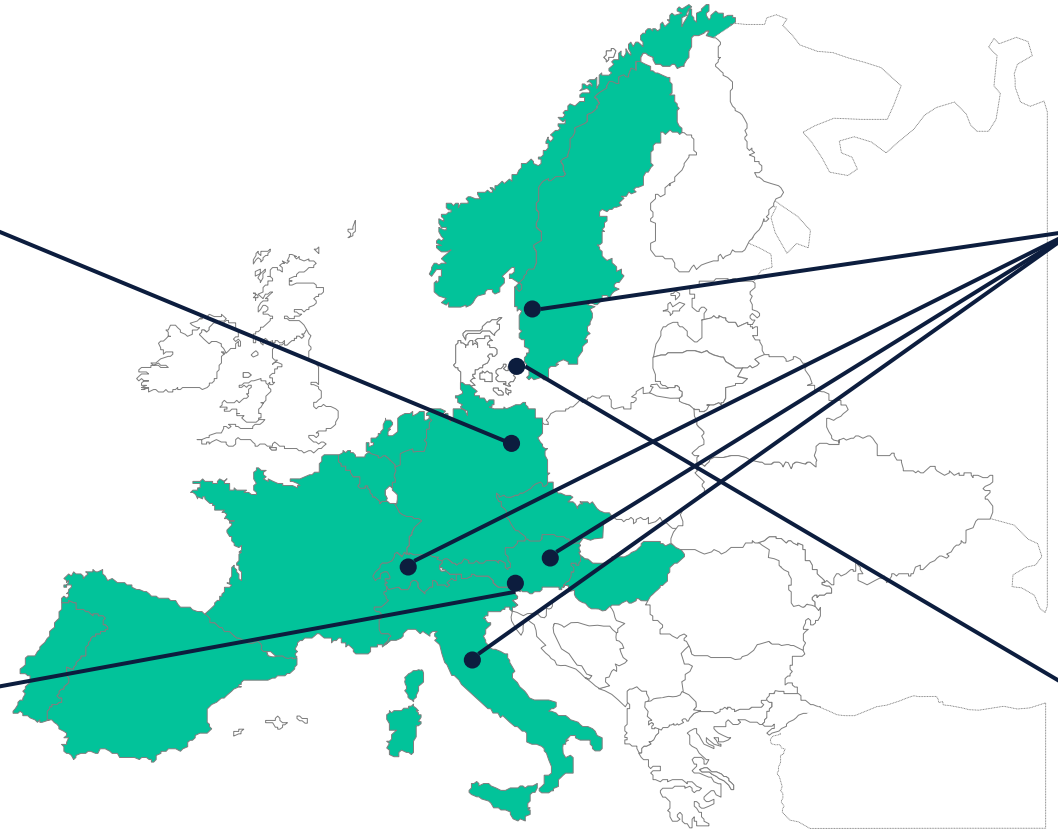
Overview



Train Test Lab
(WP 14)



Automated Shunting in Flat and Hump Yard
(WP 20 + 21)



Demo Trains for FDFTO
(WP15 - WP18)

European Checkpoints
(WP29)

Seamless Showcases
(WP33 – WP34)

FP5 TRANS4M-R

Transforming Europe's Rail Freight

Coupler, EDDP Basic Package, Train Functions

Andreas Haller & Luc Imbert

Europe's Rail

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Coupler

Introduction

EU-Rail FP5 Sub-Project DAC Core

Johan Åhman
Dellner Couplers

Product Manager

Michael Gutemann
Knorr-Bremse

Director Global Sales & Business Development Coupling Systems

Andreas Schuhmacher
Voith

VP CCE Freight Coupler

Stefan Faas
Wabtec

R&D Manager DAC

DACs

VOITH

DELLNER

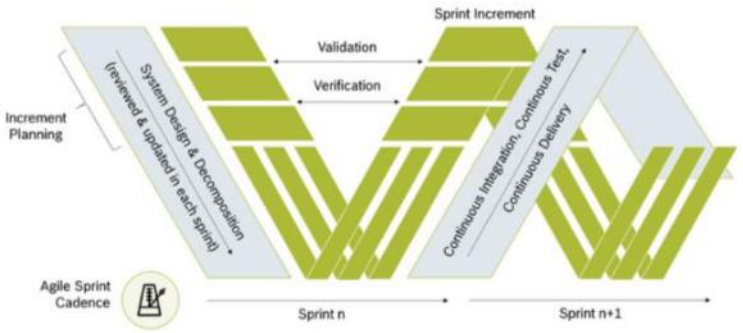
KNORR-BREMSE

Faiveley Transport
A Wabtec Company

DAC Core SCOPE

- DAC core focuses on the mechanic, pneumatic and electric coupler
- **Interfaces between**
  - coupler and wagon
  - coupler and coupler
- **The "specifications" Deliverables (WP5)**
  - 5.2 Technical specification of couplers
  - 5.3 Test and Validation procedures
- **The work packages and associated deliverables**
  - WP6 – DAC functional level 2 to 4
  - WP7 – DAC functional level 5
  - WP8 – Loco hybrid and special wagons up to functional level 5
  - Reach TRL8

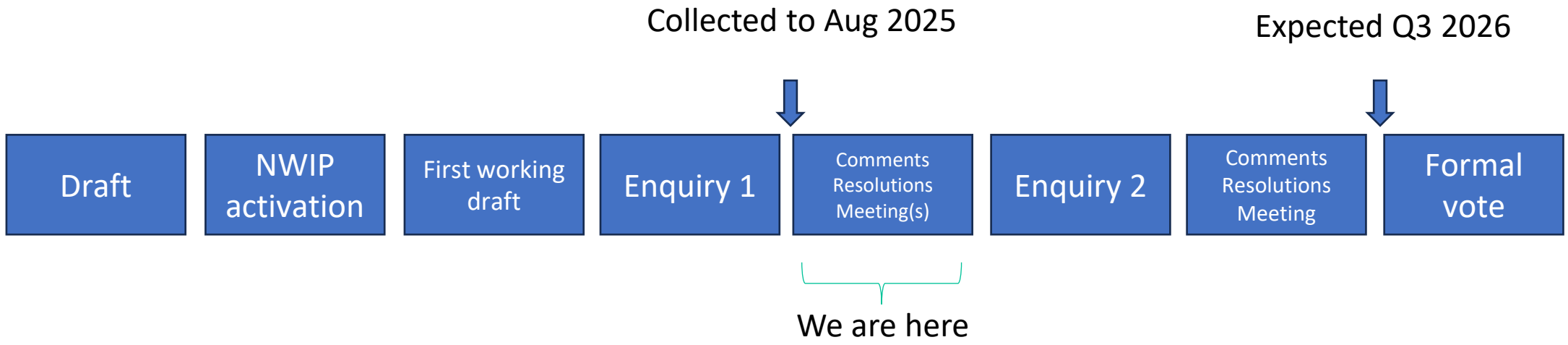
General logic to Structure of WP 6-8



- Inputs from operational procedures, architecture, safety analysis
- Translated into functional requirements (D5.2) & test methods (D5.3)
- Lab testing for proof of design
- Lab testing for interoperability of design
- Closed train testing to demonstrate design and compatibility - verification
- Supply and validation in large scale demos

Technical specifications

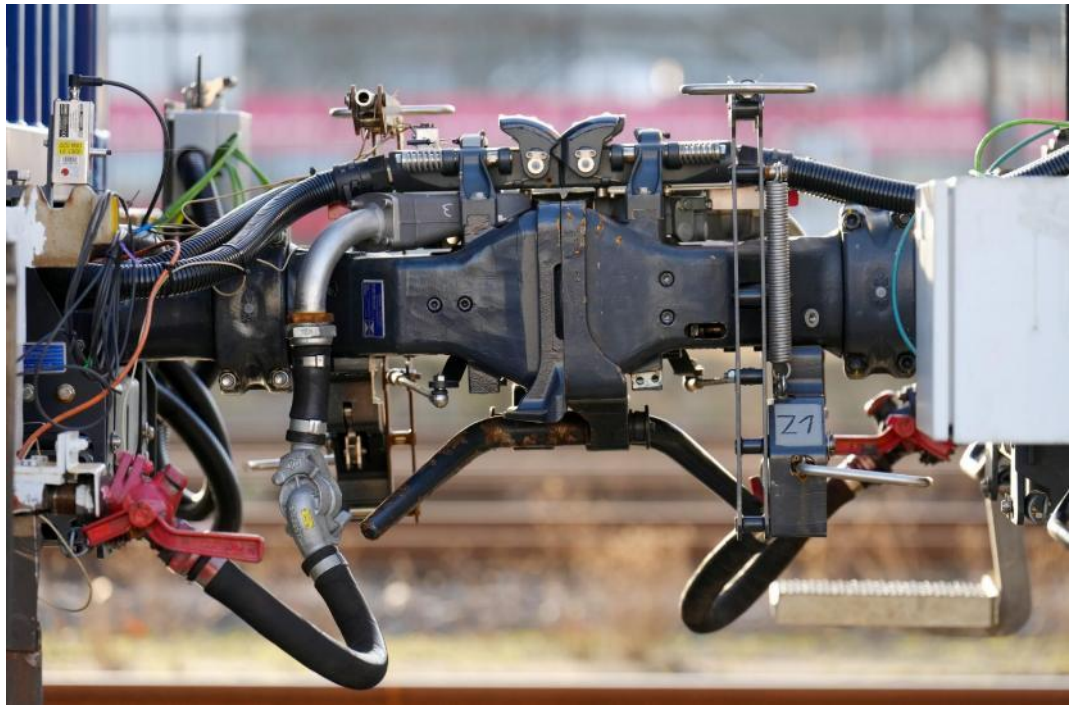
- 5.2 Technical specification of couplers approved and moved into Polarion
- 5.3 Test and Validation procedures submitted and partially moved into Polarion
- CEN Covers functional requirements; mechanical interfaces absolutely required and verification test procedures. Bases for TSI and certification.
- Work is supported by technical experts in FA5 in accordance with Grant Agreement
- Time plan



DAC Supplier Testing

Performed in full form FL2 finalization of FL5 in December 2025

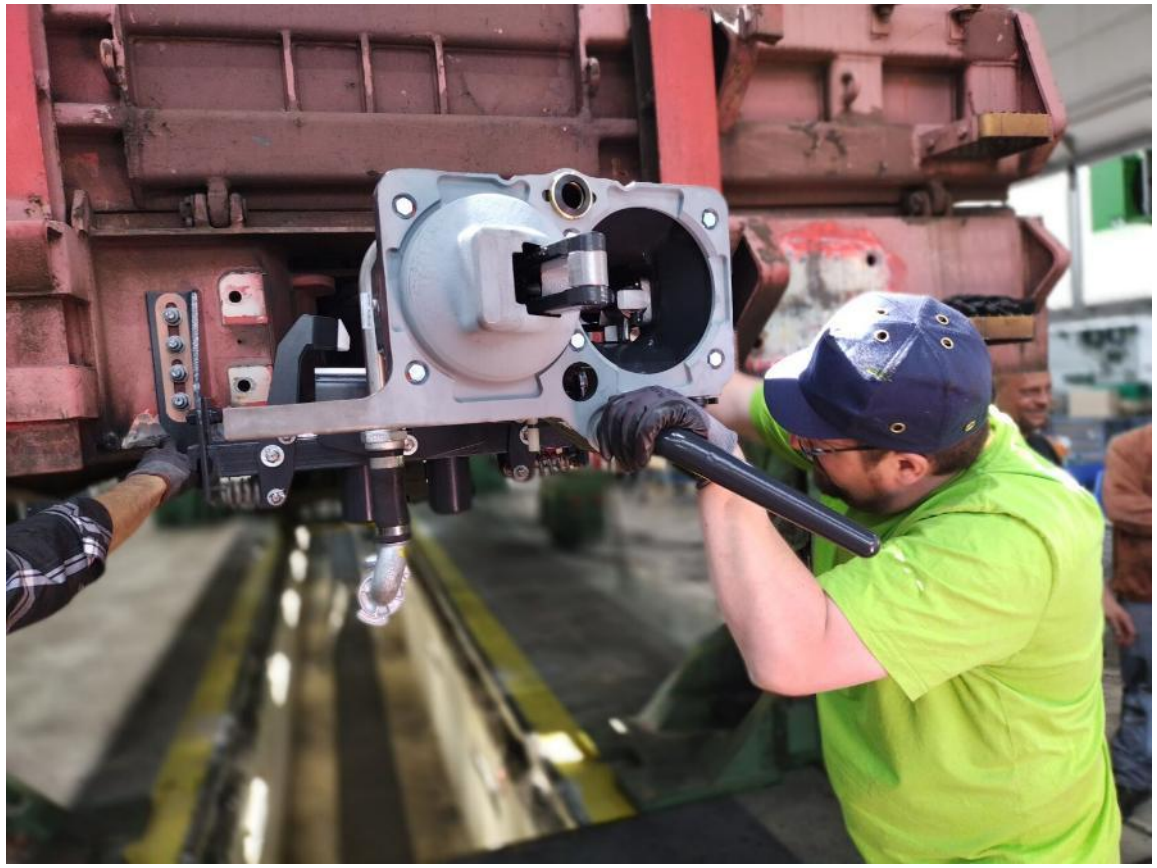
- Type Testing
- Functional testing
- Strength testing
- Derailment test on test bench
- Draft Gear / Energy Absorption Performance
- Environment testing
- Interoperability testing



Train Lab Testing

Wagon tests Performed for FL2 Currently being performed for FL5

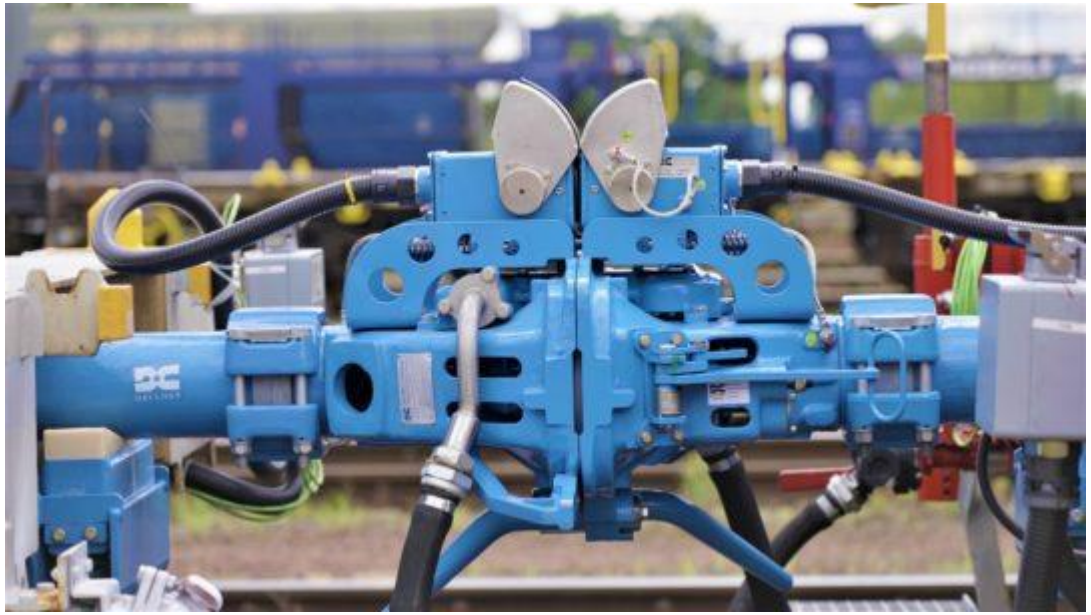
- Impact System Tests
- Running Safety Tests
- Interoperability Tests
- Installation Tests
- Manual uncoupling
- Automated uncoupling tests
- Brake pipe propagation speed test
- Communication and power lines tests



Hybrid coupler tests

Finalized in Q1 2026

- Strength testing
- Tests in DAC mode
- Impact tests in DAC mode
- Driving tests in DAC mode
- Tests in UIC mode
- Coupling tests in UIC mode
- Uncoupling tests in UIC mode
- Change between "DAC" and "UIC" mode

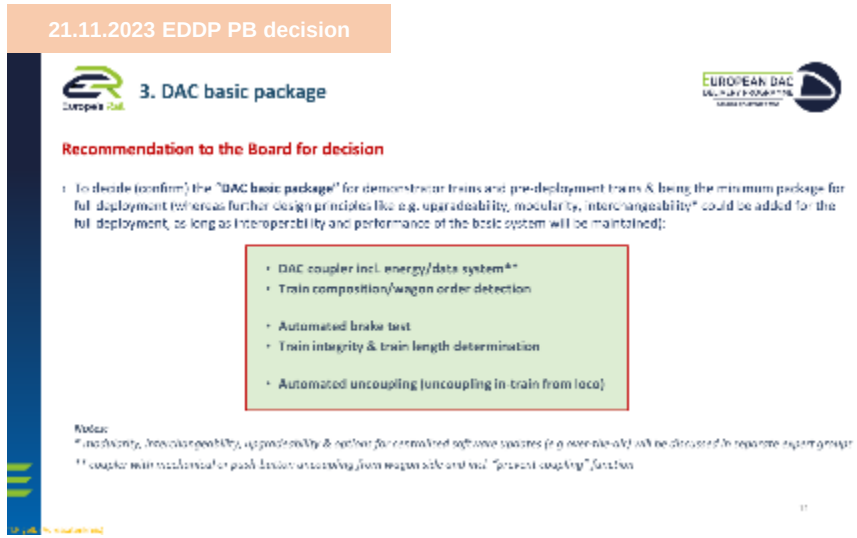


EDDP Basic Package

DAC Basic Package

- The “DAC Basic Package” was agreed during EDDP Programme Board and Supervisory Board end of 2023
- It is the minimum tech/function package for demonstrator trains, pioneer trains & for full deployment

- The “DAC basic package” consists of the following functions:
  - DAC coupler incl. energy/data system (coupler with push-button uncoupling from wagon side and incl. “prevent coupling” function)
  - Train composition/wagon order detection
  - Automated brake test
  - Train integrity & train length determination
  - Automated uncoupling (uncoupling in-train from loco)



- **FP5/EDDP want to provide a more detailed description to whom it may concern → see following slide**

DAC Basic Package: further clarification

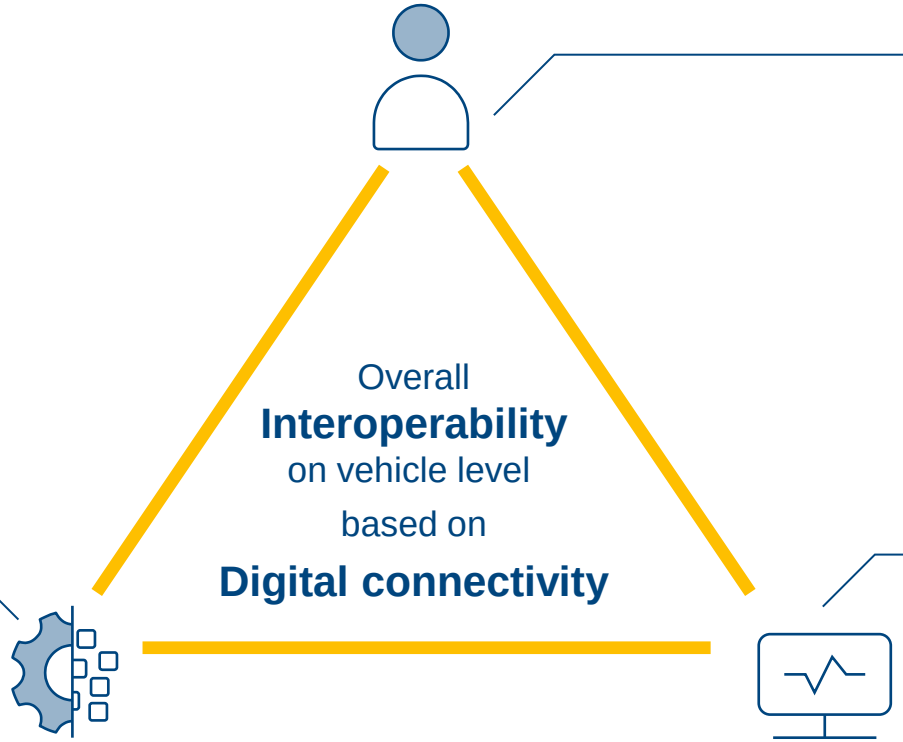
FP5 / EDDP propose the **below more detailed definition** for provision to whom it may concern:

"DAC basic package"	
DAC coupler incl. energy/data system (coupler with mechanical or push-button uncoupling from wagon side and incl. "prevent coupling" function)	▪ Mechanical and pneumatical automatic coupling ▪ Manual mechanical decoupling by emergency release ▪ Autom. E-coupling (data and power) ▪ 400V AC electrical power on train level and 48V DC on wagon level ▪ Single Pair Ethernet in-train data communication
Train composition/wagon order detection	▪ Train composition detection
Automated brake test	▪ Automated brake test
Train integrity & train length determination	▪ Train integrity, safe train length determination
Automated uncoupling	▪ Automated uncoupling via train communication network ▪ Automated uncoupling locally triggered by push-button

Train Functions

TRANS4M-R project content Train functions

generate added value to the user



Train function user

- Train driver
- Operational staff
- Brake test responsible
- Automated train operation (ATO) system, for example a yard automation system

Train control functions

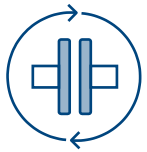
- Change of operation mode
- De-coupling
- Parking brake control
- Network based EP-Brake
- Distributed power (multi-traction for up to 4 loco in a train)
- Power management

Train monitoring functions

- Train composition detection
- Train length determination
- Train integrity monitoring
- Automated brake test
- Parking brake / brake monitoring
- Distributed power (multi-traction for up to 4 loco in a train)
- Power management – battery load monitoring

TRANS4M-R project content Train functions

pre-requisites



Step 1

Upgrade Digital Automatic Coupler

DAC 4 and DAC 5 development as interoperability component

+

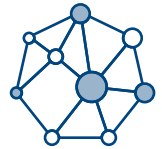
Step 2

Establish energy supply system

From locomotives to wagons

- 400V AC system 2* 1 phase (redundant)
- 3 kW loco power supply
- 2 * 2 train lines
- Wagon power supply incl. board battery system 48V DC

+



Step 3

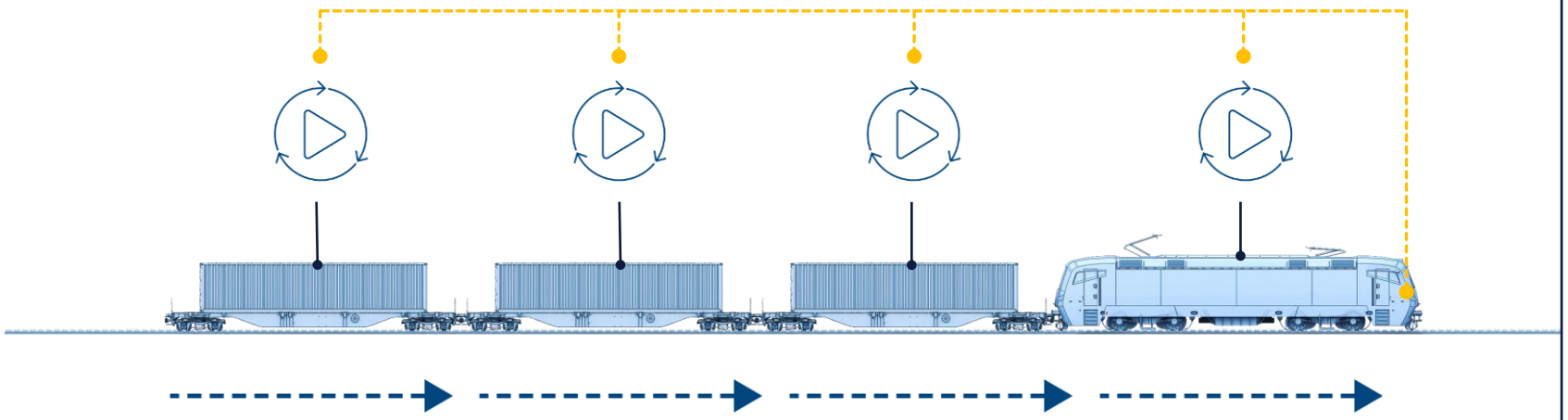
Implement train communication system

- Ethernet train backbone acc. IEC61375 with a new physical interface: SPE (single pair ethernet)
- 2 * 2 cables (redundant)
- 10 Mbit / s

Example of train functions

Competitive rail freight transportation requires Digital Freight Train automation

Train Run Mode



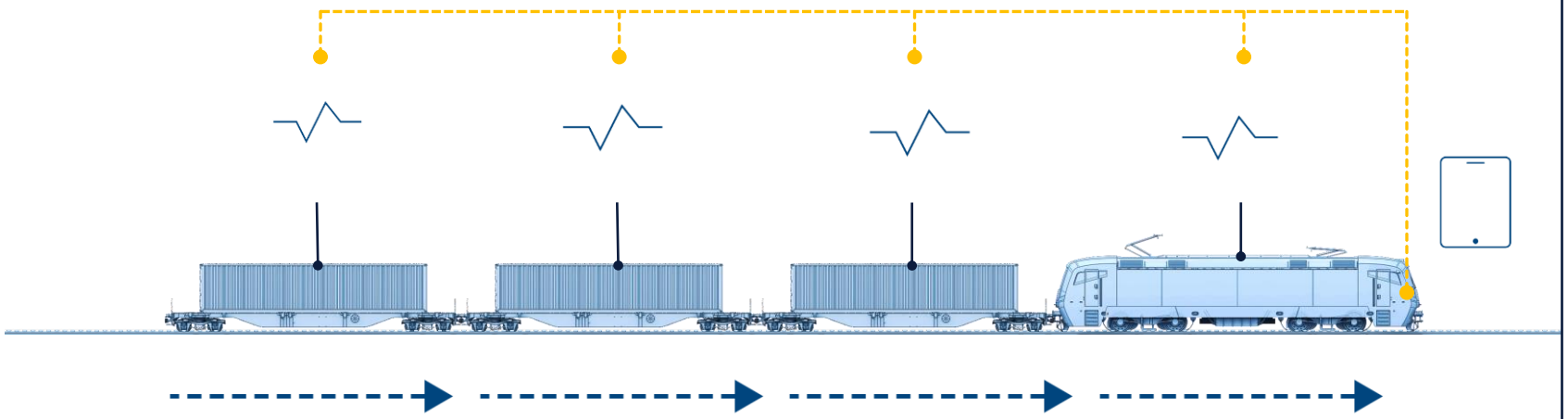
Train is moving

Train Run Mode

Competitive rail freight transportation requires Digital Freight Train automation

Train Run Mode

Train integrity monitoring



Train Run Mode

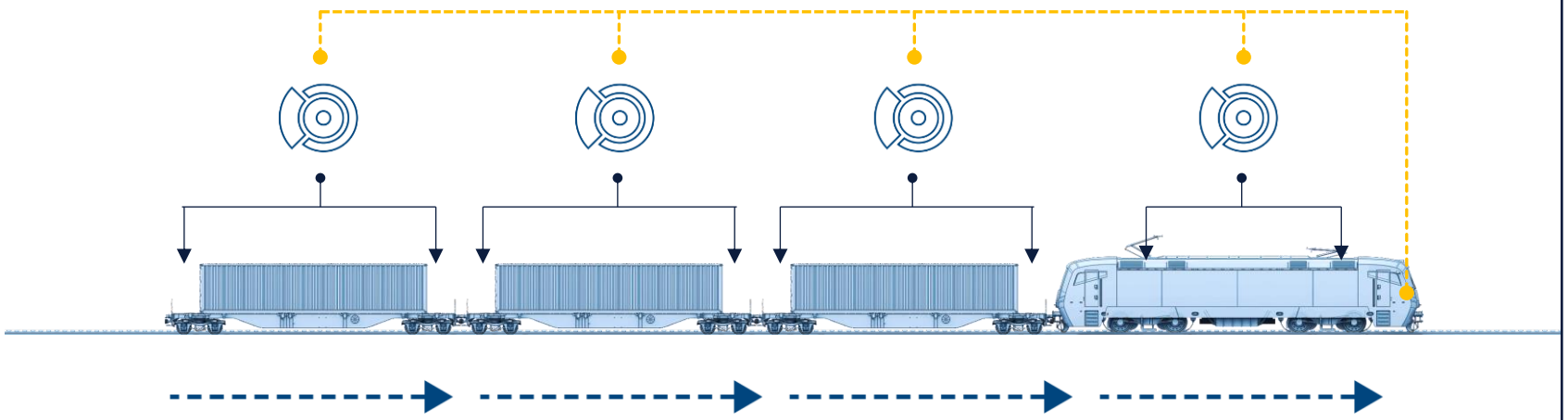
- Train integrity monitoring

Competitive rail freight transportation requires Digital Freight Train automation

Train Run Mode

Train has stopped

Network based electro-pneumatic braking process*



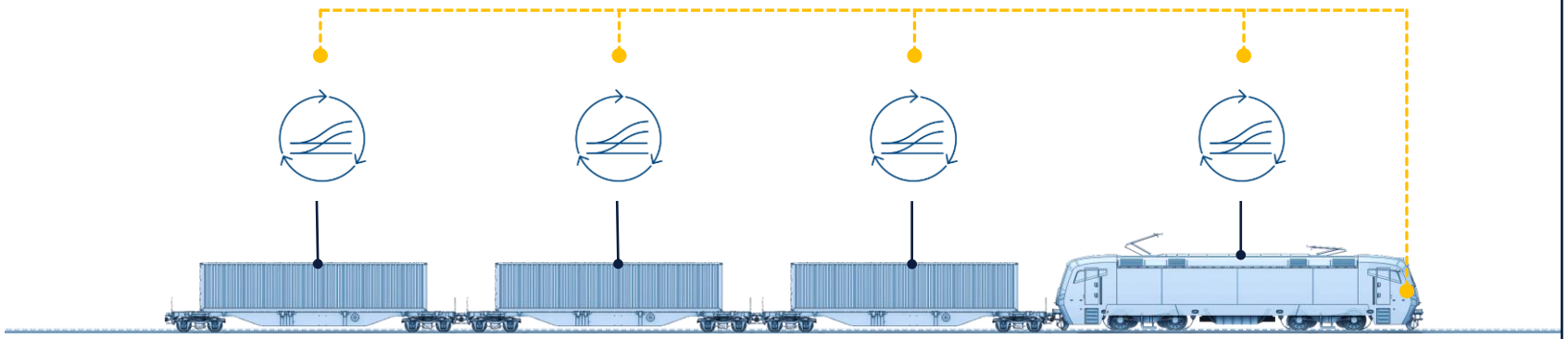
Train Run Mode

- Train integrity monitoring
- Network based electro-pneumatic brake
- Train has stopped

** electro-pneumatic braking process as potential future application, not in EDDP DAC Basic Package*

Competitive rail freight transportation requires Digital Freight Train automation

Shunting Mode



Train Run Mode

- Train integrity monitoring
- Network based electro-pneumatic brake
- Train has stopped

Change to Shunting Mode

Competitive rail freight transportation requires Digital Freight Train automation

Shunting Mode

Apply parking brake

Train Run Mode

- Train integrity monitoring
- Network based electro-pneumatic brake
- Train has stopped

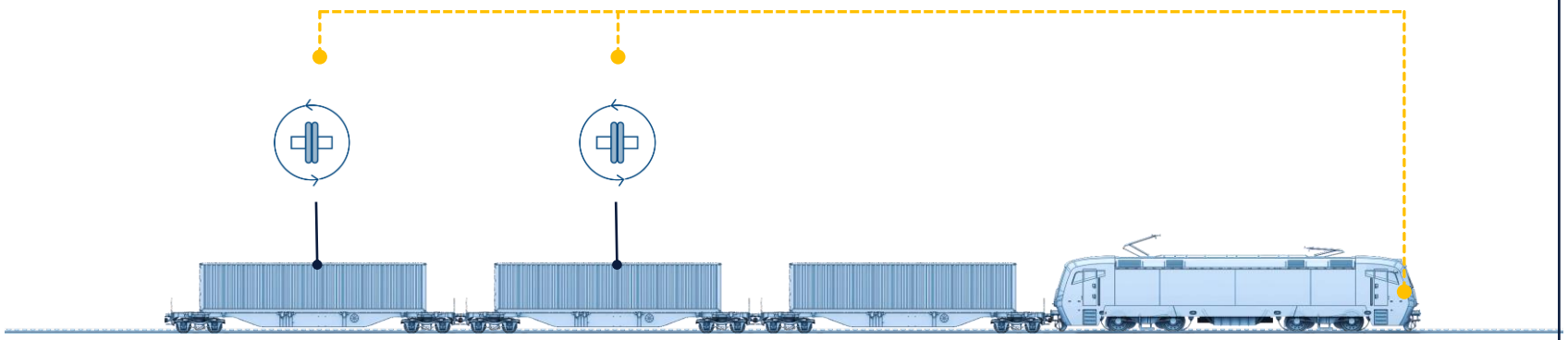
Change to Shunting Mode

- Apply parking brake

Competitive rail freight transportation requires Digital Freight Train automation

Shunting Mode

De-couple



Train Run Mode

- Train integrity monitoring
- Network based electro-pneumatic brake
- Train has stopped

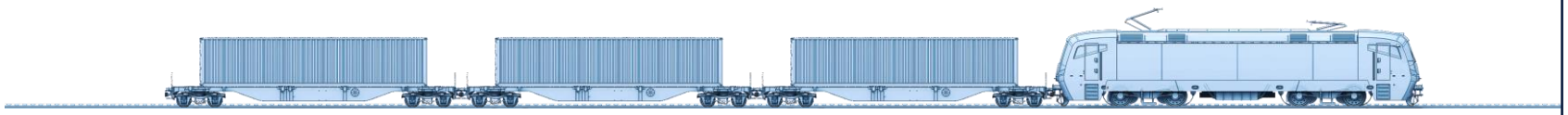
Change to Shunting Mode

- Apply parking brake
- De-couple

Competitive rail freight transportation requires Digital Freight Train automation

Shunting Mode

Move forward



Train Run Mode

- Train integrity monitoring
- Network based electro-pneumatic brake
- Train has stopped

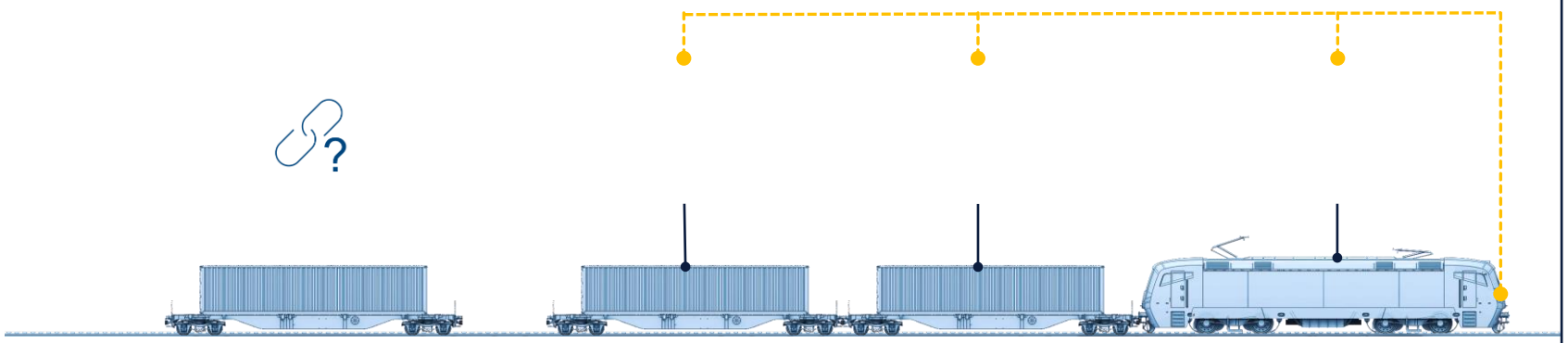
Change to Shunting Mode

- Apply parking brake
- De-couple
- Move forward

Competitive rail freight transportation requires Digital Freight Train automation

Shunting Mode

Train composition detection



Train Run Mode

- Train integrity monitoring
- Network based electro-pneumatic brake
- Train has stopped

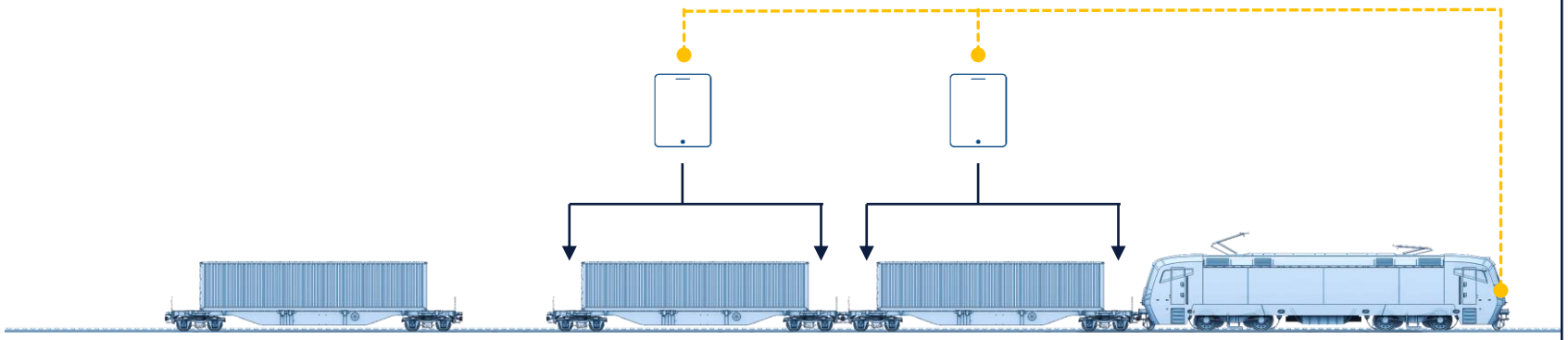
Change to Shunting Mode

- Apply parking brake
- De-couple
- Move forward
- Train composition detection

Competitive rail freight transportation requires Digital Freight Train automation

Shunting Mode

Automated brake test



Train Run Mode

- Train integrity monitoring
- Network based electro-pneumatic brake
- Train has stopped

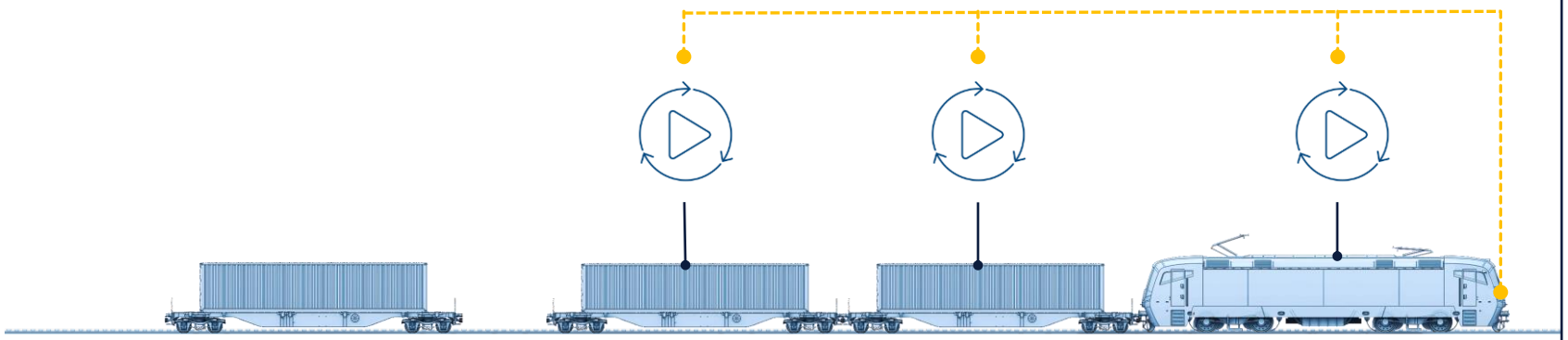
Change to Shunting Mode

- Apply parking brake
- De-couple
- Move forward
- Train composition detection
- Automated brake test
  - Release brakes
  - Apply brakes
  - Release brakes

Competitive rail freight transportation requires Digital Freight Train automation

Change Train Mode

Single Mode | **Train Run Mode**



Train Run Mode

- Train integrity monitoring
- Network based electro-pneumatic brake
- Train has stopped

Change to Shunting Mode

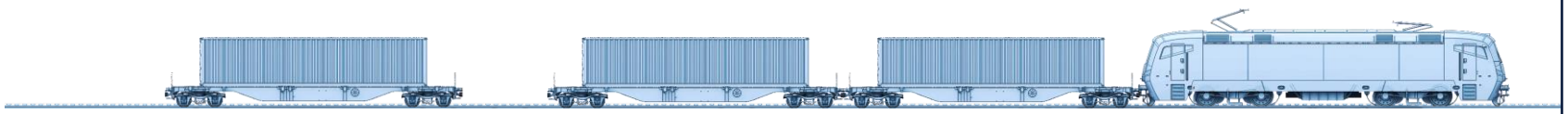
- Apply parking brake
- De-couple
- Move forward
- Train composition detection
- Automated brake test
  - Release brakes
  - Apply brakes
  - Release brakes

Change to Train Run Mode

Competitive rail freight transportation requires Digital Freight Train automation

Train Run Mode

Move away



Train Run Mode

- Train integrity monitoring
- Network based electro-pneumatic brake
- Train has stopped

Change to Shunting Mode

- Apply parking brake
- De-couple
- Move forward
- Train composition detection
- Automated brake test
  - Release brakes
  - Apply brakes
  - Release brakes

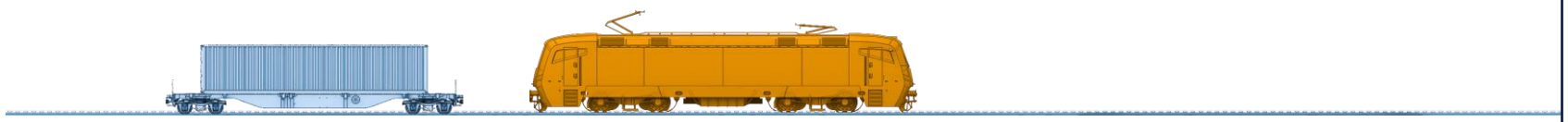
Change to Train Run Mode

- Move away

Competitive rail freight transportation requires Digital Freight Train automation

Single Mode

Shunting locomotive arrives



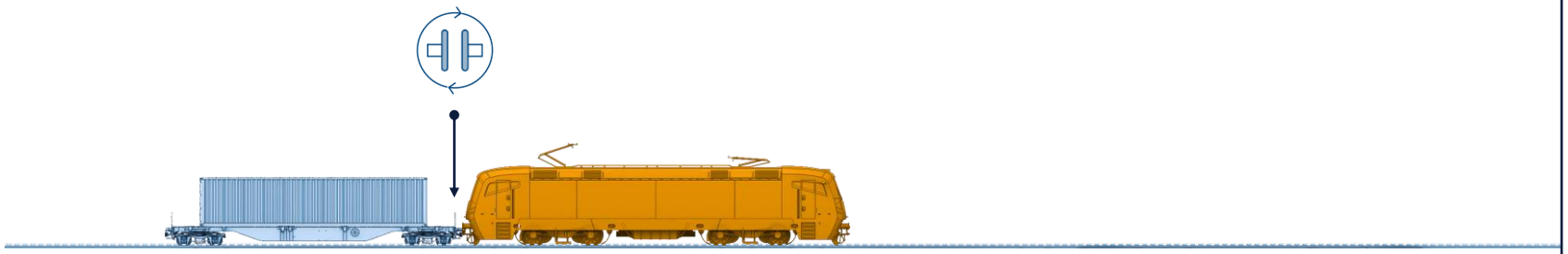
Single Mode

- Shunting locomotive arrives

Competitive rail freight transportation requires Digital Freight Train automation

Shunting Mode

Automatic coupling



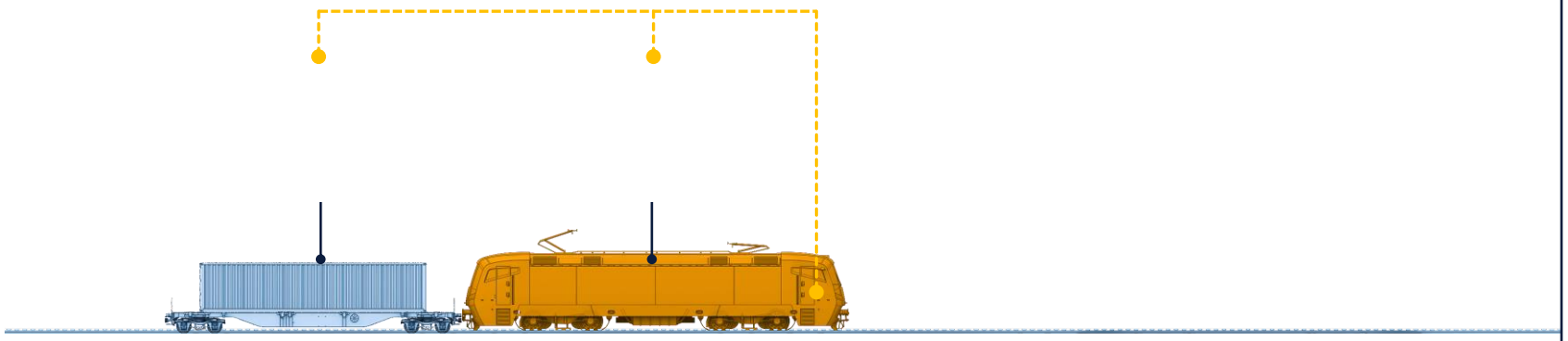
Single Mode

- Shunting locomotive arrives
- Automatic coupling

Competitive rail freight transportation requires Digital Freight Train automation

Shunting Mode

Train composition detection



Single Mode

- Shunting locomotive arrives
- Automatic coupling

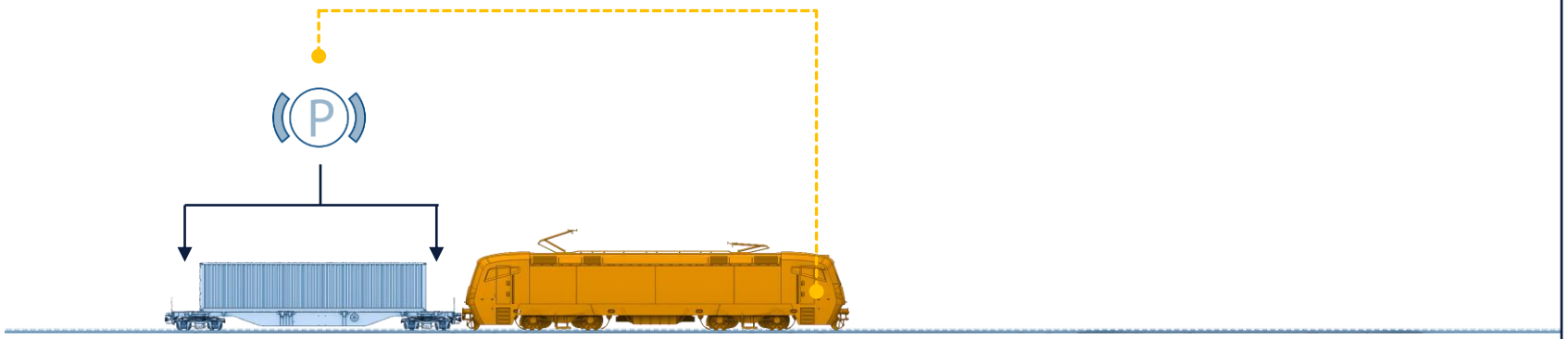
Shunting Mode

- Train composition detection

Competitive rail freight transportation requires Digital Freight Train automation

Shunting Mode

Release parking brake



Single Mode

- Shunting locomotive arrives
- Automatic coupling

Shunting Mode

- Train composition detection
- Release parking brake

Competitive rail freight transportation requires Digital Freight Train automation

Shunting Mode

Movement in shunting yard

Single Mode

- Shunting locomotive arrives
- Automatic coupling

Shunting Mode

- Train composition detection
- Release parking brake
- Movement in shunting yard

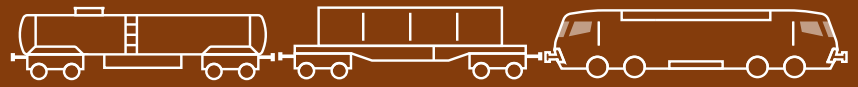
Competitive rail freight transportation requires Digital Freight Train automation

Train Preparation

faster processing

Train Operation

more transportation capacity
dynamic infrastructure utilization



Maintenance Services

sustain, enhance, accelerate

Shunting & Parking

faster processing

Train Run Mode

- Train integrity monitoring
- Network based electro-pneumatic brake*

Shunting Mode

- Apply / release parking brake*
- De-coupling from Loco
- De-coupling locally at a coupling point

Train Neutral Mode

- Train composition detection incl. train length determination
- Automated brake test

- Change of operation mode
- (Automatic coupling)

**not in the scope of EDDP DAC Basic Package*

FP5 TRANS4M-R

Transforming Europe's Rail Freight

Testing and Demo

Anna Björkman, Albrecht Emmerich, Cesar Osorio

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DAC/FDFTO Testing and Demo

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Cesar Osorio
Mercitalia

Sub-project Manager/ WP17 lead

Valerie Baumgartner
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DAC/FDFTO Testing and Demo

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WP14 lead

Albrecht Emmerich
Rail Cargo Group

WP15 lead

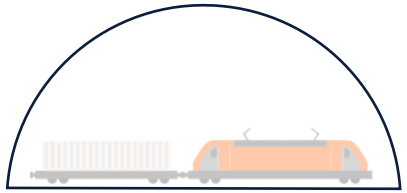
Jonas Eriksson
Lindholmen Science Park

WP16 lead

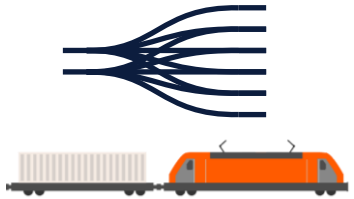
Christian Schmidt
SBB Cargo

WP18 lead

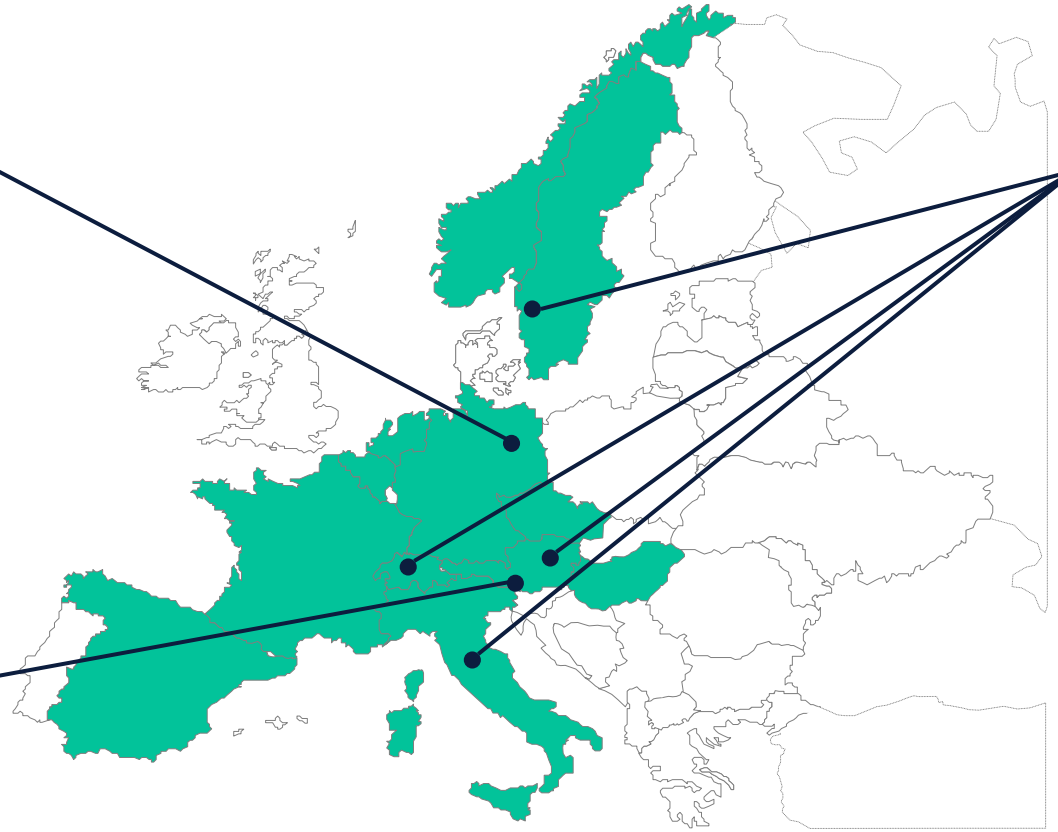
Demonstrators



Train test lab
(Closed environment)



Automated shunting
(Hump and flat yard)



Demo trains
(Public tracks)

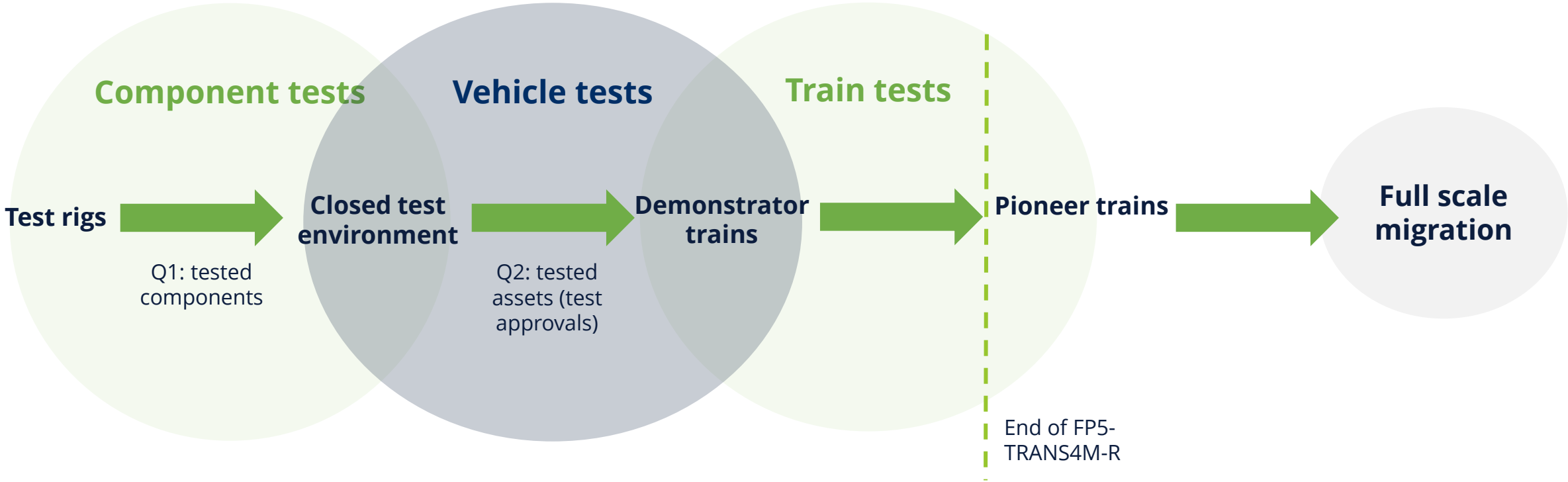
- **Scandinavia:** Focus on FDFT technology in challenging environmental (winter) conditions
- **Austria & Italy:** Focus on EDDP DAC basic package used for operational procedures
- **Switzerland:** Focus on Powerline PLUS technology and hump shunting

Expected results

Test activities carried out

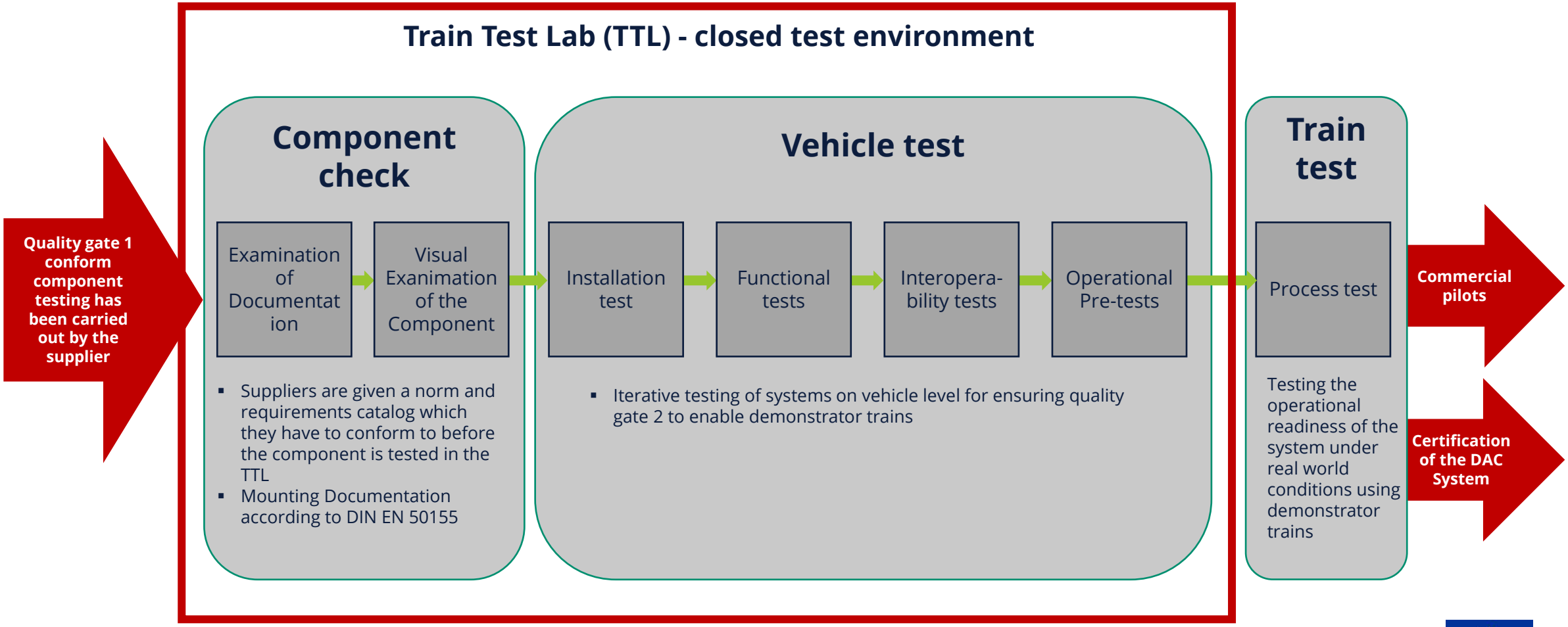
- Stepwise approach according to quality gate set-up ensures safe operation for FDFTO system
- Aim of the test activities are to confirm requirements set for
  - Functionality
    - DAC
    - Energy and data
    - Train functions
  - Authorization
  - Safety
  - Operational procedures
- Show reliability of the system in real operation

Quality gate concept



WP14 test procedure

WP14 Train Test Lab



Tests in closed environment

Focusing on functional, interoperability and installation tests in a safe environment

2023 Q3 – 2025 Q4 test activities focus on DAC with actuators

General description

- After an evaluation of installability and serviceability, functionality of the DAC systems is tested. This includes coupling and uncoupling at different speeds, as well as validation of the pneumatic system. Then validation of DAC as an interoperability interface is planned, along with initial tests regarding suitability in an operational environment.
- Further tests are to be carried out to determine the running ability of vehicles retrofitted with DAK.

Examples of important tests

- Interoperable coupling/uncoupling
- Running ability in special infrastructure

2025 Q4-2026 Q2 test activities focus on train functions

General description

- For Validation of energy and data systems as well as train functions, first step is to validate system integration until end of 2025.
- After that, test focus is on the functionality and safety of hardware systems and train functions. If requirements are met, interoperability is validated and initial operational suitability tests are carried out.

Examples of important tests

- Long train configuration test
- EMC test
- Interoperability test
- Electrical safety on vehicle level

Steel train in Sweden

Test focus and location

Transport of steel slabs between Luleå and Borlänge, with train weights up to 3800 tonnes and a distance of 1000 km one way.

General description

Focusing on train operation in commercial traffic and harsh weather conditions, with also some coupling tests in these sometime extreme temperatures below minus30.

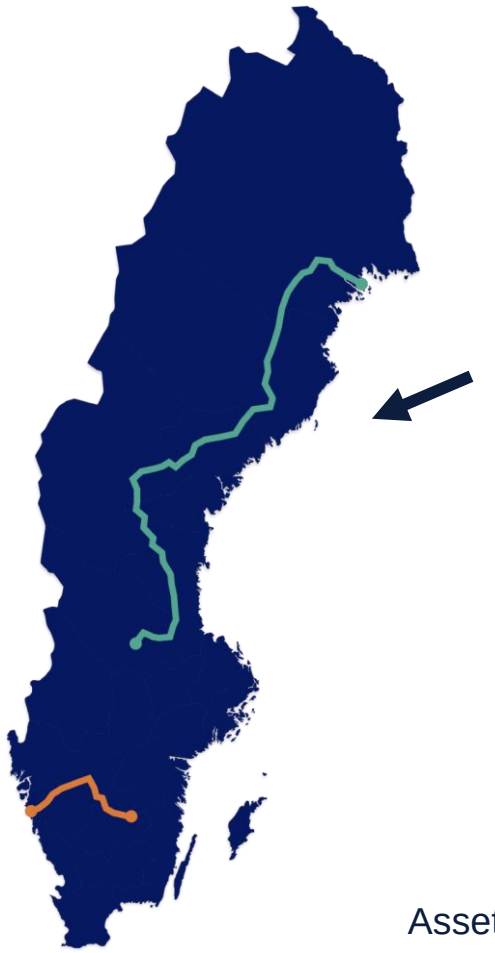
Input to LCC evaluation and reliability in winter conditions and heavy loads.

Examples of test cases

- Operational procedures
  - Train run
  - Coupling

Phase 2 2025: Additional 10 DAC

Test location



Shunting hubs and tracks:

- Runs from from Luleå to Borlänge on a daily basis
- 250,000 km per year

Assets: 42 wagons, 38 DAC

Demo train in Austria

Test focus and location

Phase 2 2026 Q2 - 2026 Q4 test activities

General description:

- Test of train functions: composition detection, train integrity, train length determination, automated brake test, automated uncoupling
- Flat shunting, hump shunting, fly shunting, train run

Assets: 26 wagons, 2 locomotives, 50 DAC, 4 hybrid couplers

Test locations in Austria

Main shunting hubs, tracks and EU freight corridors in Austria:

Demo train in Italy

Test focus and location

Phase 1 2026 Q1-Q2 test activities

- Test rig tests to prepare authorization (DAC and hybrid coupler)
- Preparation of locomotive (test with hybrid coupler and LCU)
- Installation and first tests in TTL (Berlin)

Phase 2 2026 Q2/Q3-Q4 test activities

- Functional testing DAC and CCU
- Test of train functions: train composition detection, train integrity, train length determination, automated brake test, automated uncoupling
- Flat Shunting and train Run

Examples of test cases

- Coupling, Uncoupling
- Wagon Processing
- Train run
- Shunting Preparation
- Train Preparation
- Train run

Test location in Italy

Main shunting hubs, tracks and EU freight corridors in Italy

Assets: 42 wagons, 1 locomotive, 82 DAC, 2 hybrid couplers

Demo train in Italy

Test rig tests for WP17 Demo Train

WP17 DAC Wagon in Expoferroviaria 2025

FP5 TRANS4M-R

Transforming Europe's Rail Freight

Seamless

Jan Bergstrand

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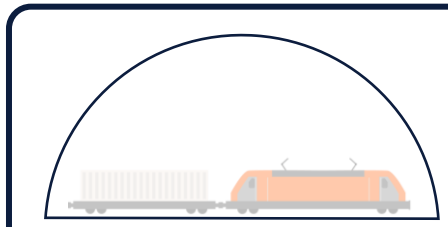
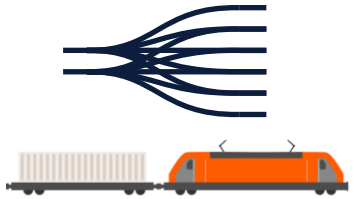
Demonstations

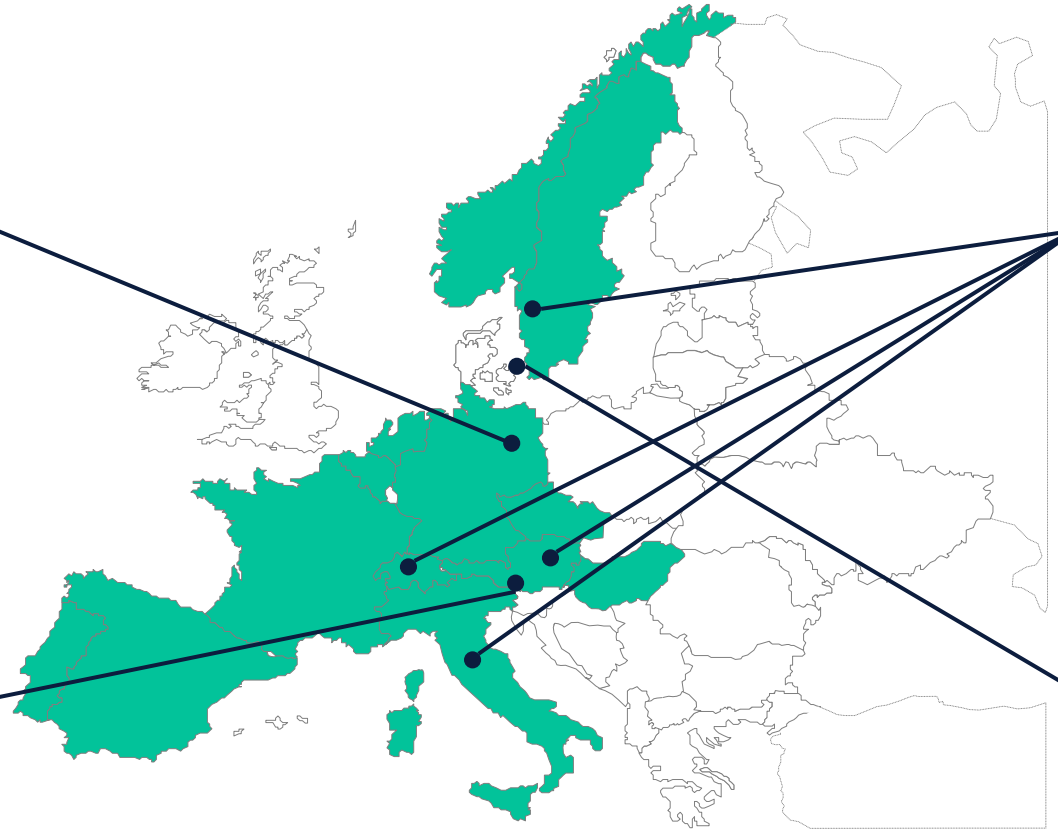
Overview



Train Test Lab
(WP 14)



Automated Shunting in Flat and Hump Yard
(WP 20 + 21)

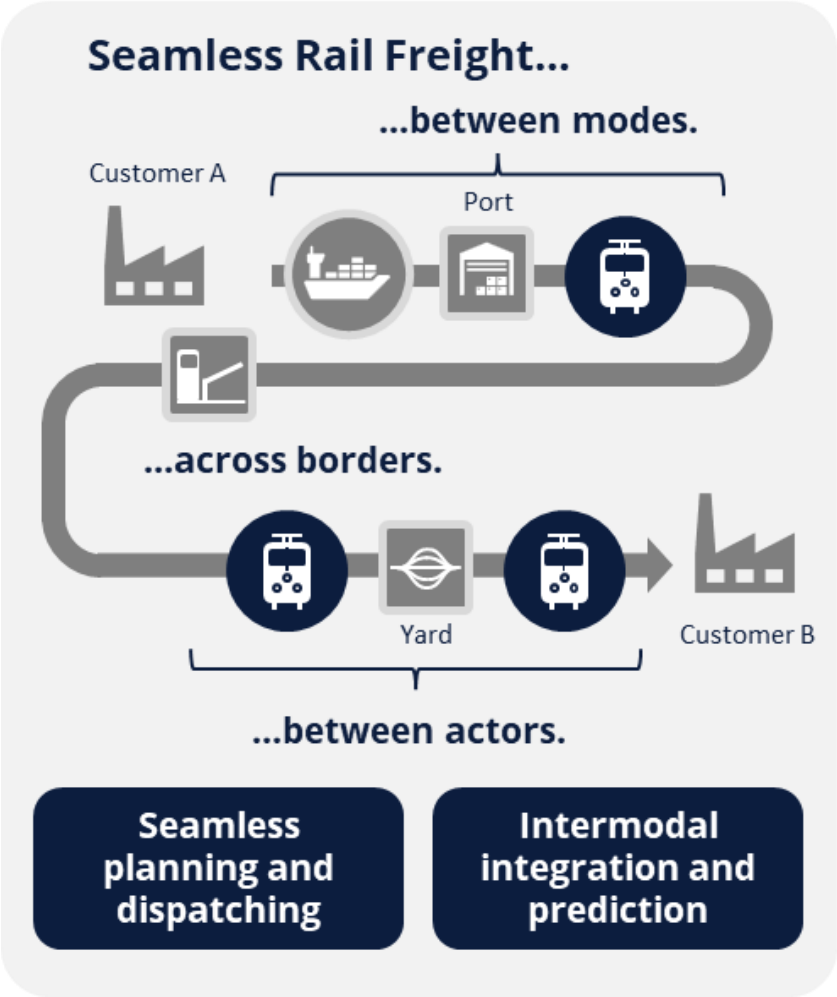


Demo Trains for FDFTO
(WP15 - WP18)

European Checkpoints
(WP29)
Seamless Showcases
(WP33 – WP34)

Seamless Freight Operations

Vision and technical enablers



- European Checkpoints
- Seamless Multimodal and Intermodal Integration
- Seamless Operations

FP5TRANS4M-R

Transforming
Europe's Rail Freight

Multimodal Booking

Yves Sterbak

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Outline Demand

Find existing services and routes. Proceed to direct booking.

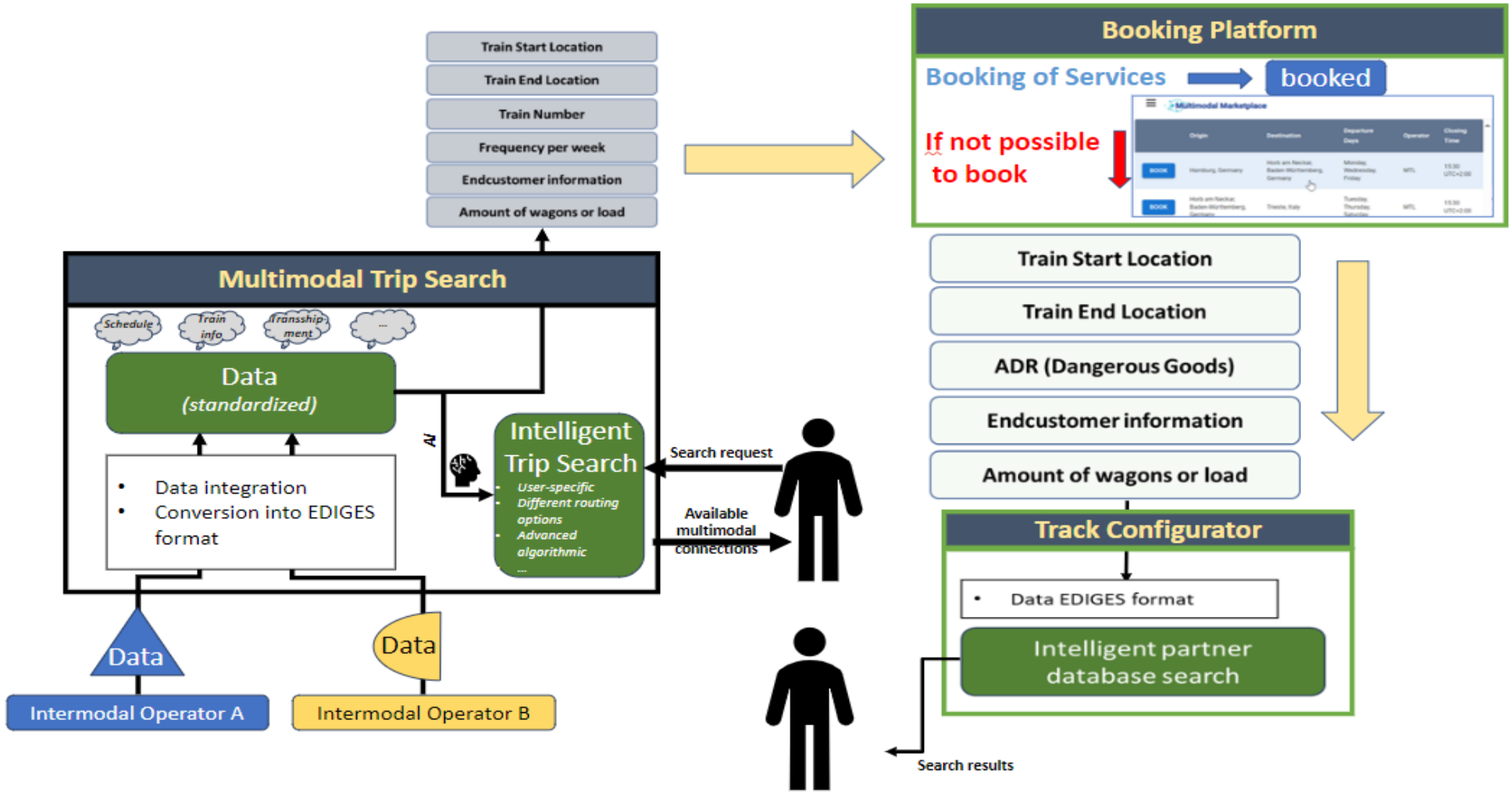
Book multiple vendor Services in a single user Interface.

Establish new rail services where offerings are missing.

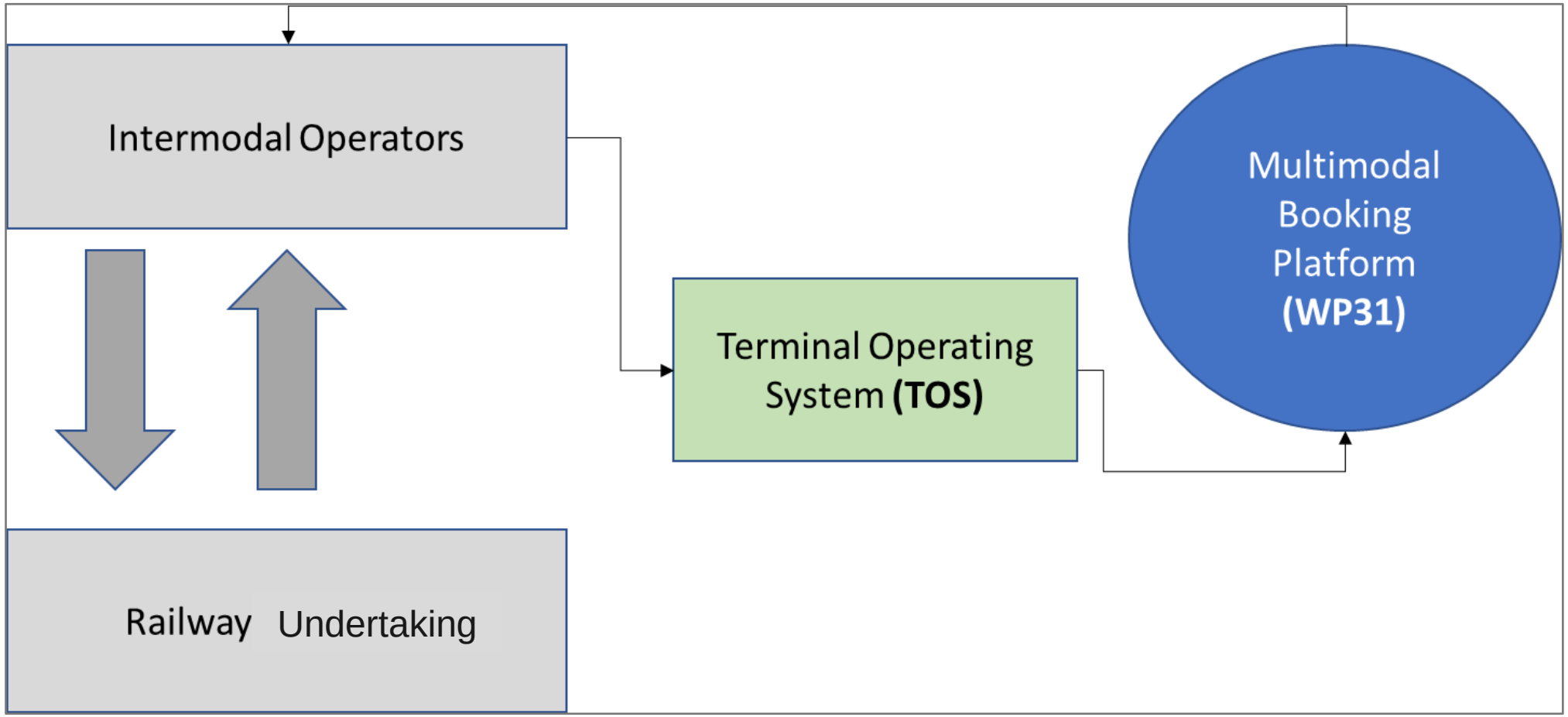
Intermodal Services

- Truck Services
- Train Services
- Terminal & Yard Services
- Other Services

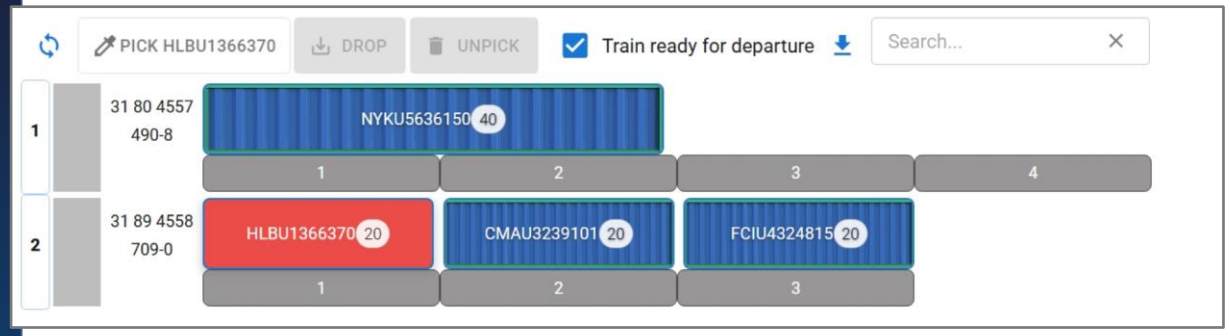
Flow Chart

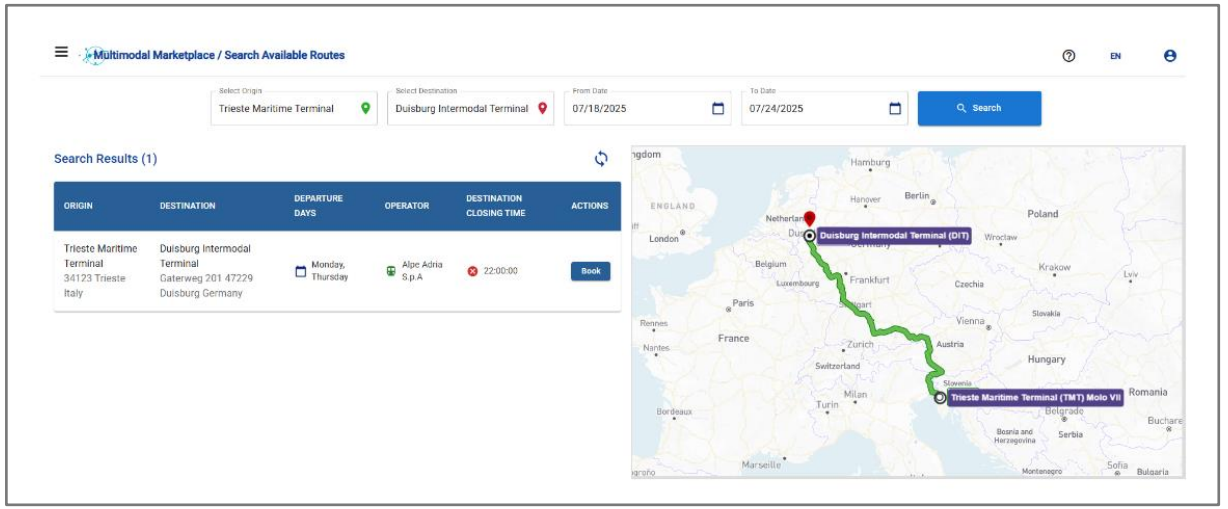

Train Start Location
Train End Location
Train Number
Frequency per week
Endcustomer information
Amount of wagons or load
Booking Platform
Booking of Services
booked
If not possible to book
Multimodal Trip Search
Schedule
Train info
Transshipment
...
Data (standardized)
Data integration
Conversion into EDIGES format
AI
Intelligent Trip Search
User-specific
Different routing options
Advanced algorithmic
...
Search request
Available multimodal connections
Data
Data
Intermodal Operator A
Intermodal Operator B
Train Start Location
Train End Location
ADR (Dangerous Goods)
Endcustomer information
Amount of wagons or load
Track Configurator
Data EDIGES format
Intelligent partner database search
Search results

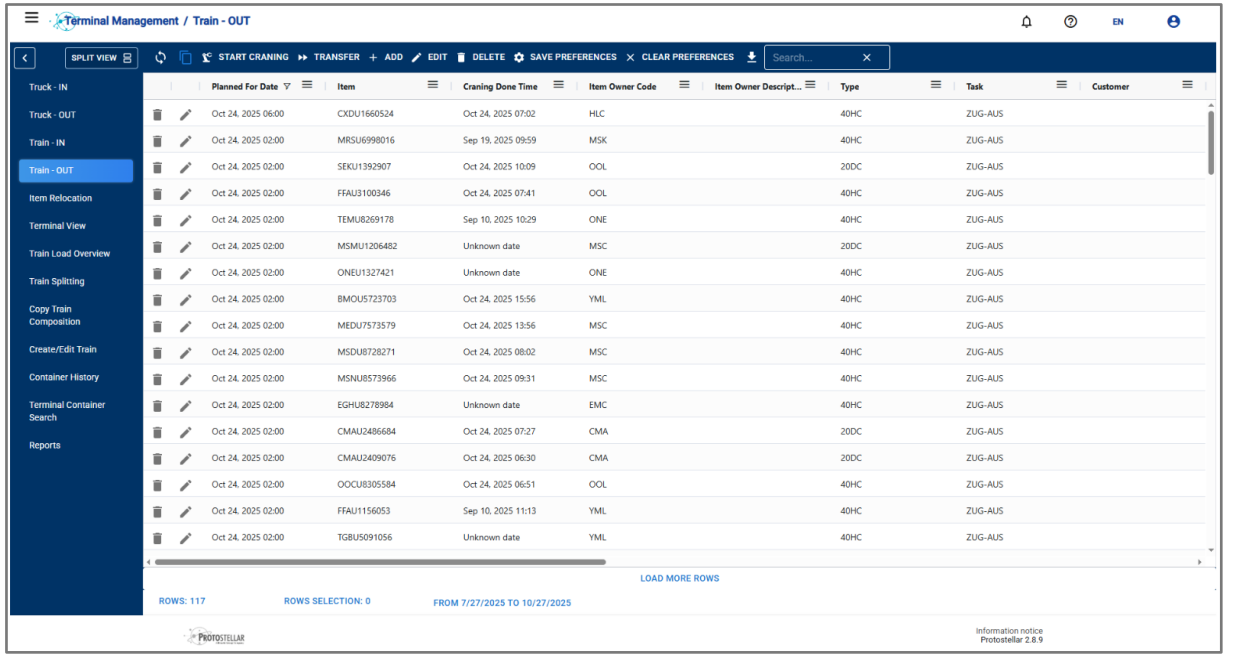
Data Flow as Success Factor



Demonstrator in progress







FP5TRANS4M-R

Transforming Europe's Rail Freight

European Railway Checkpoints - Intelligent Monitoring of Seamless Rail Freight Transports

Behzad Kordnejad & Ingrid Nordmark

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European Railway Checkpoints

Seamless Rail Freight Technology

Capturing logistics and maintenance data through a gate equipped with cameras, RFID reader and sensors.

- Enabling stakeholders to improve operations and enhancing their offer to the market
- Enabling less administrative burdens and enhanced costumer information, operational efficiency and maintenance.

Demonstration of European Railway Checkpoints

European Railway Checkpoints (ERC)

- *Modular System with harmonised procedures*

Module 1: AI-powered condition monitoring (Germany)
Use case 1: Condition monitoring: Bogie Analyzer

Module 2: Checkpoints for improving sharing of logistics information *(Sweden)*
Use case 2: Rolling stock and ILU identification

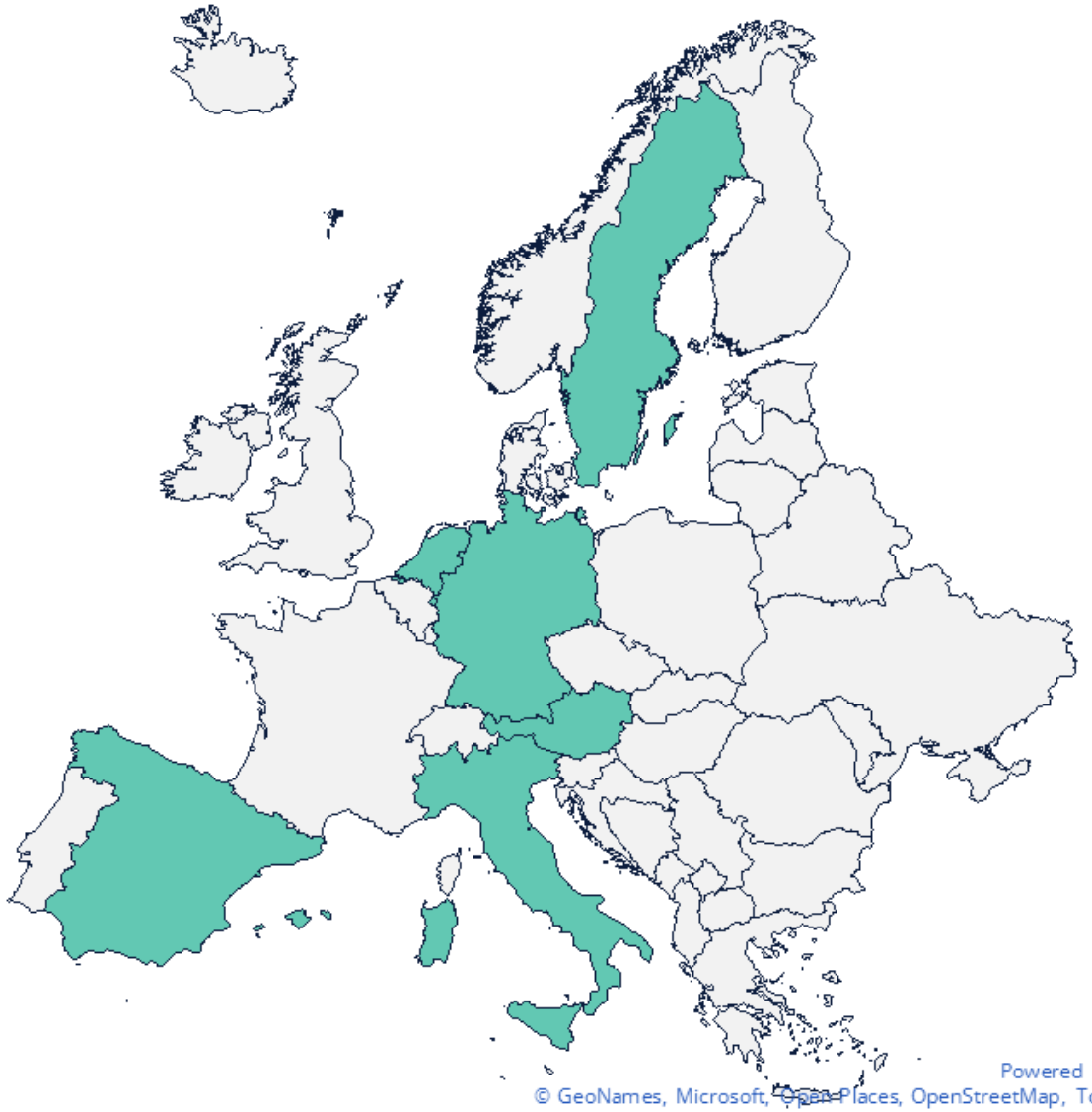
Module 3: Checkpoints deployment in Can Tunis for capturing yard movements *(Spain)*
Use case 3: Integrating checkpoints with On-board systems

Module 4: Recognition of Hazardous Materials Plates/Placards and UIC Code *(Netherlands)*
Use case 4: Identification of dangerous goods

Final demonstration: *D29.2 Demonstration and Evaluation of standardised European Railway Checkpoints at borders or other operational stop points*

Webinar 2026-01-27 11.30-13.00

Main partners



FP5 TRANS4M-R

Transforming Europe's Rail Freight

Q&A

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