



ERJU SYSTEM PILLAR


Stakeholder Requirements Specification Appendix : Pain points list



Stakeholder Requirements Specification

Appendix : Pain points list

DRAFT

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Abstract	The objectives of this document are to resume the all pain points
Config Item	Stakeholder Requirements Specification
Document ID	Pain Points/Stakeholder Requirements Specification Appendix Pain points list#724168 
Classification	Public
Status	In Progress (educated draft, discussion in domain nearly finished)
Version	1.0
Revision	724168
Last Change Date	02.10.2025
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Table 1. : Use Case #1
Table 2. : Use Case #2

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1 Introduction

Although the  Common Business Objectives document already presents a list of challenges facing the railway system and industry, these are still high level. In order to have more tangible problems to solve, a list of pain points has been established. These pain points have been compiled from various sources:

- Linx4Rail: The initial source was an simulation performed for Linx4Rail whereby two scenarios were imagined and played out to identify in this process where pain points could be observed. The two scenarios were:
 - Use case #1: Drive a freight train from Rotterdam to Genoa on Corridor 1
 - Use case #2 analysis: Perform a high-speed trip from Paris to Berlin
- SC2.1: During the architectural process in the year 2023, new pain points were identified and added to the list from Linx4Rail.
- SC2.2: During the architectural process in the year 2024, new pain points were identified and added to the list from Linx4Rail.

2 Pain points



Each pain point from Linx4Rail is described according to:

- the **Step**: which refers to the stage of operation of the train.
- the **Stakeholder**: which refers to the person or entity expressing the pain point.
- the **Operational process**: which refers to the action or process associated to the observed pain point.

2.1 Use case #1: Drive a freight train from Rotterdam to Genoa on Corridor 1



Lack of freight customer information in general, especially digital information

- **Step**: General,
- **Stakeholder**: Freight customer,
- **Operational process**: Query to know shipment location and estimated time of arrival

[2024-08-26 11:25 , has parent :  SPT1RS-701 - Use case #1: Drive a freight train from Rotterdam to Genoa on Corridor 1, SPT1RS-678,  Issue]



Lots of paper, costly, causes delays

- **Step**: Consignment
- **Stakeholder**: Customers, Customs and railway undertaking
- **Operational process**: Performs shipments clearanc

[2024-08-26 11:37 , has parent :  SPT1RS-701 - Use case #1: Drive a freight train from Rotterdam to Genoa on Corridor 1, SPT1RS-679,  Issue]



No single point of contact within the different EU actors

- **Step**: Preparation
- **Stakeholder**: Railway undertaking
- **Operational Process**: checks with infrastructure managers if railway slots are available (which means that the corresponding timetable does exist

[2024-08-26 11:50 , has parent :  SPT1RS-701 - Use case #1: Drive a freight train from Rotterdam to Genoa on Corridor 1, SPT1RS-683,  Issue]




No standardized EU method / form to reserve slots

- **Step**: Preparation
- **Stakeholder**: Railway undertaking
- **Operational Process**: checks with infrastructure managers if railway slots are available (which means that the corresponding timetable does exist

[2024-08-26 11:50 , has parent :  SPT1RS-701 - Use case #1: Drive a freight train from Rotterdam to Genoa on Corridor 1, SPT1RS-682,  Issue]




Processing times are too long during preparation

- **Step:** Preparation
- **Stakeholder:** Railway undertaking
- **Operational Process:** checks with infrastructure managers if railway slots are available (which means that the corresponding timetable does exist)

[2024-08-26 11:50 , has parent :  SPT1RS-701 - Use case #1: Drive a freight train from Rotterdam to Genoa on Corridor 1
_ is derived by :  SPT1RS-791 - Task 1 recommends that the Task 4 System Pillar and FP 5 innovation pillar should automatise manual process of data processing (braking sheets..), SPT1RS-681,  Issue]



Lack of asset availability

- **Step:** Preparation
- **Stakeholder:** Railway undertakings
- **Operational Process:** Checks (with railway keeper) if locomotive & wagons are available and if driver is available.

[2024-08-26 11:50 , has parent :  SPT1RS-701 - Use case #1: Drive a freight train from Rotterdam to Genoa on Corridor 1
_ is derived by :  SPT1RS-805 - Task 1 Recommends that the Infrastructure maintenance manager should be the entity that decides of the implementation of maintenance methods on reliability and maintainability in order to improve asset availability depending on the context while maintaining safety levels., SPT1RS-680,  Issue]



Limited asset interoperability

- **Step:** Preparation
- **Stakeholder:** Railway undertakings
- **Operational Process:** Checks (with railway keeper) if locomotive & wagons are available and if driver is available.

[2024-08-26 13:22 , has parent :  SPT1RS-701 - Use case #1: Drive a freight train from Rotterdam to Genoa on Corridor 1, SPT1RS-693,  Issue]



Variety of railway rules

- **Step:** Preparation
- **Stakeholder:** Railway undertakings
- **Operational Process:** Organizes transportation (if order is acceptable and slots & assets are available) including specific timetable.

[2024-08-26 13:22 , has parent :  SPT1RS-701 - Use case #1: Drive a freight train from Rotterdam to Genoa on Corridor 1, SPT1RS-692,  Issue]



Internal Rules

- **Step:** Preparation
- **Stakeholder:** Railway undertakings
- **Operational Process:** Organizes transportation (if order is acceptable and slots & assets are available) including specific timetable

[2024-08-26 13:22 , has parent :  SPT1RS-701 - Use case #1: Drive a freight train from Rotterdam to Genoa on Corridor 1, SPT1RS-691,  Issue]



Possible unavailability of loading facilities

- **Step:** Preparation
- **Stakeholder:** Freight forwarder
- **Operational Process:** Brings the freight to the terminal and load the wagon.

[2024-08-26 13:22 , has parent :  SPT1RS-701 - Use case #1: Drive a freight train from Rotterdam to Genoa on Corridor 1, SPT1RS-690,  Issue]


Shortage of capacity



- **Step:** Preparation
- **Stakeholder:** Railway undertakings
- **Operational Process:** Compose the train.

[2024-08-26 13:22 , has parent :  SPT1RS-701 - Use case #1: Drive a freight train from Rotterdam to Genoa on Corridor 1, SPT1RS-689,  Issue]

Different operating rules for composing a train



- **Step:** Preparation
- **Stakeholder:** Railway undertakings
- **Operational Process:** Compose the train.

[2024-08-26 13:22 , has parent :  SPT1RS-701 - Use case #1: Drive a freight train from Rotterdam to Genoa on Corridor 1

_ is derived by :  SPT1RS-790 - Task 1 recommends that a common work should be led with task 2 to analyse the need for harmonisation of operational train categories., SPT1RS-688,  Issue]



Ineffective operations due to safety regulations

- **Step:** Preparation
- **Stakeholder:** Railway undertakings
- **Operational Process:** Compose the train.

[2024-08-26 13:22 , has parent :  SPT1RS-701 - Use case #1: Drive a freight train from Rotterdam to Genoa on Corridor 1, SPT1RS-687,  Issue]



Unplanned restrictions affecting capacity

- **Step:** Preparation
- **Stakeholder:** Infrastructure Manager
- **Operational Process:** Reserves the available slots (which means they are bought) and disseminates them along the various actors.

[2024-08-26 13:22 , has parent :  SPT1RS-701 - Use case #1: Drive a freight train from Rotterdam to Genoa on Corridor 1, SPT1RS-686,  Issue]



Failures & incidents affecting capacity

- **Step:** Preparation
- **Stakeholder:** Infrastructure Manager
- **Operational Process:** Reserves the available slots (which means they are bought) and disseminates them along the various actors.

[2024-08-26 13:22 , has parent :  SPT1RS-701 - Use case #1: Drive a freight train from Rotterdam to Genoa on Corridor 1, SPT1RS-685,  Issue]

Driver unavailability

- **Step:** Preparation
- **Stakeholder:** Driver
- **Operational Process:** Manages the train departure activities (data entry, safety procedures, etc.)

[2024-08-26 13:22 , has parent :  SPT1RS-701 - Use case #1: Drive a freight train from Rotterdam to Genoa on Corridor 1, SPT1RS-684,  Issue]

Knowledge of route books

- **Step:** Preparation
- **Stakeholder:** Driver
- **Operational Process:** Manages the train departure activities (data entry, safety procedures, etc.)

[2024-08-26 13:25 , has parent : 📄 SPT1RS-701 - Use case #1: Drive a freight train from Rotterdam to Genoa on Corridor 1, SPT1RS-697, 📄 Issue]

Driver not allowed to move from a main line to a siding line

- **Step:** Driving
- **Stakeholder:** Driver
- **Operational Process:** operates the train according to the operating rules (signaling, timetable, waiting/stopping, etc.)

[2024-08-26 13:25 , has parent : 📄 SPT1RS-701 - Use case #1: Drive a freight train from Rotterdam to Genoa on Corridor 1, SPT1RS-696, 📄 Issue]

Most of the time spent waiting due to limited network capacity

- **Step:** Driving
- **Stakeholder:** Driver
- **Operational Process:** operates the train according to the operating rules (signaling, timetable, waiting/stopping, etc.)

[2024-08-26 13:25 , has parent : 📄 SPT1RS-701 - Use case #1: Drive a freight train from Rotterdam to Genoa on Corridor 1, SPT1RS-695, 📄 Issue]

Lack of adaptation of operational rules

Step: Border cross & handover

Stakeholder: Infrastructure manager

Operational Process: Handover of train between 2 areas of control.

[2024-08-26 13:25 , has parent : 📄 SPT1RS-701 - Use case #1: Drive a freight train from Rotterdam to Genoa on Corridor 1

_ is derived by : 📄 SPT1RS-788 - Regarding the interactions between Infrastructure Managers and Drivers, Task 1 recommends that the System Pillar should work on operational harmonization from a driver's perspective, SPT1RS-694, 📄 Issue]

Issues of compatibility & data consistency between systems

- **Step:** Border cross & handover
- **Stakeholder:** Infrastructure manager
- **Operational Process:** Handover of train between 2 areas of control.

[2024-08-26 13:27 , has parent : 📄 SPT1RS-701 - Use case #1: Drive a freight train from Rotterdam to Genoa on Corridor 1, SPT1RS-699, 📄 Issue]

2.2 Use case #2 analysis: Perform a high-speed trip from Paris to Berlin

International homologation issues of rolling stock

- **Step:** Strategic planning
- **Stakeholder:** Railway undertakings
- **Operational Process:** Define a cooperative or competitive offering to perform the service (joint offer, e.g. SNCF / DB)

[2024-08-26 13:27 , has parent : 📄 SPT1RS-745 - Use case #2 analysis: Perform a high-speed trip from Paris to Berlin, SPT1RS-698, 📄 Issue]



Issues of rolling stock / route compatibility

- **Step:** Strategic planning
- **Stakeholder:** Railway undertakings
- **Operational Process:** Define a cooperative or competitive offering to perform the service (joint offer, e.g. SNCF / DB)

[2024-08-26 13:36 , relates to : 📄 SPMS-3964 - Manage rolling stock compatibility
has parent : 📄 SPT1RS-745 - Use case #2 analysis: Perform a high-speed trip from Paris to Berlin, SPT1RS-706, 📄 Issue]



Key infrastructure data not provided by IM (RINF not always fully documented and not sufficient e.g. works)

- **Step:** Strategic planning
- **Stakeholder:** Railway undertakings
- **Operational Process:** Define a cooperative or competitive offering to perform the service (joint offer, e.g. SNCF / DB)

[2024-08-26 13:36 , has parent :  SPT1RS-745 - Use case #2 analysis: Perform a high-speed trip from Paris to Berlin, SPT1RS-705,  Issue]



Infrastructure charging is un-homogeneous from IM to IM – can be very expensive and unpredictable

- **Step:** Strategic planning
- **Stakeholder:** Railway undertakings & Infrastructure Managers
- **Operational Process:** Buy infrastructure path

[2024-08-26 13:36 , has parent :  SPT1RS-745 - Use case #2 analysis: Perform a high-speed trip from Paris to Berlin, SPT1RS-704,  Issue]



Different voltage standards and telecom standards between countries

- **Step:** Strategic planning
- **Stakeholder:** Railway undertakings
- **Operational Process:** Assesses rolling stock & energy supply systems compatibility

[2024-08-26 13:36 , has parent :  SPT1RS-745 - Use case #2 analysis: Perform a high-speed trip from Paris to Berlin, SPT1RS-703,  Issue]



Different signaling systems between countries Different operating rules (nominal & degraded modes) and safety case

- **Step:** Strategic planning
- **Stakeholder:** Railway undertakings
- **Operational Process:** Assesses rolling stock & energy supply systems compatibility

[2024-08-26 13:36 , has parent :  SPT1RS-745 - Use case #2 analysis: Perform a high-speed trip from Paris to Berlin, SPT1RS-702,  Issue]



Compatibility of the new service with existing service

- **Step:** Strategic planning
- **Stakeholder:** Infrastructure Managers
- **Operational Process:** define paths for the proposed service (either direct service / connecting service).

[2024-08-26 13:39 , has parent :  SPT1RS-745 - Use case #2 analysis: Perform a high-speed trip from Paris to Berlin, SPT1RS-711,  Issue]

Not enough available (infrastructure) capacity for slots

- **Step:** Strategic planning
- **Stakeholder:** Infrastructure Managers
- **Operational Process:** define paths for the proposed service (either direct service / connecting service).

[2024-08-26 13:39 , has parent :  SPT1RS-745 - Use case #2 analysis: Perform a high-speed trip from Paris to Berlin, SPT1RS-710,  Issue]

Not enough available (rolling stock) capacity

- **Step:** Strategic planning
- **Stakeholder:** Railway Undertakings
- **Operational Process:** define paths for the proposed service (either direct service / connecting service).

[2024-08-26 13:39 , relates to : 🚂 SPMS-4003 - Manage fleet maintenance
has parent : 📄 SPT1RS-745 - Use case #2 analysis: Perform a high-speed trip from Paris to Berlin,
SPT1RS-709, 📄 Issue]

Driver habilitation for rolling stock & operating rules takes times

- **Step:** Strategic planning
- **Stakeholder:** Railway Undertakings
- **Operational Process:** Train staff for international service (language, ...).

[2024-08-26 13:39 , has parent : 📄 SPT1RS-745 - Use case #2 analysis: Perform a high-speed trip from Paris to Berlin

_ is derived by : 📄 SPT1RS-788 - Regarding the interactions between Infrastructure Managers and Drivers, Task 1 recommends that the System Pillar should work on operational harmonization from a driver's perspective, SPT1RS-708, 📄 Issue]

Many different languages

- **Step:** Strategic planning
- **Stakeholder:** Railway Undertakings
- **Operational Process:** Train staff for international service (language, ...).

[2024-08-26 13:39 , has parent : 📄 SPT1RS-745 - Use case #2 analysis: Perform a high-speed trip from Paris to Berlin, SPT1RS-707, 📄 Issue]

No direct service available today

- **Step:** Ticket purchase
- **Stakeholder:** Passenger
- **Operational Process:** Looks for available trains, time tables and tariffs and buy ticket.

[2024-08-26 13:43 , has parent : 📄 SPT1RS-745 - Use case #2 analysis: Perform a high-speed trip from Paris to Berlin, SPT1RS-718, 📄 Issue]

No global integration of time tables and commercial arrangements- only particular arrangements

- **Step:** Ticket purchase
- **Stakeholder:** Passenger
- **Operational Process:** Looks for available trains, time tables and tariffs and buy ticket.

[2024-08-26 13:43 , has parent : 📄 SPT1RS-745 - Use case #2 analysis: Perform a high-speed trip from Paris to Berlin, SPT1RS-717, 📄 Issue]

No door-to-door full trip tickets – expensive through agency

- **Step:** Ticket purchase
- **Stakeholder:** Passenger
- **Operational Process:** Looks for available trains, time tables and tariffs and buy ticket.

[2024-08-26 13:43 , has parent : 📄 SPT1RS-745 - Use case #2 analysis: Perform a high-speed trip from Paris to Berlin, SPT1RS-716, 📄 Issue]




Prices are too high compared to other transportation means (Low-cost airlines / Car ...)

- **Step:** Ticket purchase
- **Stakeholder:** Passenger
- **Operational Process:** Buy a ticket.

[2024-08-26 13:43 , has parent : 📄 SPT1RS-745 - Use case #2 analysis: Perform a high-speed trip from Paris to Berlin, SPT1RS-715, 📄 Issue]



No global door to door transportation service – inefficient transportation from home to station (bus, metros, hotels)

- **Step:** Provide access to train
- **Stakeholder:** Passenger
- **Operational Process:** Go home from station.

[2024-08-26 13:43 , has parent :  SPT1RS-745 - Use case #2 analysis: Perform a high-speed trip from Paris to Berlin
_ is derived by :  SPT1RS-792 - Task 1 recommends that the door-to-door service and service information should be tackled in System Pillar and Innovation Pillar., SPT1RS-714,  Issue]



Different ticketing systems No global door to door service (guaranteed arrival in case of delay, ...)

- **Step:** Provide access to train
- **Stakeholder:** Passenger
- **Operational Process:** Interconnect with high speed / regional line

[2024-08-26 13:43 , has parent :  SPT1RS-745 - Use case #2 analysis: Perform a high-speed trip from Paris to Berlin, SPT1RS-713,  Issue]

Compatibility of international tickets with local check-in systems - TBC

- **Step:** Provide access to train
- **Stakeholder:** Passenger
- **Operational Process:** Get information on train access

[2024-08-26 13:43 , has parent :  SPT1RS-745 - Use case #2 analysis: Perform a high-speed trip from Paris to Berlin, SPT1RS-712,  Issue]



In case of delay on one of the network - timely data transmission issues between infrastructure management and difficult rescheduling capacity

- **Step:** Perform transportation service
- **Stakeholder:** Infrastructure managers
- **Operational Process:** Manages train path into traffic

[2024-08-26 13:54 , has parent :  SPT1RS-745 - Use case #2 analysis: Perform a high-speed trip from Paris to Berlin, SPT1RS-728,  Issue]




Issue in data exchange format between infrastructure managers - manual operations

- **Step:** Perform transportation service
- **Stakeholder:** Infrastructure managers
- **Operational Process:** Manages train path into traffic

[2024-08-26 13:54 , has parent :  SPT1RS-745 - Use case #2 analysis: Perform a high-speed trip from Paris to Berlin, SPT1RS-727,  Issue]



Different operating rules & signalling systems between countries

- **Step:** Perform transportation service
- **Stakeholder:** Drivers
- **Operational Process:** Drive the train

[2024-08-26 13:54 , has parent :  SPT1RS-745 - Use case #2 analysis: Perform a high-speed trip from Paris to Berlin
_ is derived by :  SPT1RS-788 - Regarding the interactions between Infrastructure Managers and Drivers, Task 1 recommends that the System Pillar should work on operational harmonization from a driver's perspective, SPT1RS-726,  Issue]

Language issues



- **Step:** Perform transportation service
- **Stakeholder:** Drivers
- **Operational Process:** Drive the train

[2024-08-26 13:54 , has parent :  SPT1RS-745 - Use case #2 analysis: Perform a high-speed trip from Paris to Berlin, SPT1RS-725,  Issue]

Different Key management system authority for encryption data



- **Step:** Perform transportation service
- **Stakeholder:** Drivers

- **Operational Process:** Drive the train

[2024-08-26 13:54 , has parent :  SPT1RS-745 - Use case #2 analysis: Perform a high-speed trip from Paris to Berlin, SPT1RS-724,  Issue]


Maximize rolling stock availability and minimize down time



- **Step:** Perform transportation service
- **Stakeholder:** Rolling Stock
- **Operational Process:**

[2024-08-26 13:54 , has parent :  SPT1RS-745 - Use case #2 analysis: Perform a high-speed trip from Paris to Berlin, SPT1RS-723,  Issue]

Insufficient information of travellers in case of delay and solution finding


- **Step:** Arriving at destination
- **Stakeholder:** Passenger
- **Operational Process:** Wants to have reliable information on connecting trains / connecting service



[2024-08-26 13:54 , has parent :  SPT1RS-745 - Use case #2 analysis: Perform a high-speed trip from Paris to Berlin

_ is derived by :  SPT1RS-792 - Task 1 recommends that the door-to-door service and service information should be tackled in System Pillar and Innovation Pillar., SPT1RS-722,  Issue]

No single responsibility – especially in terms of door-to-door trips



- **Step:** Arriving at destination
- **Stakeholder:** Passenger
- **Operational Process:** Aftercare: Wants to be refunded in case of excessive delay, and being taken care of (hotels, ...)

[2024-08-26 13:54 , has parent :  SPT1RS-745 - Use case #2 analysis: Perform a high-speed trip from Paris to Berlin

_ is derived by :  SPT1RS-792 - Task 1 recommends that the door-to-door service and service information should be tackled in System Pillar and Innovation Pillar., SPT1RS-721,  Issue]



Lack of knowledge of local maintenance teams of foreign rolling stock

- **Step:** Arriving at destination
- **Stakeholder:** Railway undertakings
- **Operational Process:** perform unscheduled maintenance activities in case of non-critical failure

[2024-08-26 13:54 , has parent :  SPT1RS-745 - Use case #2 analysis: Perform a high-speed trip from Paris to Berlin, SPT1RS-720,  Issue]

Lack of safety maintenance equipment (e.g. wheel reprofiling



- **Step:** Arriving at destination
- **Stakeholder:** Railway undertakings
- **Operational Process:** perform unscheduled maintenance activities in case of non-critical failure

[2024-08-26 13:54 , has parent :  SPT1RS-745 - Use case #2 analysis: Perform a high-speed trip from Paris to Berlin, SPT1RS-719,  Issue]

2.3 SC2.1



Identification of part

- **Step:**
- **Stakeholder:**
- **Operational process:** Deliver maintenance
- **Linked capability:** Maintain and Monitor Rolling Stocks

[2024-08-26 14:03 , has parent :  SPT1RS-741 - SC2.1, SPT1RS-740,  Issue]



Redesign activity due to the different life of component

- **Step:**
- **Stakeholder:**
- **Operational process:** Deliver maintenance
- **Linked capability:** Maintain and Monitor Rolling Stock

[2024-08-26 14:03 , has parent :  SPT1RS-741 - SC2.1, SPT1RS-736,  Issue]



Rolling stock certification process

- **Step:**
- **Stakeholder:**
- **Operational process:** Provide certificates
- **Linked capability:** Maintain and Monitor Rolling Stock

[2024-08-26 14:03 , has parent :  SPT1RS-741 - SC2.1, SPT1RS-739,  Issue]



In case of delays : How to communicate the decisions (and compensate for them ?)

- **Step:**
- **Stakeholder:**
- **Operational process:** Manage connections
- **Linked capability:** Operate Train

[2024-08-26 14:03 , has parent :  SPT1RS-741 - SC2.1, SPT1RS-734,  Issue]



In case of delays : How to manage the accountability between the different RUs ?

- **Step:**
- **Stakeholder:**
- **Operational process:** Manage connections
- **Linked capability:** Operate Train

[2024-08-26 14:03 , has parent :  SPT1RS-741 - SC2.1, SPT1RS-732,  Issue]

In case of delays : How to take care of passengers in case of broken connection



- **Step:**
- **Stakeholder:**
- **Operational process:** Manage connections
- **Linked capability:** Operate Train

[2024-08-26 14:03 , has parent :  SPT1RS-741 - SC2.1, SPT1RS-731,  Issue]

Non-harmonised orders to driver in degraded situations



- **Step:**
- **Stakeholder:**
- **Operational process:** Operational Traffic Management (signalling)
- **Linked capability:** Operate Train

[2024-08-26 14:03 , has parent :  SPT1RS-741 - SC2.1

_ is derived by :  SPT1RS-788 - Regarding the interactions between Infrastructure Managers and Drivers, Task 1 recommends that the System Pillar should work on operational harmonization from a driver's perspective, SPT1RS-730,  Issue]



Balance between CCS on board and on infrastructure

- **Step:**
- **Stakeholder:**
- **Operational process:** All
- **Linked capability:** Upgrade and renew infrastructure network capabilities

[2024-08-26 14:03 , has parent :  SPT1RS-741 - SC2.1, SPT1RS-729,  Issue]



Pre-authorisation is going too far

- **Step:**
- **Stakeholder:**
- **Operational process:** Deliver pre-authorisation to upgrade or renew infrastructure
- **Linked capability:** Upgrade and renew infrastructure network capabilities

[2024-08-26 14:03 , has parent :  SPT1RS-741 - SC2.1, SPT1RS-737,  Issue]



Lack of uniformity in process instantiation

- **Step:**
- **Stakeholder:**
- **Operational process:** Deliver pre-authorisation to upgrade or renew infrastructure
- **Linked capability:** Upgrade and renew infrastructure network capabilities

[2024-08-26 14:03 , has parent :  SPT1RS-741 - SC2.1, SPT1RS-738,  Issue]



Test campaign for vehicle authorization (e.g ESC test)

- **Step:**
- **Stakeholder:**
- **Operational process:** Deliver authorization to upgrade or renew infrastructure or rolling stocks
- **Linked capability:** Upgrade and renew infrastructure network capabilities

[2024-08-26 14:03 , has parent :  SPT1RS-741 - SC2.1, SPT1RS-733,  Issue]

We are not able to provide continuous interoperability across network borders (flying handover) due to different (and sometimes incompatible) design rules from one state to another;

- **Step:**
- **Stakeholder:**
- **Operational process:** Design infrastructure / Upgrade or renew infrastructure
- **Linked capability:** Upgrade and renew infrastructure network capabilities.

[2024-08-26 14:03 , has parent :  SPT1RS-741 - SC2.1, SPT1RS-735,  Issue]

Full conformity to TSI is not always necessary for interoperability



- **Step:**
- **Stakeholder:**
- **Operational process:** Design infrastructure
- **Linked capability:** Upgrade and renew infrastructure network capabilities.

[2024-08-26 14:03 , has parent :  SPT1RS-741 - SC2.1, SPT1RS-743,  Issue]

Energy consumption calculation for legacy, rolling stock and fixed installation

- **Step:**
- **Stakeholder:**
- **Operational process:** Measure electrical consumption
- **Linked capability:** Manage electrical energy

[2024-08-26 14:03 , has parent :  SPT1RS-741 - SC2.1



_ is derived by :  SPT1RS-856 - Task 1 recommends that the Traffic Manager should be in charge of managing the o..., SPT1RS-744,  Issue]

2.4 SC2.2

Technical reliability of EE infrastructure

- **Step:**
- **Stakeholder:**
- **Operational process:** Manage electrical energy supply incidents
- **Linked capability:** Manage electrical energy



[2024-08-26 14:18 , has parent :  SPT1RS-742 - SC2.2

_ is derived by :  SPT1RS-854 - Task 1 & Task 2 recommend that the Energy Manager (EM) should introduce where re..., SPT1RS-756,  Issue]

Difficulty in change of energy supplier

- **Step:**
- **Stakeholder:**
- **Operational process:** Supply electrical energy
- **Linked capability:** Manage electrical energy



[2024-08-26 14:18 , has parent :  SPT1RS-742 - SC2.2

_ is derived by :  SPT1RS-858 - Task 1 recommends promoting/supporting legal solutions that will be strictly ded..., SPT1RS-755,  Issue]

Difficulty in managing several power suppliers (in coordination)

- **Step:**
- **Stakeholder:**
- **Operational process:** Supply electrical energy
- **Linked capability:** Manage electrical energy

[2024-08-26 14:18 , has parent :  SPT1RS-742 - SC2.2

_ is derived by :  SPT1RS-858 - Task 1 recommends promoting/supporting legal solutions that will be strictly ded..., SPT1RS-754,  Issue]

Different countries have different distributions of the activities on actors of the industry



- **Step:**
- **Stakeholder:**
- **Operational process:** Collect, transform and distribute electrical energy
- **Linked capability:** Manage electrical energy

[2024-08-26 14:18 , has parent :  SPT1RS-742 - SC2.2

_ is derived by :  SPT1RS-858 - Task 1 recommends promoting/supporting legal solutions that will be strictly ded..., SPT1RS-753,  Issue]



Managing different power supply frequencies

- **Step:**
- **Stakeholder:**
- **Operational process:** Collect, transform and distribute electrical energy
- **Linked capability:** Manage electrical energy

[2024-08-26 14:18 , has parent :  SPT1RS-742 - SC2.2, SPT1RS-751,  Issue]



Pantograph variability

- **Step:**
- **Stakeholder:** Rolling stock
- **Operational process:** Consume, transform and store electrical energy
- **Linked capability:** Manage electrical energy

[2024-08-26 14:18 , has parent :  SPT1RS-742 - SC2.2, SPT1RS-750,  Issue]




Interface current and electromagnetic compatibility

- **Step:**
- **Stakeholder:** Rolling stock & energy manager
- **Operational process:** Consume, transform and store electrical energy
- **Linked capability:** Manage electrical energy

[2024-08-26 14:18 , has parent :  SPT1RS-742 - SC2.2, SPT1RS-749,  Issue]




Trustable location of trains

- **Step:**
- **Stakeholder:** Energy manager
- **Operational process:** Collect, transform and distribute electrical energy
- **Linked capability:** Manage electrical energy

[2024-08-26 14:18 , has parent :  SPT1RS-742 - SC2.2
_ is derived by :  SPT1RS-857 - Task 1 recommend that Infrastructure and trains should equip when needed with GP..., SPT1RS-748,  Issue]




Trustable energy meters and their interoperability

- **Step:**
- **Stakeholder:** Rolling stock
- **Operational process:** Measure electrical energy
- **Linked capability:** Manage electrical energy

[2024-08-26 14:18 , has parent :  SPT1RS-742 - SC2.2
_ is derived by :  SPT1RS-857 - Task 1 recommend that Infrastructure and trains should equip when needed with GP..., SPT1RS-747,  Issue]






Exchange data between countries; common standard for settlements

- **Step:**
- **Stakeholder:**
- **Operational process:** Pay electrical energy consumption.
- **Linked capability:** Manage electrical energy

[2024-08-26 14:18 , has parent :  SPT1RS-742 - SC2.2
_ is derived by :  SPT1RS-883 - Task 1 recommends develop a single standard for meter communication with DCS app..., SPT1RS-746,  Issue]

Dealing with a variety of fuel sources

- **Step:**
- **Stakeholder:** Railway Undertakings & Rolling stock
- **Operational process:** .
- **Linked capability:** Manage electrical energy

[2024-08-26 14:18 , has parent :  SPT1RS-742 - SC2.2
_ is derived by :  SPT1RS-848 - Task 1 recommends that the Energy Manager (IM) should use renewable energy from...
_ is derived by :  SPT1RS-849 - Task 1 recommends that the Station Manager (IM) should equip stations and stops...
_ is derived by :  SPT1RS-855 - Task 1 recommend that EM, IM & RU should collaborate to replace where relevant b..., SPT1RS-752,  Issue]

Annexes

Table 1 : Use Case #1

Use case #1: Drive a freight train from Rotterdam to Genoa on Corridor 1			
Step	Stakeholder	Does what (operational process)	"As-Is" Pain points (standardization & others)

General	Customer	wants to know where his shipment is located, and estimated time of arrival	Lack of customer information in general, especially digital information
Consignement	Customers, Customs and railway undertaking	performs shipments clearance	Lots of paper, costly, causes delays
Preparation	Freight Shipper	defines its freight transportation demand	No specific pain point
Preparation	Railway undertaking	checks with the infrastructure managers if railway slots are available (which mean that the corresponding timetable does exist)	- No single point of contact within the different EU actors
			- No standardized EU method / form to reserve slots
			- Processing times are too long during preparation
Preparation	Railway undertaking	checks (with the railway keeper) if locomotive & wagons are available and if driver is available	- Lack of asset availability
			- Limited asset interoperability
Preparation	Railway undertaking	organizes transportation (if order is acceptable and slots & assets are available) including specific timetable	- Variety of railway rules
			- Internal issues
Preparation	Freight Forwarder	brings the freight to the terminal and load the wagons	Possible unavailability of loading facilities
Preparation	Railway undertaking	compose the train	- Shortage of capacity
			- Different operating rules for composing a train
			- ineffective operations due to safety regulations
Preparation	Infrastructure Manager	reserves the available slots (which means that they were bought) and disseminates them along the various actors	- Unplanned restrictions affecting capacity
			- Failures & incidents affecting capacity
Preparation	Driver	manages the train departure activities (data entry, safety procedures, etc.)	- Driver unavailability
			- Knowledge of route books
Driving	Infrastructure Manager	sets a route (movement & parking)	<i>Already mentioned before (step 7)</i>
Driving	Driver	operates the train according to the operating rules (signaling, timetable, waiting/stopping, etc.)	- Driver not allowed to move from a main line to a siding line

			Most of the time spent waiting due to limited network capacity
Border cross & handover	Infrastructure Manager	Handover of train between 2 areas of control	<ul style="list-style-type: none"> - Lack of adaptation of operational rules - Issues of compatibility & data consistency between systems
Arrival	Driver	drives the train to the final terminal	<i>Similar to manage train departure & driving</i>
Arrival	Railway undertaking	unloads the train	<i>Similar to steps 3</i>
Arrival	Railway undertaking	releases the train	<i>Unknowning the availability of asset (for use & maintenance)</i>

Table 2 : Use Case #2

Use case #2 analysis: Perform a high-speed trip from Paris to Berlin			
Step	Stakeholder	Does what (operational process)	"As-Is" Pain points (standardization & others)
Strategic planning	Railway undertakings	define a cooperative offering to perform the service (joint offer, e.g. SNCF / DB)	International homologation issues of rolling stock Issues of rolling stock / route compatibility Key infrastructure data not provided by IM (RINF not always fully documented and not sufficient e.g. works)
Strategic planning	Railway undertakings	define a competitive offering to perform the service (competitive offer e.g. Trenitalia / SNCF)	Same as above
Strategic planning	Railway undertaking / IM	Buy infrastructure path	Infrastructure charging is un-homogeneous from IM to IM – can be very expensive and unpredictable
Strategic planning	Railway undertakings	assesses rolling stock & energy supply systems compatibility	Different voltage standards and telecom standards between countries Different signaling systems between countries Different operating rules (nominal & degraded modes) and safety case
Strategic planning	Infrastructure manager	define paths for the proposed service (either direct service / connecting service)	Compatibility of the new service with existing service Not enough available (infrastructure) capacity for slots
Strategic planning	Railway undertakings	define paths for the proposed service (either direct service / connecting service)	Not enough available (rolling stock) capacity
	Railway undertaking		Driver habilitation for rolling stock & operating rules takes times

Strategic planning	ings	train staff for international service (language, ...)	Many different languages
Ticket Purchase	Passenger	Looks for available trains, time tables and tariffs and buy ticket	No direct service available today
Ticket Purchase	Passenger	Looks for available trains, time tables and tariffs and buy ticket	No global integration of time tables and commercial arrangements- only particular arrangements No door-to-door full trip tickets – expensive through agency
Ticket Purchase	Passenger	Buy a ticket	Prices are too high compared to other transportation means (Low-cost airlines / Car ...)
Prepare Train	Railway undertakings	Prepare train	To Be Defined
Provide access to train	Passengers	Go from home to station	No global door to door transportation service – inefficient transportation from home to station (bus, metros, hotels) ...
Provide access to train	Passengers	Interconnect with high speed / regional line	Different ticketing systems No global door to door service (guaranteed arrival in case of delay, ...)
Provide access to train	Passengers	get information on train access	Compatibility of international tickets with local check -in systems - TBC
Perform transportation service	Infrastructure managers	manages train path into traffic	in case of delay on one of the network - timely data transmission issues between infrastructure management and difficult rescheduling capacity
Perform transportation service	Infrastructure managers	manages train path into traffic	issue in data exchange format between infrastructure managers - manual operations
Perform transportation service	Drivers	drive the train	Different operating rules & signalling systems between countries Language issues Different Key management system authority for encryption data
Perform transportation service	Rolling stock		Maximize rolling stock availability and minimize down time
Arriving at destination	Passenger	Wants to have reliable information on connecting trains / connecting service	Unsufficient information of travellers in case of delay and solution finding
Arriving at destination	Passenger	Aftercare: Wants to be refunded in case of excessive delay, and being taken care of (hotels, ...)	No single responsibility – especially in terms of door-to-door trips
Arriving at destination	Railway undertakings	park train & operate simple maintenance activities - cleaning, ...	No specific pain - Provision of tracks equipped for maintenance

Arriving at destination	Railway undertakings	perform unscheduled maintenance activities in case of non-critical failure	Lack of knowledge of local maintenance teams of foreign rolling stock
Arriving at destination	Railway undertakings	perform unscheduled maintenance activities in case of non-critical failure	Lack of safety maintenance equipment (e.g. wheel reprofiling)

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