




ERJU SYSTEM PILLAR

Stakeholder Requirements Specification : Operate Train Capability



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Author(s)	Olivier
Abstract	The report below presents the functional description of the SP Task 1 architecture proposal for the railway network capability: Operate train. On top of this, the SP Task 1 has issued a limited number of global recommendations for the Railway network architecture in order to reach the common business objectives set out and pain points for System Pillar.
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CONTACT: For more information contact Administrator

ARC, REQ and OD

System Architect, Requirements Manager and Operational Design (respectively)

The REQ, OD and ARC roles have been assigned to the team by studied capabilities :

Capability	Person
Operate Train	Daniel Windisch
	Jean-Marc Pourchier
	Werner Ried
	Hans Menschaert
	Piotr Chylinski
	Emre Teke
	Gerald Schinagl
	Aude Chailley

[SPT1RS-552]

External Experts for: ARC, REQ and OD

System Architect, Requirements Manager and Operational Design (respectively).

Capability	
Operate train	Piotr Chylinski
	Hans Menschaert

[SPT1RS-760]

Facilitated by:

MOD, TOOL Capella

Modeller & Capella Superusers

Assignee(s)	CESAMES - Olivier EBEL
Role in Team	SP Task 1 Railway System

[SPT1RS-555]

TOOL Polaron

Polarion Superuser

Assignee(s)	FOJUD Artur; CHAILLEY Aude
Role in Team	SP Task 1 Railway System

[SPT1RS-551]

QM

Quality Manager

Assignee(s)	Emre TEKE Frederic HENON CESAMES - Olivier EBEL
Role in Team	SP Task 1 Railway System

[SPT1RS-759]

With the supervision of:

LEAD Railways

Domain Lead

Assignee(s)	Frederic HENON
Role in Team	SP Task 1 Railway System

[SPT1RS-554]

LEAD Suppliers

Domain Lead

Assignee(s)	TEKE Emre
Role in Team	SP Task 1 Railway System

[SPT1RS-553]

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1 Preamble

1.1 Purpose

The purpose of this document is to describe the different steps necessary to operate a train. It is restricted to operational time slot, describing the necessary inputs, but no into detail the previous phases to obtain them.

The to-be operate train capability reflects in particular the description of the System Pillar task 3 proposal to add a common data space for traffic management data.

1.2 Intended Audience

This document is addressed to the entire Pillar System for internal assessments, and recommendations for Europe's Rail further developments.

1.3 Document context


The document has been produced by taking into account the following assumptions :

- As Task 1 is informing the operational layer of the architecture, at a very high level, it is not the responsibility of Task 1 to explore the solution space but rather to explore the problem space and make sure that the issues tackled at a lower level of the architecture are effectively responding to stakeholder needs.
- This is the first issue of the report for the Operate train capability and it will carry on being developed via new versions of the report.
- The recommendations issued via this report are not formal requirements but shall however be used to stage future technical discussions across the System Pillar working group.
- This report has been developed in collaboration with the EET team in order to comply with the SEMP rules as closely as possible.
- The architecture proposal in this report has been devised for the moment only from the SP Task 1 perspective taking into account peer review of the SC2.1 deliverable. Future work will invariably involve sharing and discussing this architecture with the other Tasks in order to refine the understanding.


1.4 Glossary

1.4.1 Terms


Accident

Accident' means an unwanted or unintended sudden event or a specific chain of such events which have harmful consequences; accidents are divided into the following categories: collisions; derailments; level crossing accidents; accidents to persons involving rolling stock in motion; fires and others. [SPT1RS-1000,  Definition]


Serious Accident

Serious accident means any train collision or derailment of trains resulting in the death of at least one person or serious injuries to five or more persons or extensive damage to rolling stock, the infrastructure or the environment, and any other accident with the same consequences which has an obvious impact on railway safety regulation or the management of safety; 'extensive damage' means damage that can be immediately assessed by the investigating body to cost at least EUR 2 million in total. [SPT1RS-1001,  Definition]


Allocation

Allocation means the allocation of railway infrastructure capacity by an infrastructure manager [SPT1RS-1002,  Definition]


Allocation Body

An Allocation Body is an independent organization responsible for train path allocation to Railway Undertakings and other Applicants; this includes the designation of individual paths and the assessment of their availability. In most cases, the AB is the same organization as the Infrastructure Manager. But if the rail operator is not independent from the Infrastructure Manager, then path allocation must be carried out, according to Directive 2012/34/EU, by an independent Allocation Body. [SPT1RS-1003,  Definition]


Allocation process

The process by which capacity is granted to an Applicant by the Infrastructure Manager or relevant capacity Allocation Body; this capacity is available for the duration of the working timetable period only. [SPT1RS-1004,  Definition]


Applicant

Applicant means a railway undertaking or an international grouping of railway undertakings or other persons or legal entities, such as competent authorities under Regulation (EC) No 1370/2007 and shippers, freight forwarders and combined transport operators, with a public-service or commercial interest in procuring infrastructure capacity; [SPT1RS-1005,  Definition]


Holder of the vehicle type authorization

Holder of the vehicle type authorization means the natural or legal person that has applied for and received the vehicle type authorization, or its legal successor [SPT1RS-1006,  Definition]


Certification body

Certification body means a body, responsible for the certification of entities in charge of maintenance or for certification of the entity or organization that fulfill maintenance functions referred to in points (b), (c) or (d) of Article 14(3) of Directive (EU) 2016/798, or parts of those functions [SPT1RS-1007,  Definition]


Competent Authority

Competent authority means any public authority or group of public authorities of a Member State or Member States which has the power to intervene in public passenger transport in a given geographical area or any body vested with such authority [SPT1RS-1008,  Definition]

Competent Local Authority

Competent local authority means any competent authority whose geographical area of competence is not national [SPT1RS-1009,  Definition]

Coordination

Coordination means the process through which the infrastructure manager and applicants will attempt to resolve situations in which there are conflicting applications for infrastructure capacity. [SPT1RS-1010,  Definition]

ECM

Entity in charge of maintenance ('ECM') means an entity in charge of the maintenance of a

vehicle, and registered as such in a vehicle register referred to in Article 47 of Directive (EU) 2016/797

The maintenance of vehicles is defined in the Article 14 of Directive (EU) 2016/798.

In particular, the four functions of ECMs are described in the Article 14 (3):

(a) a management function to supervise and coordinate the maintenance functions referred to in points (b) to (d) and to ensure the safe state of the vehicle in the railway system;


[editorial edition : ECM 1 in this document]

(b) a maintenance development function responsible to manage the maintenance documentation, including the configuration ation management, based on design and operational data as well as on performance and return on experience; [editorial edition : ECM 2 in this document]


(c) a fleet-maintenance management function to manage the vehicle's removal for maintenance and its return to operation after maintenance; [editorial edition : ECM 3 in this document]

(d) a maintenance delivery function to deliver the required technical maintenance of a vehicle or parts of it, including the release to service documentation. [editorial edition : ECM 4 in this document]


The entity in charge of maintenance shall carry out the management function itself, but may outsource the maintenance functions referred to in points (b) to (d), or parts thereof, to other contracting parties such as maintenance workshops.

[SPT1RS-1011,  Definition]


Existing Railway System

Existing rail system means the infrastructure composed of lines and fixed installations of the existing rail network as well as the vehicles of all categories and origins traveling on that infrastructure [SPT1RS-1012,  Definition]


Fleet

All the vehicles of the railway company [SPT1RS-1013,  Definition]

Incident

Incident means any occurrence, other than an accident or serious accident, affecting the safety of railway operations [SPT1RS-1014,  Definition]


Infrastructure Capacity

Infrastructure capacity means the potential to schedule train paths requested for an element of infrastructure for a certain period [SPT1RS-1015,  Definition]


RNE Glossary

Narrow definition: the maximum number of trains which can be planned to move in both directions over a specified section of track in a 24hour period.


General definition: the totality of potential train paths that can be accommodated on a

railway line or a network
[SPT1RS-1016,  Definition]


Infrastructure Manager

Infrastructure manager means any body or firm responsible in particular for establishing, managing and maintaining railway infrastructure, including traffic management and control-command and signalling; the functions of the infrastructure manager on a network or part of a network may be allocated to different bodies or firms. [SPT1RS-1017,  Definition]


Innovative solutions

The article 10 of the INFRA TSI shall be taken into account regarding innovative solutions for maintenance, upgrading and renewal of infrastructure. [SPT1RS-1018,  Definition]


Keeper

Keeper means the natural or legal person that, being the owner of a vehicle or having the right to use it, exploits the vehicle as a means of transport and is registered as such in a vehicle register referred to in Article 47 [SPT1RS-1019,  Definition]

Exchanged Data

Data interchanged between at least two entities (in this case, data generated and processed by the IMs). [SPT1RS-1020,  Definition]


Monitoring data

The entity in charge of maintenance shall, either directly or via the keeper provide information to the railway undertakings and infrastructure managers operating the vehicles, keepers, manufacturers, holders of vehicles authorizations and holders of the type authorization of vehicles, subsystems or components, as most appropriate and shall in particular, inform them of exceptional maintenance findings beyond wear and tear. [SPT1RS-1021,  Definition]

National Safety Authority definition 1

National safety authority means a safety authority as defined in point (7) of Article 3 of Directive (EU) 2016/798 [SPT1RS-1022,  Definition]


National Safety Authority definition 2

National safety authority means the national body entrusted with the tasks regarding railway safety in accordance with this Directive [2016 / 798] or any body entrusted by several Member States with those tasks in order to ensure a unified safety regime [SPT1RS-1023,  Definition]

Network


Network means the entire railway infrastructure managed by an infrastructure manager; [SPT1RS-1024,  Definition]

Network Statement


Network statement means the statement which sets out in detail the general rules, deadlines, procedures and criteria for charging and capacity-allocation schemes, including such other information as is required to enable applications for infrastructure capacity. [SPT1RS-1025,  Definition]

Railway Infrastructure

Railway infrastructure means the items listed in Annex I [of DIRECTIVE 2012/34/EU OF THE

EUROPEAN PARLIAMENT AND OF THE COUNCIL of 21 November 2012 establishing a single European railway area (recast) [SPT1RS-1026,  Definition]

Railway Undertaking

Railway undertaking means any public or private undertaking licensed according to this Directive, the principal business of which is to provide services for the transport of goods and/or passengers by rail with a requirement that the undertaking ensure traction; this also includes undertakings which provide traction only; [SPT1RS-1027,  Definition]


Regulatory authorities

Under European Union legislation, each Regulatory Body (RB) has the task to oversee the application of Community rules and act as an appeal body in case of disputes.


DIRECTIVE 2012/34/EU, Article 55: 'Each Member State shall establish a single national regulatory body for the railway sector. Without prejudice to paragraph 2, this body shall be a stand-alone authority which is, in organizational, functional, hierarchical and decision-making terms, legally distinct and independent from any other public or private entity. It shall also be independent in its organization, funding decisions, legal structure and decision-making from any infrastructure manager, charging body, allocation body or applicant. It shall furthermore be functionally independent from any competent authority involved in the award of a public service contract.'

Thus it shall ensure that charges set by the Infrastructure Manager comply with Chapter II of 2001/14/EU and are non-discriminatory. The RB oversees negotiations between applicants and the IM and intervenes when the requirements of 2001/14 are likely to be contravened.

Applicants have the right to appeal to the RB if they believe that they have been unfairly treated, discriminated against or are in any other way aggrieved. In particular, they may appeal against decisions adopted by the IM (or where appropriate the Railway Undertaking) concerning: a) the network statement; b) criteria contained within it; c) the allocation process and its outcome; d) the charging scheme; e) level or structure of infrastructure fees which it is, or may be, required to pay; f) arrangements for access.

[SPT1RS-1028,  Definition]


Renewal

Renewal means any major substitution work on a subsystem or part of it which does not change the overall performance of the subsystem; [SPT1RS-1029,  Definition]


Services

Services are one of the two key components of economics, the other being goods. A service is a type of economic activity (or series of activities) that is of a more or less intangible nature, is not stored and does not result in ownership. Normally (but not necessarily) it takes place in interactions between the customer and service employees and /or systems of the service provider, provided as solutions to customer problems. Examples of services include the transfer of goods, such as the postal service delivering mail, and the use of expertise or experience, such as a person visiting a doctor. Services include the provision of what is necessary for maintenance of thing or operation, assistance and advice. RNE


dictionary

[SPT1RS-1030,  Definition]

Service Facility

Service facility means the installation, including ground area, building and equipment, which has been specially arranged, as a whole or in part, to allow the supply of one or more services referred to in points 2 to 4 of Annex II of DIRECTIVE 2012/34/EU OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 21 November 2012 establishing a single European railway area (recast). [SPT1RS-1031,  Definition]


Substitution [in the framework of maintenance]

Substitution in the framework of maintenance' means any replacement of components by parts of identical function and performance in the framework of preventive or corrective maintenance [SPT1RS-1032,  Definition]


Timetable

Document or system that gives details of a train(s) schedule over a particular route (OPE TSI appendix J)

This definition can be completed by the RNE definition:

' A schedule listing the times at which certain events, such as arrivals and departures at a transport station, are expected to take place. The timetable defines all planned train and rolling-stock movements which will take place on the relevant infrastructure during the period for which it is in force. Example: "annual timetable" ("yearly timetable" is incorrect)' [SPT1RS-1033,  Definition]

Working Timetable

Working timetable means the data defining all planned train and rolling-stock movements which will take place on the relevant infrastructure during the period for which it is in force [SPT1RS-1034,  Definition]


Traffic Management

Traffic management shall ensure the safe, efficient and punctual operation of the railway, including effective recovery from service disruption.


The infrastructure manager shall determine procedures and means for:

- the real time management of trains,
- operational measures to maintain the highest possible performance of the infrastructure in case of delays or incidents, whether actual or anticipated, and
- the provision of information to the railway undertaking(s) in such cases.

Any additional processes required by the railway undertaking and which affect the interface with the infrastructure manager(s) may be introduced after being agreed with the infrastructure manager.


[SPT1RS-1035,  Definition]

Operation and Traffic Management

The procedures and related equipment permitting coherent operation of the various structural subsystems, during both normal and degraded operation, including in particular train composition and train driving, traffic planning and management. [SPT1RS-1036,  Definition]

Traffic Monitoring

The monitoring of railway traffic involves systematically keeping track of (or supervising) and collecting information concerning parameters such as: train location, train speed, train direction. It uses graphical systems. The main graphic screens of these systems show two kinds of diagrams: train tracks and train schedules. Train track diagrams indicate the actual layout of railway tracks, signals, stations, and so on. They indicate the current position of trains, the condition of signals, the direction of switches, and so on, using simplified drawings of actual railway tracks and signals. To notify operators of this information, the color of tracks and signals are displayed, and a train's number is displayed in text that dynamically changes according to supervisory data. Train schedule diagrams consist of lines which correspond to the movements of trains, train numbers for each train line, and horizontal lines which show the positions of stations. They are presented as charts that illustrate train movements in actual time depicted along a horizontal axis.


[SPT1RS-1037,  Definition]

Train


Eurostat/ITF/UNECE definition: one or more railway vehicles hauled by one or more locomotives or rail-cars, or one rail-car traveling alone, running under a given number or specific designation from an initial fixed point to a terminal fixed point. (A light engine, i.e. a locomotive traveling on its own, is not considered to be a train.)

UNISIG definition for ERTMS: a traction unit (vehicle from where a train is operated) with or without coupled railway vehicles or a train set of vehicles with train data available.


General definition: one or more railway vehicles capable of being moved. It may consist of a locomotive (sometimes more than one) to provide power with various unpowered vehicles attached to it. It may consist of a multiple unit, i.e. several vehicles formed into a fixed formation or set, which carry their own power and do not require a locomotive. A train may be only a locomotive running light (deadheading) to a point elsewhere on the railway. A train may carry passengers, freight or, rarely nowadays, both.

[SPT1RS-1038,  Definition]


Train crew

Members of the on-board staff of a train, who are certified as competent and appointed by a railway undertaking to carry out specific, designated safety related tasks on the train, for example the driver or the guard. [SPT1RS-1039,  Definition]


Train dispatch

The indication to the person driving the train that all station or depot activities are completed and that, as far as the staff responsible are concerned, movement authority has been granted for the train. [SPT1RS-1040,  Definition]


Train Driver

Train driver means a person capable and authorized to drive trains, including locomotives, shunting locomotives, work trains, maintenance railway vehicles or trains for the carriage of passengers or goods by rail in an autonomous, responsible and safe manner. [SPT1RS-1041,  Definition]


Train Path

Train path means the infrastructure capacity needed to run a train between two places over a given period. [SPT1RS-1042,  Definition]


Train preparation

Ensuring that a train is in a fit condition to enter service, that the train equipment is correctly deployed and the train composition matches the train's designated route(s). Train preparation also includes technical inspections carried out prior to the train entering service. [SPT1RS-1043,  Definition]

Upgrading

Upgrading means any major modification work on a subsystem or part of it which results in a change in the technical file accompanying the 'EC' declaration of verification, if that technical file exists, and which improves the overall performance of the subsystem. [SPT1RS-1044,  Definition]

Vehicle

Vehicle means a railway vehicle suitable for circulation on wheels on railway lines, with or without traction; a vehicle is composed of one or more structural and functional subsystems. [SPT1RS-1045,  Definition]

1.4.2 Abbreviations

This paragraph contains the definition, abbreviations and symbols used by the Arcadia method with Capella throughout the all document.

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Operational Capability



Capability of an organization to provide a high level service leading to an operational objective being reached (for example Provide weather forecasts, etc.);

Operational Entity



Entity belonging to the real world (organization, existing system, etc.) whose role is to interact with the system being studied or with its users (for example Crew, Ship, etc.);

Operational Actor



Particular case of a (human) non-decomposable operational entity (for example Pilot, etc.);

Operational Activity



Process step carried out in order to reach a precise objective by an operational entity, which might need to use the future system in order to do so (for example Detect a threat, Collect meteorological data, etc.);

Operational Interaction



Exchange of information or of unidirectional matter between operational activities (for example meteorological data, etc.);

Operational Process



Series of activities and of interactions that contribute toward an operational capability.

Operational Scenario



Scenario that describes the behavior of entities and and/or operational activities in the context of an operational capability. It is commonly represented as a sequence diagram, with the vertical axis representing time.

2 Introduction

Task 1 is responsible for describing the top level architecture for System Pillar (SP). The objective of this report is to stage discussions on the technical integration of the other tasks and to formulate top-level requirements derived from the Common Business Objectives (CBO).

The report below presents the functional description of the SP Task 1 architecture proposal for the railway network capability: Operate train. On top of this, the SP Task 1 has issued a limited number of global recommendations for the Railway network architecture in order to reach the common business objectives set out for System Pillar.

In the document, the organization of the chapter "2 Operate Train Functional Architecture Description" will be as follows:

2.1 AS-IS : This section describes the workflow followed to describe the existing functional architecture of the "Operate Train" capability.

2.2 TO-BE : This section describes the workflow followed to describe the TO-BE functional architecture of the "Operate Train" capability as well as the recommendations raised by this new architecture.

2.3 Discussion of the architecture : This section describes the conclusion of the development of the architecture at a high level and the synthesis of contribution to the identified CBOs.

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3 Operate Train Functional Architecture Description

3.1 AS-IS

The description of the AS-IS is a static picture of the European Railway sector as if it were compliant to all currently applicable TSI's. This is an idealized view of the system, knowing that full compliance to the currently applicable TSI's is still a work in progress.

3.1.1 Process followed

The activities pursued on the AS-IS architecture were the following:

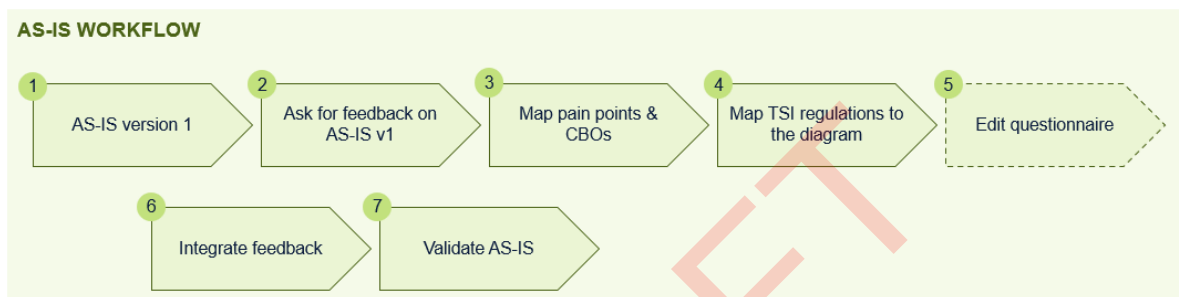





Figure 1 : AS-IS workflow

where:

- AS-IS Version 1: refers to the deliverable from last year, SC2.1:  240307 SP-LOT2-TASK1-Deliverables-SC2_1-v1-1
- Ask for feedback on AS-IS v1: Last year's deliverable was sent out to all contributors of System Pillar in order to collect feedback.
- Map Pain Points & CBOs: From previous years and programs, a list of pain points and Common Business Objectives (CBOs) have been compiled, this activity consisted in locating them on the Operate Train capability view.
 - Pain points: are described in the document: *SPT1RailwaySystem/Pain Points/Pain points list : 724230* . The aim of the mapping was to identify current difficulties observed with the 'Operate train' capability and identify the associated activities. A visual representation of the mapping is included in the annexes of this report.
 - Common Business Objectives: are described in the document:  Common Business Objectives . The aim of the mapping is to identify areas of potential improvement of the architecture. A visual representation of the mapping is included in the annexes of this report.
- Map TSI regulations to the diagram: consisted in identifying the field of application of the various TSIs, described in this document:  TSIs & other regulations . The objective for this activity is to identify areas of the diagram that are already constrained or optimized. A visual representation of this mapping is included in the annexes of this report.
- Edit questionnaire: consisted in listing questions relative to the Operate Train capability that were either difficult to address or need to be assessed by a broader audience. Therefore, the questionnaire could be sent out to a wider audience and was a different means of collecting feedback. This activity was never finished and sent outside of Task 1, however a draft version was compiled and is included in the annexes of this document.

3.1.2 Functional Description

On the following page is a view of the validated AS-IS capability view for Operate Train:

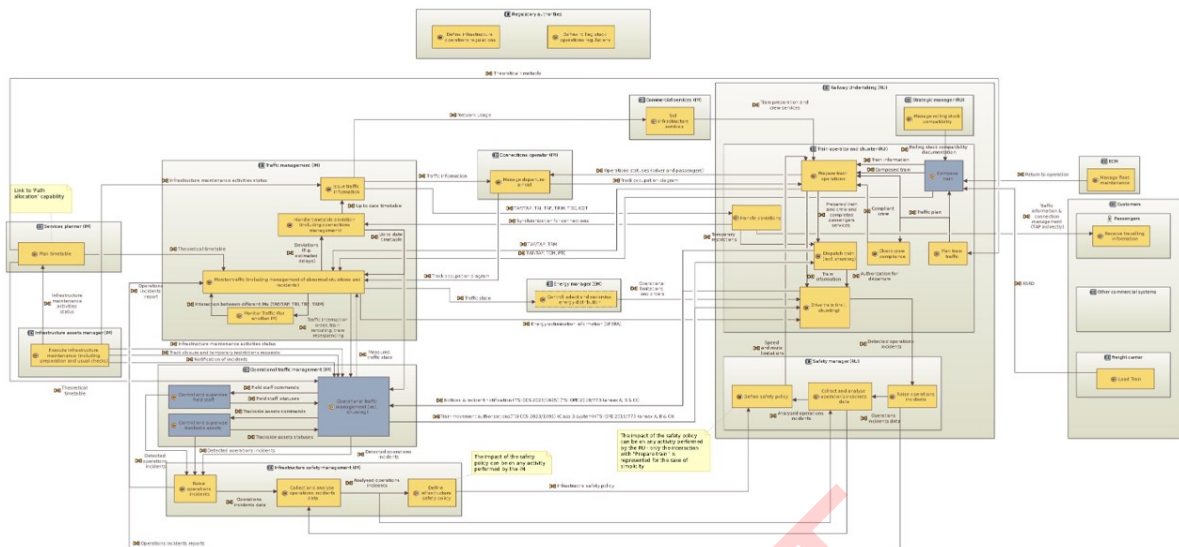


Figure 2 : Operate Train AS-IS Version 2

The view of the AS-IS Operate train capability has been improved in 2024, the Version 1 can be observed in the Annexes or in the end of year report 2023. The main modifications between these two version are highlighted in the view below:

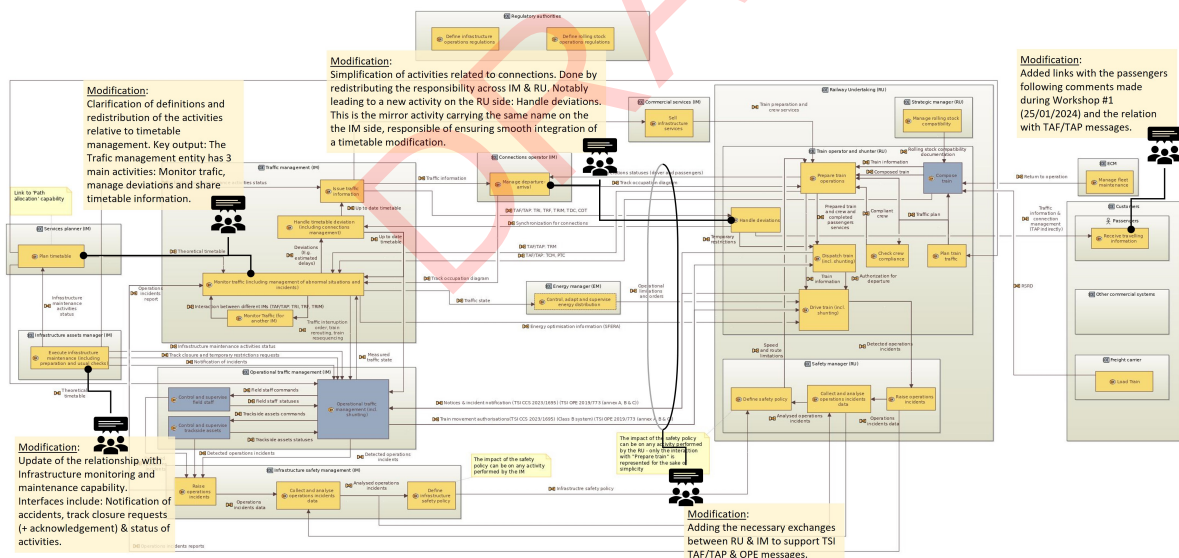


Figure 3 : Modifications of Operate Train version 2

The main modifications between these two version are:

- **Update of the naming of functions inside the Traffic Management Entity.**

The first key update was to consider that the timetable is in fact an input to the Traffic Management entity in the train operation. Ahead of the trains being able to operate, a sequence of activities results in the timetable: IM allocates paths to RUs who requested them; defined processes linked with commercial exchanges are performed for that. The outcome of this modification was to allocate the "Plan timetable"

activity to the "Capacity Manager" (or Services Planner as it is called in) rather than the traffic management.

Following this update, the Traffic Management entity was modeled following a pattern of optimization system: Capture, Process & Deliver. Capture (or acquire) consists in identifying issues and collecting data for corrective measures, which corresponds to the "Monitor traffic" activity. Process (or analyze) consists in solving the optimization problem posed by the issues identified, which corresponds to the "Handle deviations" activity. And finally, Deliver consists in sharing the information to all that need to know, which corresponds to the "send traffic information" activity.

Therefore the Traffic Management entity can be perceived as aiming to solve an optimization problem to increase traffic and avoid disruptions.

- **Adding a link to the Maintain & Monitor Infrastructure capability.**

Initially, there were no links between the Operate Train Capability and the Maintain & Monitor Infrastructure capability. The necessary exchanges were therefore added: The notification of incidents, track closure & restriction requests and the maintenance activities' status.

- **A simplification of the representation relative to connections.**

The representation for dealing with delays involving multiple actors was updated. When a train is delayed, the impact is communicated through the "Issue Traffic information" activity implemented by "Traffic Management". The delay can have impacts on potential connecting trains:

- In the case where the train is destined to a large train station, the reorganisation of track allocation in the train station can necessitate a Connections Operator, who has knowledge of train station track layout and its representation as a track occupation diagram. The "Manage departure-arrival" activity represents this process - it has for input the information of a delay (or other impactful event) and outputs the updated track occupation diagram.
- If the connecting train is operated by a different railway undertaking, then negotiations will ensue between the railway undertakings to maintain the connection. A new activity was introduced for railway undertakings called "Handle deviations" in response to the equivalent on the Traffic Management side. This activity centralizes the impactful events on the services the RU provides and, if necessary, reorganizes its resources to adapt to the new situation.
- For cases of pan-European trains, then other infrastructure managers may be impacted. In this case the IMs will communicate to evaluate the impacts and take appropriate action. These communications are represented via the communication loop on the "Monitor traffic" activity.

- **Adding the necessary interactions between activities to support the TSI communications (OPE, CCS & TAF/TAP mainly).**

TSI communications are described in the model as "Harmonized telematic messages" with more detail in the descriptions. A number of these communications were not previously represented.

- **Adding interactions with end clients (passengers & freight).**

Previously, there were barely any connections with the "Customers" in the Operate Train diagram. Indeed these exchanges will be better represented in a separate capability however there are necessary interactions that were added. The first traffic and connections management information should circulate among all the stakeholders including the passengers. These communications are the responsibility of the RU and are implemented via the "Handle deviations" activity.

For freight, the "Freight carriers" need to inform the Rolling Stock Reference Database in order for the RU to perform its activities.

- **Other minor naming modifications to improve understanding.**

These are described in more detail in the feedback forms in the annex of this document.

3.2 TO-BE

The TO-BE architecture constitutes a "target architecture" and therefore is formalized by recommendations on the issues to tackle to improve the performance of the railway sector. There is need to handle the migration from AS-IS to TO-BE, but this topic is not described in this report.

3.2.1 Process followed

The activities pursued for the TO-BE architecture:

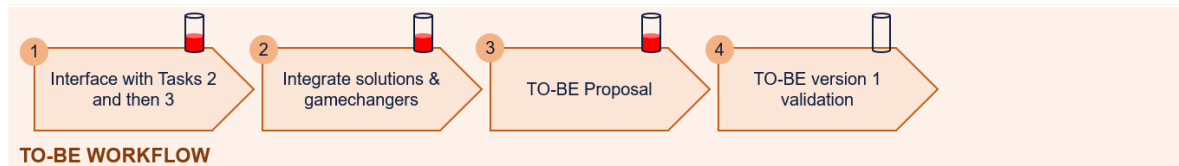


Figure 4 : TO-BE Workflow

Moreover, the results of the AS-IS were used as inputs for the work on the TO-BE following the process below:

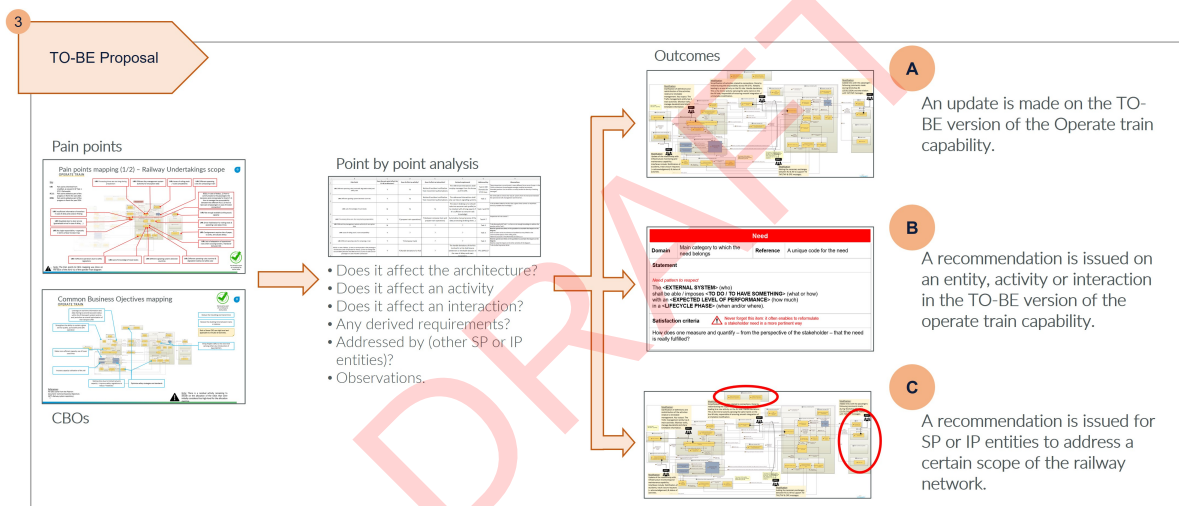


Figure 5 : TO-BE outcomes

The important information from the schema above is the fact that the outcomes of the TO-BE architecture analysis can be of three different formats:

- A. An update in the diagram:** Some proposed modifications can be seen directly on the capability view and therefore appear as an update from the AS-IS architecture to the TO-BE.
- B. A recommendation issued on a modelling artefact:** Many modifications may be significant but do not involve a tangible modification of the view since the impact is in the level of performance associated to the Entity, Activity or interaction. In this case, the modification (or suggestion) is described in the form of a recommendation following a structured template.
- C. An Open point:** A possible outcome is also to identify areas of the diagram that are highlighted in the analysis as being a space for improvement but which isn't addressed in the current scope of work.

3.2.2 Functional Description

This section aims at describing the TO-BE architecture. The description shall start by introducing the entities and actors involved in the capability and then their responsibilities in terms of activities and interactions.

[OAB] Operate train [Operational activity allocation]

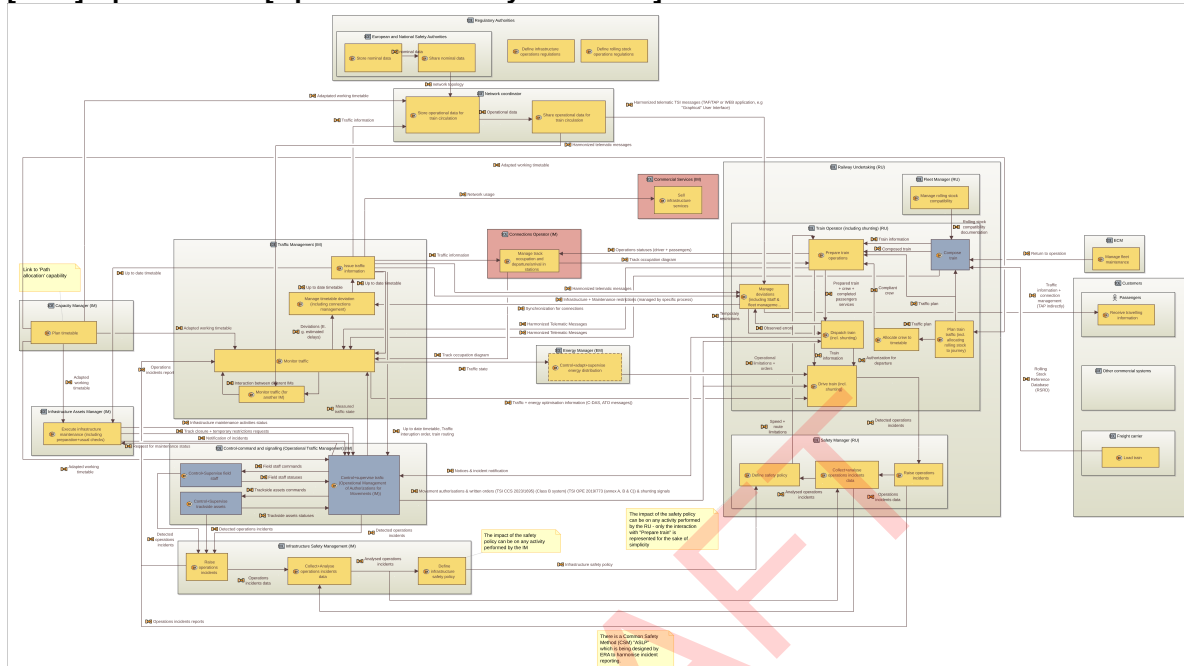


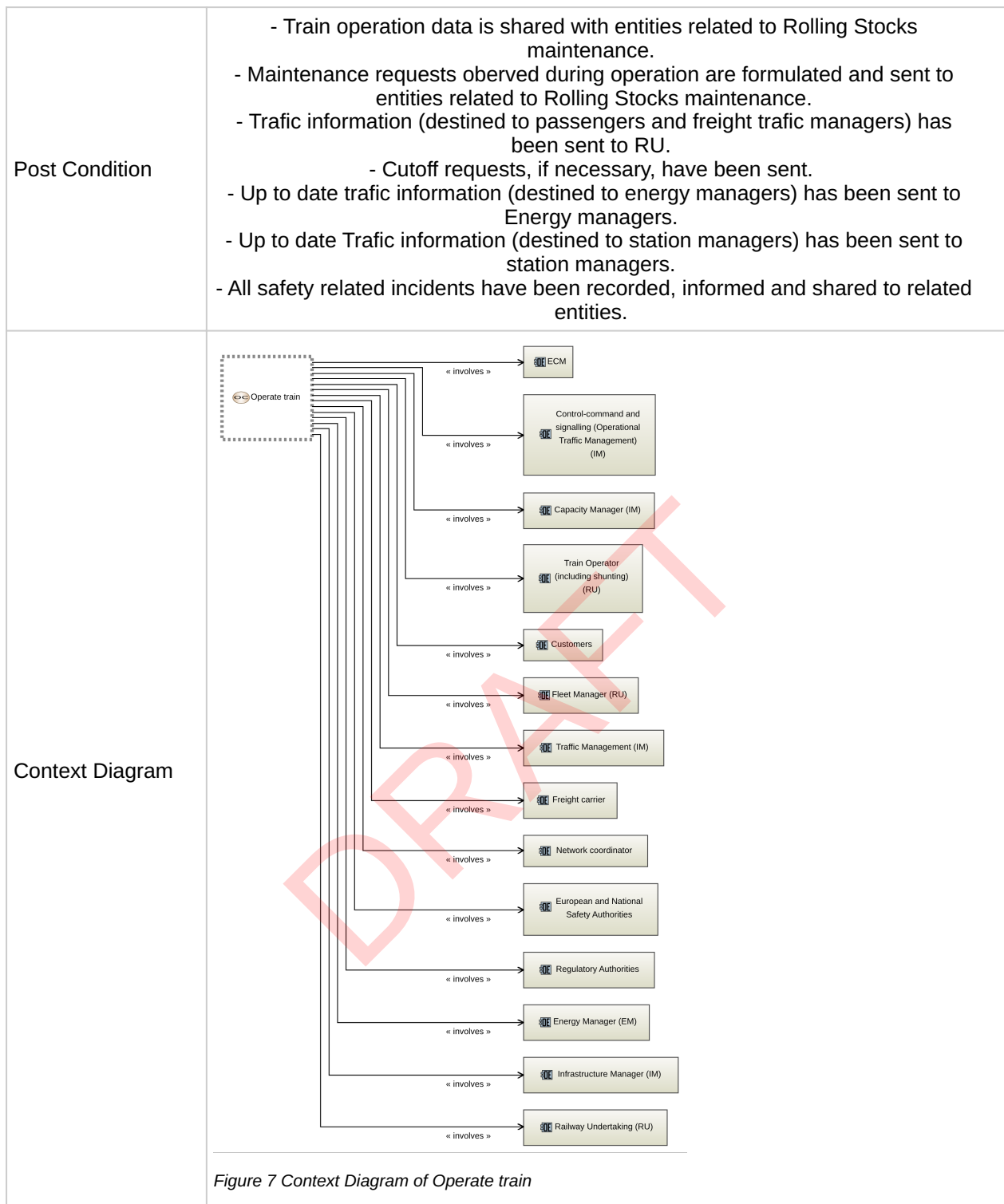
Figure 6 Diagram [OAB] Operate train [Operational activity allocation]
















[SPMS-3884]

3.2.2.1 Operational Artefacts (Capability, Entities & Activities)

Operate train

Pre Condition	<ul style="list-style-type: none"> - The Rolling Stock assets must be available & their associated restrictions known (incl. Design and configuration documentation) <ul style="list-style-type: none"> - A theoretical timetable is available. - Track closures and restrictions are known (have been sent by infrastructure maintenance entities). - The RSRD and passenger information is known (has been sent by associated entities). <ul style="list-style-type: none"> - Electrical power is available in the infrastructure. - Limitations & orders related to energy consumption in the infrastructure is known. - The track occupation diagrams are known (sent by railway station managers). <ul style="list-style-type: none"> - The safety policies for the entities involved are known and applied. - The trainset is authorised (ERA TV) and has network access - Infrastructure operation regulations are taken into account by those who write the operational instructions to which the operational staff comply - Rolling stock operation regulations are taken into account by those who write the operational instructions to which the operational staff comply
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Involved entities	<ul style="list-style-type: none"> •  SPMS-4049 - Infrastructure Manager (IM) •  SPMS-4056 - Customers •  SPMS-4057 - European and National Safety Authorities •  SPMS-4060 - Control-command and signalling (Operational Traffic Management) (IM) •  SPMS-4063 - Railway Undertaking (RU) •  SPMS-4066 - Freight carrier •  SPMS-4068 - Traffic Management (IM) •  SPMS-4077 - Energy Manager (EM) •  SPMS-4080 - Fleet Manager (RU) •  SPMS-4084 - Train Operator (including shunting) (RU) •  SPMS-4085 - ECM •  SPMS-4087 - Regulatory Authorities •  SPMS-4090 - Capacity Manager (IM) •  SPMS-7052 - Network coordinator
ID	SPMS-3943
Type	 C2P-Capability

The Operational Capability "Operate Train" is composed of 6 operational entities which are:

- Infrastructure Manager (IM)
- Railway Undertaking (RU)
- Energy Manager (EM)
- Customers
- Entity in Charge of Maintenance (ECM)
- Regulatory authorities

[COC] Operate train [Single operational capability context]

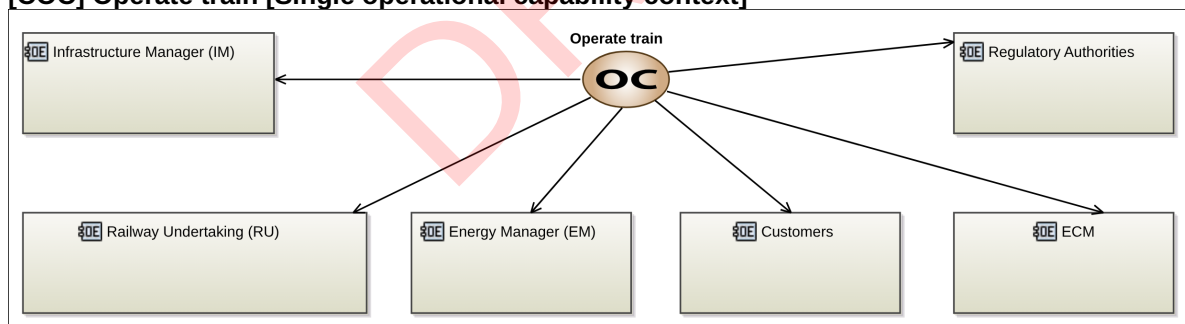












Figure 8 Diagram [COC] Operate train [Single operational capability context]

[SPMS-3891]

3.2.2.1.1 Infrastructure Manager (IM)

Infrastructure Manager (IM)

Type	 C2P-Operational Entity
ID	SPMS-4049





Children	<ul style="list-style-type: none"> •  SPMS-4052 - Infrastructure Monitoring Manager (IM) •  SPMS-4055 - Commercial Services (IM) •  SPMS-4058 - Connections Operator (IM) •  SPMS-4060 - Control-command and signalling (Operational Traffic Management) (IM) •  SPMS-4067 - Infrastructure Safety Management (IM) •  SPMS-4068 - Traffic Management (IM) •  SPMS-4081 - Infrastructure Assets Manager (IM) •  SPMS-4086 - Infrastructure Designer (IM) •  SPMS-4090 - Capacity Manager (IM) •  SPMS-4091 - Station manager and other facilities (IM)
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The Operational Entity "Infrastructure Manager" is composed of 8 operational sub-entities which are:

- Capacity manager
- Infrastructure assets manager
- Traffic management
- Control-command and signalling (Operational Traffic Management)
- Infrastructure safety management
- Connections operator
- Energy manager
- Commercial services

Capacity Manager (IM)

Entity in charge of the timetable design.



Type	 C2P-Operational Entity
ID	SPMS-4090
Allocated	<ul style="list-style-type: none"> •  SPMS-3965 - Plan timetable •  SPMS-3972 - Plan long term capacity •  SPMS-4020 - Allocate capacity

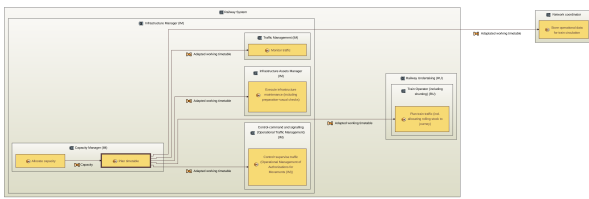
The Operational Entity "Capacity Manager" is detailed in the "Infrastructure Architecture Report".

Plan timetable












Directive 2012/34/EU: Infrastructure managers shall manage rail infrastructure capacity through a planning and allocation process comprising three phases: (a) strategic capacity planning; (b) scheduling and allocation of infrastructure capacity; (c) adaptation and rescheduling of allocated capacity. This activity is realized by the following function defined in the functional architecture of SPT3 :

- Export Capacity Plan
- Capture Capacity Plan
- Build Operational Plan

Type	 C2P-Operational Activity
Allocated to	<ul style="list-style-type: none"> •  SPMS-4090 - Capacity Manager (IM)

Context Diagram	 <p>Figure 9 Context Diagram of Plan timetable</p>
ID	SPMS-3965

Infrastructure Assets Manager (IM)

Type	 C2P-Operational Entity
ID	SPMS-4081
Allocated	<ul style="list-style-type: none"> •  SPMS-3956 - Manage infrastructure maintenance certification •  SPMS-3958 - Manage infrastructure data •  SPMS-3973 - Plan works •  SPMS-3984 - Request capacity for infrastructure maintenance •  SPMS-3986 - Organize (planned & unplanned) infrastructure maintenance (including asset management & obsolescence management) •  SPMS-3987 - Develop infrastructure maintenance capabilities (including tools) •  SPMS-3988 - Execute infrastructure maintenance (including preparation+usual checks) •  SPMS-3993 - Manage parts supply (including obsolescence management) •  SPMS-4005 - Request an infrastructure certification •  SPMS-4035 - Supervise+coordinate infrastructure maintenance

The Operational Entity "Infrastructure Assets Manager" is detailed in the "Infrastructure Architecture Report".

Traffic Management (IM)

OPERATE TRAIN: Traffic management shall ensure the safe, efficient and punctual operation of the railway, including effective recovery from service disruption.

The infrastructure manager shall determine procedures and means for:

- The real time management of trains,
- Operational measures to maintain the highest possible performance of the infrastructure in case of delays or incidents, whether actual or anticipated, and
- The provision of information to the railway undertaking(s).

Any additional processes required by the railway undertaking and which affect the interface with the infrastructure manager(s) may be introduced after being agreed with the infrastructure manager.'







COMMISSION IMPLEMENTING REGULATION (EU) 2019/773 of 16 May 2019 on the technical specification for interoperability relating to the operation and traffic management subsystem of the rail system within the European Union and repealing Decision 2012/757/EU Annex – Article 4.2.3.4.1.

This definition could be completed by the following: Operation and Traffic Management: The procedures and related equipment permitting coherent operation of the various structural subsystems, during both normal and degraded operation, including in particular train composition and train driving, traffic planning

and management.

DIRECTIVE (EU) 2016/797 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 11 May 2016 on the interoperability of the rail system within the European Union (recast) – Annex II - Article 2

MANAGE ENERGY: 'Infrastructure Manager' means any body or firm responsible in particular for establishing, managing and maintaining railway infrastructure, including traffic management and control-command and signalling; the functions of the infrastructure manager on a network or part of a network may be allocated to different bodies or firms (DIRECTIVE 2012/34/EU OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 21 November 2012 establishing a single European railway area (recast) - Article 3)

Type	 C2P-Operational Entity
ID	SPMS-4068
Allocated	<ul style="list-style-type: none"> •  SPMS-3947 - Monitor traffic (for another IM) •  SPMS-3990 - Consume electrical energy •  SPMS-4031 - Manage timetable deviation (including connections management) •  SPMS-4033 - Issue traffic information •  SPMS-4043 - Monitor traffic

The Operational Entity "Traffic Management" is composed of 4 operational activities which are:

- Monitor traffic
- Monitor traffic (for another IM)
- Handle timetable deviation (including connections management)
- Issue traffic information

Monitor traffic



This activity involves following the trains and interpreting the information from the Control, command and signalling (Operational Traffic Management). It is responsible for identifying deviations from the theoretical timetable.

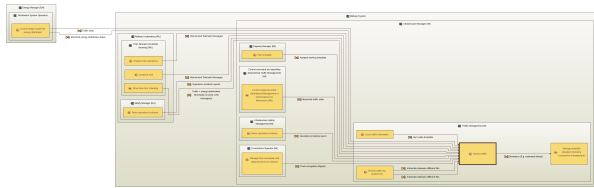
'The monitoring of railway traffic involves systematically keeping track of (or supervising) and collecting information concerning parameters such as: train location, train speed, train direction. It uses graphical systems. The main graphic screens of these systems show two kinds of diagrams: train tracks and train schedules. Train track diagrams indicate the schematic layout of railway tracks, signals, stations, and so on. They indicate the current position of trains, the condition of signals, the position of switches, and so on, using simplified drawings of actual railway tracks and signals. To notify operators of this information, the color of tracks and signals are displayed, and a train's number is displayed in text that dynamically changes according to supervisory data. Train schedule diagrams consist of lines which correspond to the movements of trains, train numbers for each train line, and horizontal and vertical lines can be inverted to show the positions of stations. They are presented as charts that illustrate train movements in actual time depicted along a horizontal axis.'

NetEurope – Glossary of Terms Related to Network Statements – Ninth edition, 2017

This activity is realized by the following function defined through the functional architecture of SPT3:



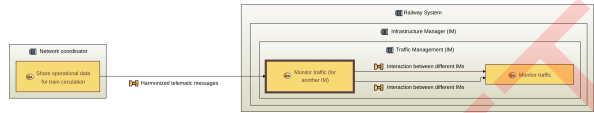
- Detect deviation
- Evaluate trains forecast
- Detects conflicts

Type	 C2P-Operational Activity
Allocated to	<ul style="list-style-type: none"> •  SPMS-4068 - Traffic Management (IM)

Context Diagram	 <p>Figure 10 Context Diagram of Monitor traffic</p>
ID	SPMS-4043

Monitor traffic (for another IM)

Cf. description of the Monitor Traffic activity.




Type	 C2P-Operational Activity
Allocated to	<ul style="list-style-type: none"> •  SPMS-4068 - Traffic Management (IM)
Context Diagram	 <p>Figure 11 Context Diagram of Monitor traffic (for another IM)</p>
ID	SPMS-3947

Manage timetable deviation (including connections management)

Decides operational variations from planned timetable and train succession order and priorities. These variations can be changing the order of trains on a line or the order of trains entering a junction. They may be decided after concertation with RUs : rerouting, adding or removing a train stop, shortening the train route...

This activity is realized by the following function defined through the functional architecture of SPT3:

- Manage incident impact
- Store scenario
- Buy/modify Scenario
- Apply user choices
- Solve conflicts semi automatically
- Solve conflicts automatically
- Calculate connections
- Display configuration data



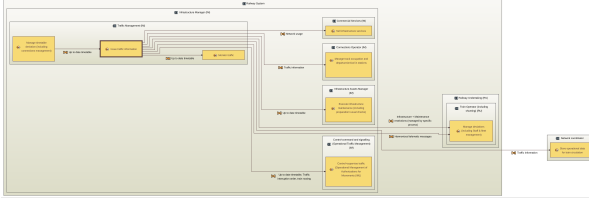
Type	 C2P-Operational Activity
Allocated to	<ul style="list-style-type: none"> •  SPMS-4068 - Traffic Management (IM)
Context Diagram	 <p>Figure 12 Context Diagram of Manage timetable deviation (including connections management)</p>
ID	SPMS-4031

Issue traffic information

Record & Share the traffic management information & decisions.






This activity is realized by the following function defined through the functional architecture of SPT3:

- Process events and decisions
- Publish real-time operational plan

Type	 C2P-Operational Activity
Allocated to	<ul style="list-style-type: none"> •  SPMS-4068 - Traffic Management (IM)
Context Diagram	 <p>Figure 13 Context Diagram of Issue traffic information</p>
ID	SPMS-4033

Control-command and signalling (Operational Traffic Management) (IM)

Issues the movement permission for a given train, provided conditions controlled by the IM are fulfilled (e.g., interlocking, flank protection, train spacing...). This can be done by several ways depending on implemented technology (line side signalling, cab signals, written orders, ETCS movement authority...). It is composed of the fixed installations (as per CCS definition : All the equipment necessary to ensure safety and to command and control movements of trains authorized to travel on the network), and the signaller who operates them.



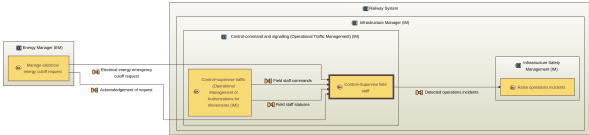
Type	 C2P-Operational Entity
ID	SPMS-4060
Allocated	<ul style="list-style-type: none"> •  SPMS-3949 - Update CS infrastructure data •  SPMS-4019 - Control+Supervise field staff •  SPMS-4023 - Control+Supervise trackside assets •  SPMS-4040 - Control+supervise traffic (Operational Management of Authorizations for Movements (IM))

The Operational Entity "Control-command and signalling (Operational Traffic Management)" is composed of 3 operational activities which are:

- Control+Supervise field staff
- Control+Supervise trackside assets
- Control+Supervise traffic (Operational traffic management (incl. shunting))

Control+Supervise field staff

Closing the tracks under request from maintenance crew and reopening them after maintenance crew authorization.

Type	 C2P-Operational Activity
Allocated to	<ul style="list-style-type: none">  SPMS-4060 - Control-command and signalling (Operational Traffic Management) (IM)
Context Diagram	 <p>The diagram illustrates the context of the Control+Supervise field staff. It features a central box labeled 'Control+Supervise field staff' which is part of a larger 'Control+Supervise field staff' system. This system is connected to several external systems: 'Traffic Manager (TM)' on the left, 'Control+Supervise field staff' on the right, 'Control+Supervise field staff' on the right, and 'Control+Supervise field staff' on the right. The diagram also shows a 'Control+Supervise field staff' system and a 'Control+Supervise field staff' system.</p> <p><i>Figure 14 Context Diagram of Control+Supervise field staff</i></p>
ID	SPMS-4019



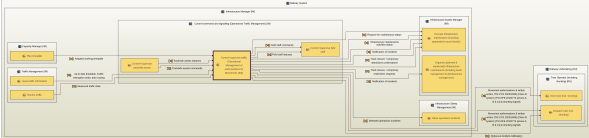
Control+Supervise trackside assets

Control/Supervise trackside assets
The trackside assets are mainly composed on switches and signals

Type	C2P-Operational Activity
Allocated to	<ul style="list-style-type: none"> SPMS-4060 - Control-command and signalling (Operational Traffic Management) (IM)
Context Diagram	<p>Figure 15 Context Diagram of Control+Supervise trackside assets</p>
ID	SPMS-4023

Control+supervise traffic (Operational Management of Authorizations for Movements (IM))





Issues movement permission, controls switches and signals

Type	 C2P-Operational Activity
Allocated to	<ul style="list-style-type: none"> •  SPMS-4060 - Control-command and signalling (Operational Traffic Management) (IM)
Context Diagram	 <p><i>Figure 16 Context Diagram of Control+supervise traffic (Operational Management of Authorizations for Movements (IM))</i></p>
ID	SPMS-4040

Infrastructure Safety Management (IM)

Entity responsible for the application of the Safety Directive 2016/798 , in accordance to the safety processes defined in the Safety Management System.

This entity is intervening in off-line to analyze operational incidents and redefines procedures in order to prevent that the same operational incidents are repeated.

Type	 C2P-Operational Entity
ID	SPMS-4067
Allocated	<ul style="list-style-type: none">  SPMS-3961 - Raise operations incidents  SPMS-4012 - Collect+Analyze operations incidents data  SPMS-4028 - Define infrastructure safety policy

The Operational Entity "Infrastructure Safety Management" is composed of 3 operational activities which are:

- Raise operations incidents
- Collect+Analyze operations incidents data
- Define infrastructure safety policy

Raise operations incidents



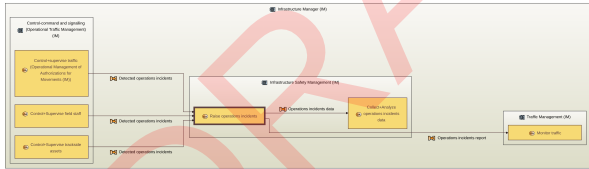
Type	 C2P-Operational Activity
Allocated to	<ul style="list-style-type: none">  SPMS-4067 - Infrastructure Safety Management (IM)
Context Diagram	 <p>The diagram shows the 'Raise operations incidents' activity within the 'Infrastructure Safety Management (IM)' system. It is connected to external systems like 'Control and Signalling' and 'Traffic Management (TM)' through interfaces such as 'Operational incidents data' and 'Operational incidents report'.</p>
ID	SPMS-3961

Figure 17 Context Diagram of Raise operations incidents

Collect+Analyze operations incidents data



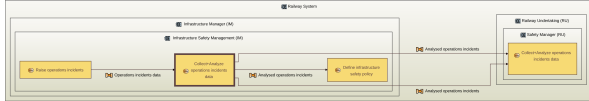

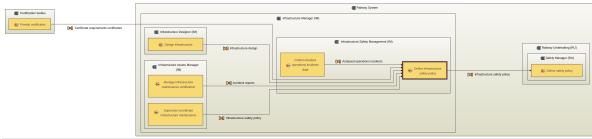
Type	 C2P-Operational Activity
Allocated to	<ul style="list-style-type: none">  SPMS-4067 - Infrastructure Safety Management (IM)
Context Diagram	 <p>The diagram shows the 'Collect+Analyze operations incidents data' activity within the 'Infrastructure Safety Management (IM)' system. It interacts with 'Operational incidents data' and 'Operational incidents report' interfaces, and is linked to 'Traffic Management (TM)'.</p>
ID	SPMS-4012

Figure 18 Context Diagram of Collect+Analyze operations incidents data



Define infrastructure safety policy

Type	 C2P-Operational Activity
------	--

Allocated to	<ul style="list-style-type: none"> •  SPMS-4067 - Infrastructure Safety Management (IM)
Context Diagram	 <p>Figure 19 Context Diagram of Define infrastructure safety policy</p>
ID	SPMS-4028

Connections Operator (IM)

- Manages station track occupation, based on the track occupation diagram.
- Manages passenger flow inside the station
- Deals with delays and connections for the passengers.



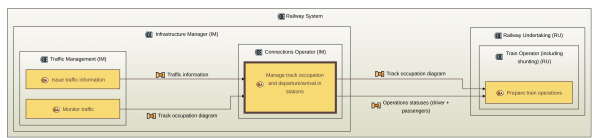
Type	 C2P-Operational Entity
ID	SPMS-4058
Allocated	<ul style="list-style-type: none"> •  SPMS-4034 - Manage track occupation and departure/arrival in stations

The Operational Entity "Connections Operator" is composed of 1 operational activity which is:

- Manage departure-arrival

Manage track occupation and departure/arrival in stations




Real time modifications of the track occupation diagram and of the timetable in the station in case of a delay.

Type	 C2P-Operational Activity
Allocated to	<ul style="list-style-type: none"> •  SPMS-4058 - Connections Operator (IM)
Context Diagram	 <p>Figure 20 Context Diagram of Manage track occupation and departure/arrival in stations</p>
ID	SPMS-4034

Commercial Services (IM)

Entity that supplies access to the tracks.

Entity that supplies infrastructures services for energy distribution in case of "Manage Energy".

Type	 C2P-Operational Entity
ID	SPMS-4055
Allocated	<ul style="list-style-type: none">  SPMS-3967 - Pay electrical energy consumption  SPMS-3974 - Sell infrastructure services

The Operational Entity "Commercial Services (IM)" is composed of 1 operational activity which is:

- Sell infrastructure services

Sell infrastructure services

Interface between RU and IM, two missions are taken into account here : selling the services described in the network statement and charging the services based on real usage of infrastructure after the train has run, taking into account the operational deviations.

Selling the service involves considering the capacity and performance of the network, gathering the RUs needs, and defining with the RUs the timetable and services, and conditions of sales





Type	 C2P-Operational Activity
Allocated to	<ul style="list-style-type: none">  SPMS-4055 - Commercial Services (IM)
Context Diagram	 <p>Figure 21 Context Diagram of Sell infrastructure services</p>
ID	SPMS-3974





3.2.2.1.2 Railway Undertaking (RU)

Railway Undertaking (RU)

'Railway Undertaking' means any public or private undertaking licensed according to this Directive, the principal business of which is to provide services for the transport of goods and/or passengers by rail with a requirement that the undertaking ensure traction; this also includes undertakings which provide traction only;

DIRECTIVE 2012/34/EU OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 21 November 2012 establishing a single European railway area (recast) – Article 3 definition 1

Type	 C2P-Operational Entity
ID	SPMS-4063
Children	<ul style="list-style-type: none">  SPMS-4050 - Commercial Services (RU)  SPMS-4078 - Safety Manager (RU)  SPMS-4080 - Fleet Manager (RU)  SPMS-4084 - Train Operator (including shunting) (RU)

Allocated	<ul style="list-style-type: none"> •  SPMS-3978 - ME_Generate electrical energy from regenerative breaking •  SPMS-3983 - Measure electrical energy consumption •  SPMS-4037 - Consume+transform+store electrical energy •  SPMS-7896 - Consume non electric energy
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The Operational Entity "Railway Undertaking" is composed of 3 operational sub-entities which are:

- Train Operator (including shunting)
- Fleet Manager
- Safety Manager

Train Operator (including shunting) (RU)

An entity operating a train through its life-cycle.

IM handles traffic management during crisis situations in coordination with the concerned RUs. This can result in train deviation, rerouting, adding stops , or re-sequencing in case of a reduced 'real-time' capacity, train cancellations can be also decided.

Type	 C2P-Operational Entity
ID	SPMS-4084
Allocated	<ul style="list-style-type: none"> •  SPMS-3948 - Plan train traffic (incl. allocating rolling stock to journey) •  SPMS-3957 - Prepare train operations •  SPMS-4007 - Compose train •  SPMS-4010 - Allocate crew to timetable •  SPMS-4018 - Compose train •  SPMS-4029 - Dispatch train (incl. shunting) •  SPMS-4030 - Manage deviations (including Staff & fleet management) •  SPMS-4039 - Drive train (incl. shunting)

The Operational Entity "Train Operator (including shunting)" is composed of 7 operational activities which are:



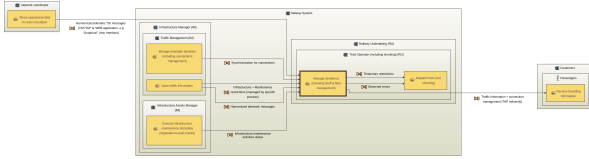
- Handle deviations (including staff & fleet management)
- Dispatch train (incl. shunting)
- Drive train (incl. shunting)
- Compose train
- Prepare train operations
- Allocate crew to timetable
- Plan train traffic (incl. allocating rolling stock to journey)

Manage deviations (including Staff & fleet management)

Directive 2012/34/EU:

1. Traffic management during normal operating conditions involving the management of incidents resulting in limited deviations from the working timetable ;
2. Disruption management to address significant disturbances to network operations requiring concerted action;
3. Traffic management during crisis situations.




These three aspects are mainly done by the IM-TMS.

Type	 C2P-Operational Activity
Allocated to	<ul style="list-style-type: none">  SPMS-4084 - Train Operator (including shunting) (RU)
Context Diagram	 <p>Figure 22 Context Diagram of Manage deviations (including Staff & fleet management)</p>
ID	SPMS-4030

Dispatch train (incl. shunting)

Train dispatch: The indication to the person driving the train that all station or depot activities are completed and that, as far as the staff responsible are concerned, movement authority has been granted for the train.

COMMISSION IMPLEMENTING REGULATION (EU) 2019/773 of 16 May 2019 on the technical specification for interoperability relating to the operation and traffic management subsystem of the rail system within the European Union and repealing Decision 2012/757/EU – Appendix J

Type	 C2P-Operational Activity
Allocated to	<ul style="list-style-type: none">  SPMS-4084 - Train Operator (including shunting) (RU)
Context Diagram	 <p>Figure 23 Context Diagram of Dispatch train (incl. shunting)</p>
ID	SPMS-4029



Drive train (incl. shunting)

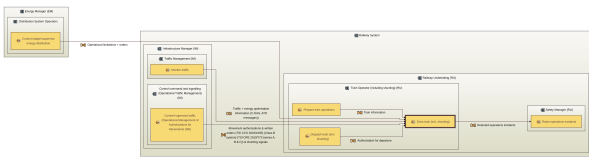
Refers to all actions the driver performs during the operation of a train.

"Train driver" means a person capable and authorized to drive trains, including locomotives, shunting locomotives, work trains, maintenance railway vehicles or trains for the carriage of passengers or goods by rail in an autonomous, responsible and safe manner.'

DIRECTIVE 2007/59/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 23 October 2007 on the certification of train drivers operating locomotives and trains on the railway system in the Community – Article 3 (b)



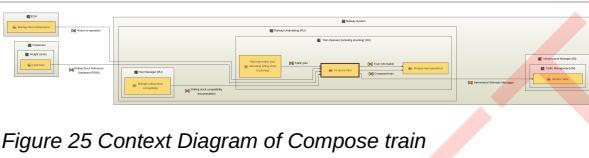
Could be implemented through DAS, ATO for GoA 0, 1 & 2 (TSI CCS)

Type	 C2P-Operational Activity
Allocated to	<ul style="list-style-type: none">  SPMS-4084 - Train Operator (including shunting) (RU)

Context Diagram	 <p>Figure 24 Context Diagram of Drive train (incl. shunting)</p>
ID	SPMS-4039

Compose train




Make sure each vehicle composing the train is compliant for the intended service and that the consist is compliant. Define braking performance of the consist and possible running restrictions.

Type	 C2P-Operational Activity
Allocated to	<ul style="list-style-type: none">  SPMS-4084 - Train Operator (including shunting) (RU)
Context Diagram	 <p>Figure 25 Context Diagram of Compose train</p>
ID	SPMS-4018

Prepare train operations

Train preparation: Ensuring that a train is in a fit condition to enter service, that the train equipment is correctly deployed and the train composition matches the train's designated route(s). Train preparation also includes technical inspections carried out prior to the train entering service.

COMMISSION IMPLEMENTING REGULATION (EU) 2019/773 of 16 May 2019 on the technical specification for interoperability relating to the operation and traffic management subsystem of the rail system within the European Union and repealing Decision 2012/757/EU – Appendix J

Type	 C2P-Operational Activity
Allocated to	<ul style="list-style-type: none">  SPMS-4084 - Train Operator (including shunting) (RU)
Context Diagram	 <p>Figure 26 Context Diagram of Prepare train operations</p>
ID	SPMS-3957



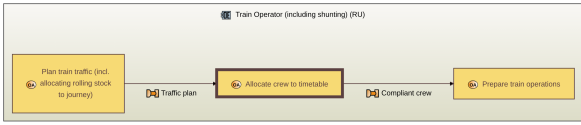
Allocate crew to timetable

Involves checking crew compliance which includes checking the skills, route and rolling stock knowledge, medical.

E.g. for a driver:



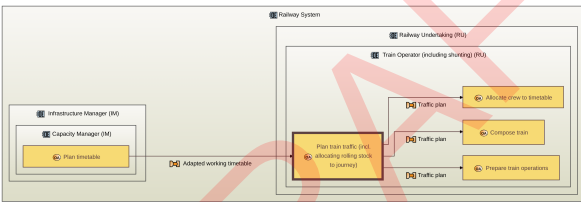
- rolling stock knowledge
- rule knowledge
- route knowledge

- physical and psychological fitness
- rest time fulfillment

Type	 C2P-Operational Activity
Allocated to	<ul style="list-style-type: none"> •  SPMS-4084 - Train Operator (including shunting) (RU)
Context Diagram	 <p>Figure 27 Context Diagram of Allocate crew to timetable</p>
ID	SPMS-4010




Plan train traffic (incl. allocating rolling stock to journey)

Includes resources management (RST, staff depending on the mission)

Type	 C2P-Operational Activity
Allocated to	<ul style="list-style-type: none"> •  SPMS-4084 - Train Operator (including shunting) (RU)
Context Diagram	 <p>Figure 28 Context Diagram of Plan train traffic (incl. allocating rolling stock to journey)</p>
ID	SPMS-3948

Fleet Manager (RU)

The Fleet Maintenance Management covers the removal from/return to operation before/after maintenance and the management of relations with ECM internal/external entities delivering maintenance. (Guide for the application of Article 14 of Directive (EU) 2016/798 and Commission Implementing Regulation (EU) No 2019/779 on a system of certification of entities in charge of maintenance for vehicles, §4.11. What is the ECM)



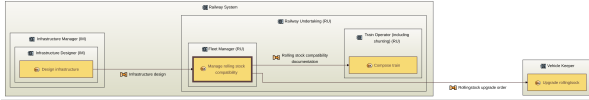
Type	 C2P-Operational Entity
ID	SPMS-4080
Allocated	<ul style="list-style-type: none"> •  SPMS-3964 - Manage rolling stock compatibility •  SPMS-3996 - Define rolling stock usage profile & performance targets

The Operational Entity "Fleet Manager" is composed of 1 operational activity which is:

- Manage rolling stock compatibility

Manage rolling stock compatibility





Identify restrictions on rolling stock running conditions (speed, loading...), depending on the route. The Route Compatibility Check (RCC) is performed, and the resulting documentation for operational staff is compiled, prior to operations under the RU responsibility.

Type	 C2P-Operational Activity
Allocated to	<ul style="list-style-type: none">  SPMS-4080 - Fleet Manager (RU)
Context Diagram	 <p>Figure 29 Context Diagram of Manage rolling stock compatibility</p>
ID	SPMS-3964

Safety Manager (RU)

Entity responsible for the application of the safety directive 2016/798, in accordance to the safety processes defined in the Safety Management System.



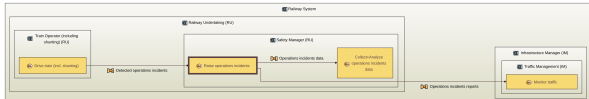
Directive (EU) 2016/798 of the European Parliament and of the Council of 11 May 2016 on railway safety.

Type	 C2P-Operational Entity
ID	SPMS-4078
Allocated	<ul style="list-style-type: none">  SPMS-3960 - Raise operations incidents  SPMS-3962 - Define safety policy  SPMS-4011 - Collect+Analyze operations incidents data



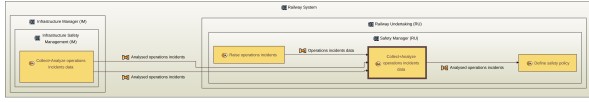
The Operational Entity "Safety Manager" is composed of 3 operational activities which are:

- Raise operations incidents
- Collect+analyze operations incidents data
- Define safety policy

Raise operations incidents




Type	 C2P-Operational Activity
Allocated to	<ul style="list-style-type: none">  SPMS-4078 - Safety Manager (RU)
Context Diagram	 <p>Figure 30 Context Diagram of Raise operations incidents</p>
ID	SPMS-3960

Collect+Analyze operations incidents data

Type	 C2P-Operational Activity
Allocated to	<ul style="list-style-type: none">  SPMS-4078 - Safety Manager (RU)
Context Diagram	 <p>Figure 31 Context Diagram of Collect+Analyze operations incidents data</p>
ID	SPMS-4011

Define safety policy

Safety policy is a basic element of the safety management system and is approved by the organizations / executive and communicated to all staff. (DIRECTIVE (EU) 2016/798 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 11 May 2016 on railway safety, art 9.3 (a))

Type	 C2P-Operational Activity
Allocated to	<ul style="list-style-type: none">  SPMS-4078 - Safety Manager (RU)
Context Diagram	 <p>Figure 32 Context Diagram of Define safety policy</p>
ID	SPMS-3962



3.2.2.1.3 Energy Manager (EM)




Energy Manager (EM)

The role of the entity « energy management » here in the TO-BE architecture is only to adapt the energy consumption in real time depending on the activity in the network, to save energy whenever it is possible. The failures and traffic restrictions are taken into account in real time by another entity of the IM and the traffic is updated at first by the traffic management, that can transfer the information to the energy manager.

So in that case, there is no direct interaction between operational traffic management and energy manager.

Sometimes energy manager is part of Infrastructure Manager, sometimes it's same entity. It depends on country organization. In this case we want to show that role of energy manager can be independent.

Type	 C2P-Operational Entity
ID	SPMS-4077
Children	<ul style="list-style-type: none">  SPMS-4083 - Distribution System Operators

Allocated	<ul style="list-style-type: none"> •  SPMS-3995 - Manage electrical energy supply incidents •  SPMS-4032 - Manage electrical energy cutoff request •  SPMS-7963 - Manage electrical energy supply incidents (from another E.M from different country)
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




The Operational Entity "Energy Manager" is detailed in the "Manager Energy Architecture Report".

3.2.2.1.4 Customers

Customers

OPERATE TRAIN: Any external entity using a transport service, eg passengers, freight carrier, entities responsible for the ticket selling and after sales services

MANAGE ENERGY: a wholesale or final customer of electricity (e.g. RU, station manager). DIRECTIVE (EU) 2019/944 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 5 June 2019 on common rules for the internal market for electricity and amending Directive 2012/27/EU






Type	 C2P-Operational Entity
ID	SPMS-4056
Children	<ul style="list-style-type: none"> •  SPMS-4064 - Other commercial systems •  SPMS-4066 - Freight carrier •  SPMS-4069 - Passengers
Allocated	<ul style="list-style-type: none"> •  SPMS-4017 - Consume electrical energy





The Operational Entity "Customers" is detailed in this document.

3.2.2.1.5 ECM (Entity in Charge of Maintenance)

ECM

As per Directive (EU) 2016/798 - article 3 - definition 20: entity in charge of the maintenance of a vehicle, and registered as such in a vehicle register referred to in article 47 of Directive (EU) 2016/797.

Type	 C2P-Operational Entity
ID	SPMS-4085
Children	<ul style="list-style-type: none"> •  SPMS-4048 - ECM D •  SPMS-4051 - ECM C •  SPMS-4082 - ECM A •  SPMS-4089 - ECM B

Allocated	<ul style="list-style-type: none"> •  SPMS-4001 - Supervise+coordinate rolling stock maintenance (including risk assessment) •  SPMS-4002 - Develop maintenance files •  SPMS-4003 - Manage fleet maintenance •  SPMS-4004 - Deliver maintenance (including preparation & usual checks)
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The Operational Entity "ECM" is detailed in the "Rolling Stock Architecture Report".








3.2.2.1.6 Regulatory Authorities

Regulatory Authorities

Under European Union legislation, each Regulatory Body (RB) has the task to oversee the application of Community rules and act as an appeal body in case of disputes.

DIRECTIVE 2012/34/EU, Article 55: 'Each Member State shall establish a single national regulatory body for the railway sector. Without prejudice to paragraph 2, this body shall be a stand-alone authority which is, in organizational, functional, hierarchical and decision- making terms, legally distinct and independent from any other public or private entity. It shall also be independent in its organization, funding decisions, legal structure and decision- making from any infrastructure manager, charging body, allocation body or applicant. It shall furthermore be functionally independent from any competent authority involved in the award of a public service contract.' Thus it shall ensure that charges set by the Infrastructure Manager comply with Chapter II of 2001/14/EU and are nondiscriminatory. The RB oversees negotiations between applicants and the IM and intervenes when the requirements of 2001/14 are likely to be contravened. Applicants have the right to appeal to the RB if they believe that they have been unfairly treated, discriminated against or are in any other way aggrieved. In particular, they may appeal against decisions adopted by the IM (or where appropriate the Railway Undertaking) concerning: a) the network statement; b) criteria contained within it; c) the allocation process and its outcome; d) the charging scheme; e) level or structure of infrastructure fees which it is, or may be, required to pay; f) arrangements for access. DIRECTIVE 2012/34/EU, Article 55, all TSI regulations and regulation 2016/798, safety directive, art 3 (8) Beyond this definition, from the operational and technical point of view, regulatory bodies may also be responsible for checking compliance to:




- the european rules, stated in TSIs;
- the 'national rules': means all binding rules adopted in a Member State, irrespective of the body issuing them, which contain railway safety or technical requirements, other than those laid down by Union or international rules, and which are applicable within that Member State to railway undertakings, infrastructure managers or third parties (regulation 2016/798, safety directive, art 3 (8))

Type	 C2P-Operational Entity
ID	SPMS-4087
Children	<ul style="list-style-type: none"> •  SPMS-4047 - European regulation authorities •  SPMS-4053 - Member states •  SPMS-4057 - European and National Safety Authorities •  SPMS-4088 - Public transport authorities
Allocated	<ul style="list-style-type: none"> •  SPMS-3976 - Define infrastructure operations regulations •  SPMS-3977 - Define rolling stock operations regulations



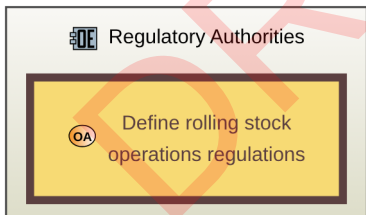
The Operational Entity "Regulatory Authorities" is composed of 2 operational activities which are:

- Define infrastructure operations regulations
- Define rolling stock operations regulations

Define infrastructure operations regulations

Type	 C2P-Operational Activity
Allocated to	<ul style="list-style-type: none"> •  SPMS-4087 - Regulatory Authorities
Context Diagram	 <p><i>Figure 33 Context Diagram of Define infrastructure operations regulations</i></p>
ID	SPMS-3976

Define rolling stock operations regulations

Type	 C2P-Operational Activity
Allocated to	<ul style="list-style-type: none"> •  SPMS-4087 - Regulatory Authorities
Context Diagram	 <p><i>Figure 34 Context Diagram of Define rolling stock operations regulations</i></p>
ID	SPMS-3977

<NEW OPERATIONAL ENTITIES : European and National Safety Authorities>

<NEW OPERATIONAL ENTITIES : Network coordinator>

3.2.3 Operational Processes

<text introduction of the paragraph description>@Olivier E.

3.2.3.1 Prepare train

[OAB] Operate train [Operational activity allocation] - Prepare Train

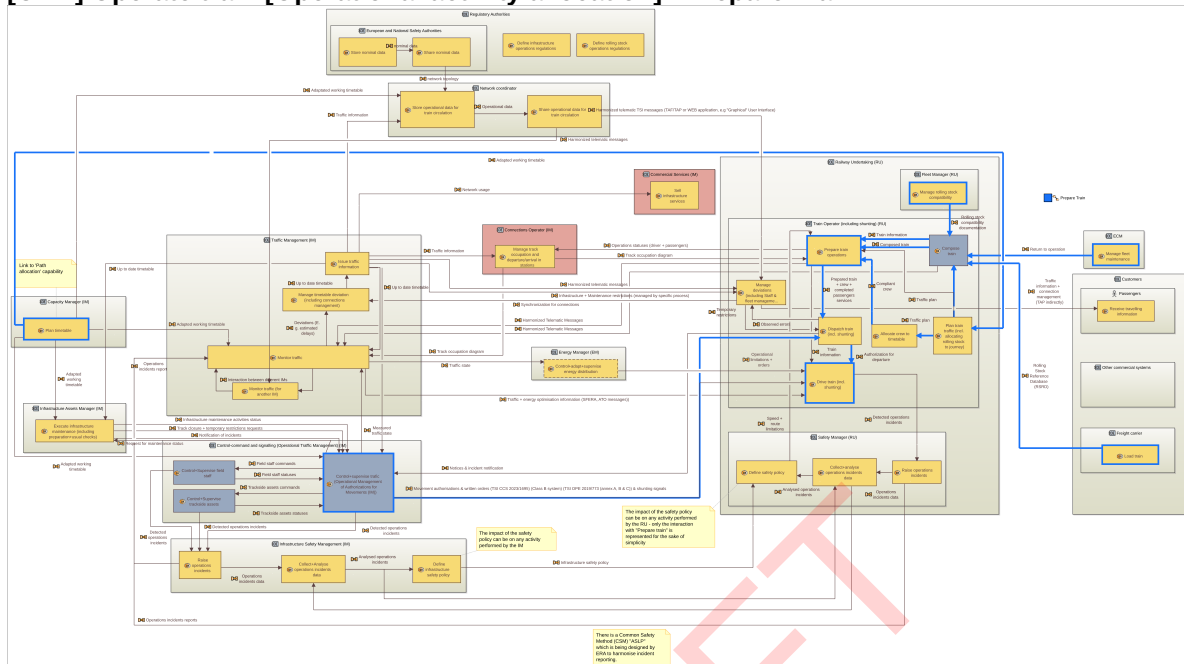


Figure 35 Diagram [OAB] Operate train [Operational activity allocation] - Prepare Train

[SPMS-7791]

Entity Scenario

The target of this scenario is to check if we have all the necessary preconditions to establish a journey:

- Verification of the compatibility of each vehicle in the train with the route
- Determination of the braking performance of the train as a whole and compliance with overall requirements
- Staffing of qualified personnel for the journey
- Train service completed (for passengers and freight)

The preconditions for departure are:

- It is time
- The signal is open
- The train is ready (all of the above conditions)

[OES] Prepare Train

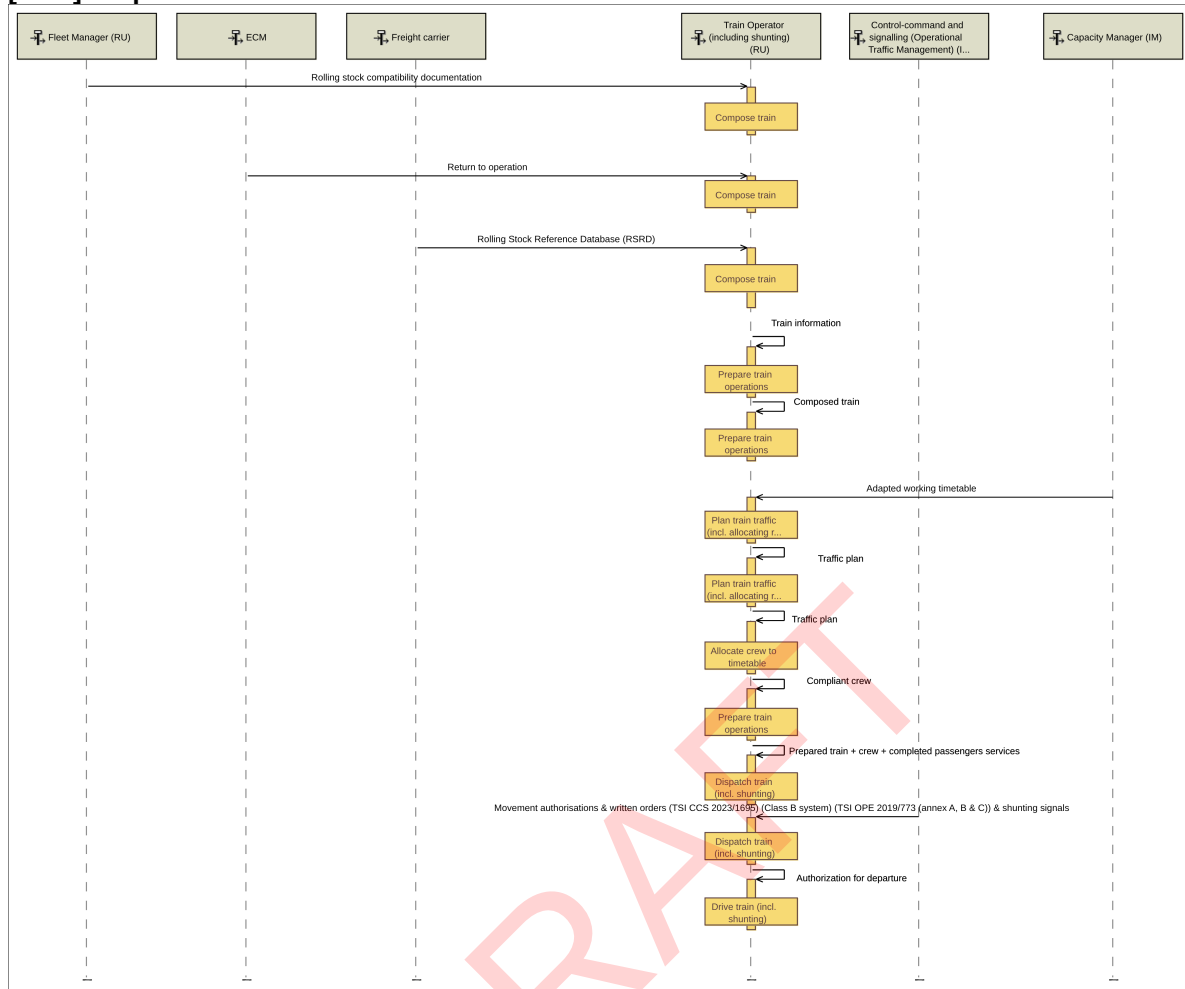


Figure 36 Diagram [OES] Prepare Train

[SPMS-7155]

3.2.3.2 Manage traffic - deviation included

[OAB] Operate train [Operational activity allocation] - Manage Traffic deviation included

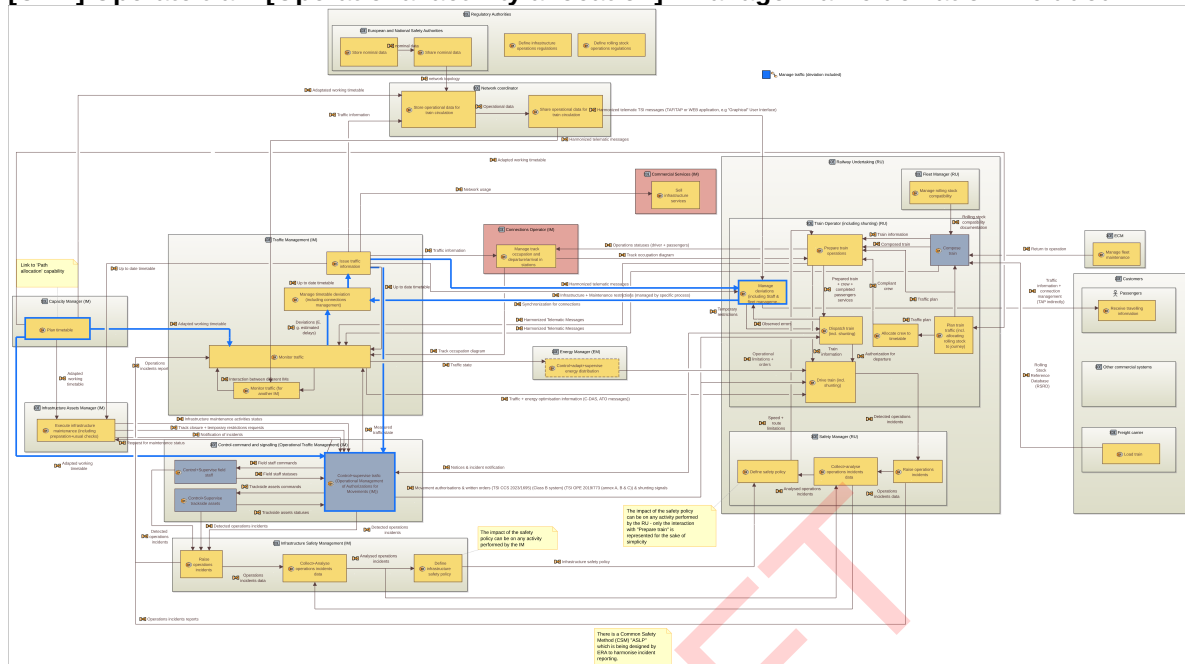


Figure 37 Diagram [OAB] Operate train [Operational activity allocation] - Manage Traffic deviation included

[SPMS-7792]

Entity Scenario

This scenario describes how to handle an event, such as a deviation from a planned schedule or an upcoming conflict, a hardware malfunction, etc.

[OES] Manage traffic (deviation included)

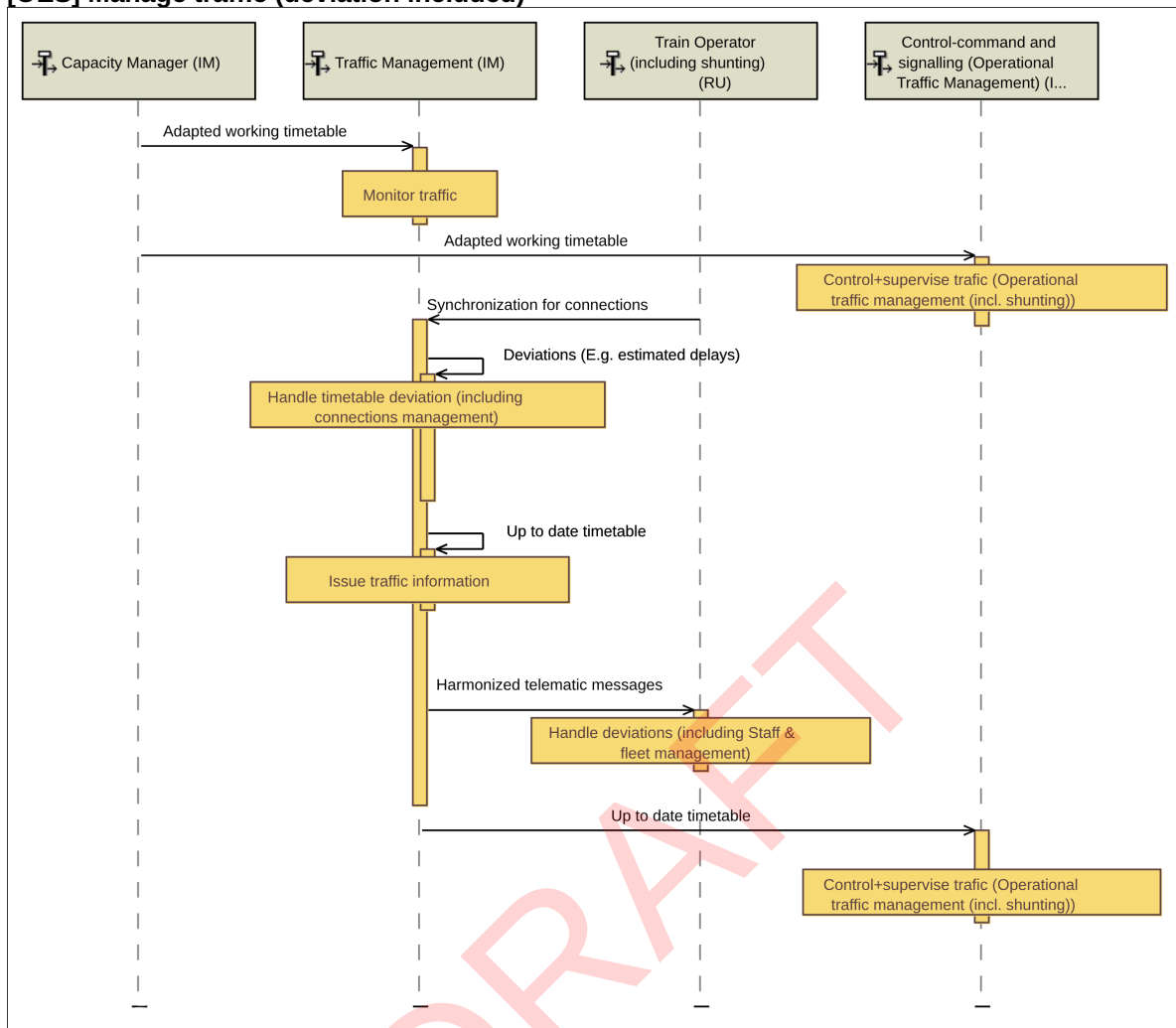


Figure 38 Diagram [OES] Manage traffic (deviation included)

[SPMS-7106]

3.2.3.3 Manage traffic - including federated approach

[OAB] Operate train [Operational activity allocation] - Manage Traffic including federated approach

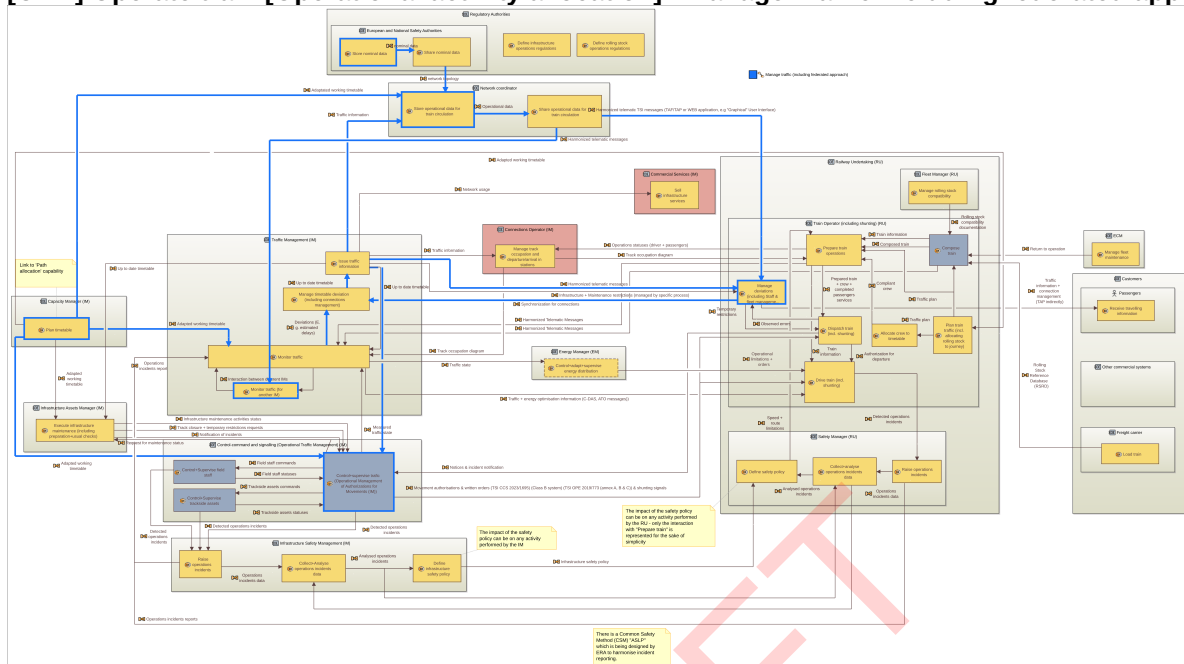


Figure 39 Diagram [OAB] Operate train [Operational activity allocation] - Manage Traffic including federated approach

[SPMS-7793]

Entity Scenario

This scenario describes how to handle an event (such as a deviation from a planned schedule or an upcoming conflict, a hardware malfunction, etc) including the federated approach.

[OES] Manage traffic (including federated approach)

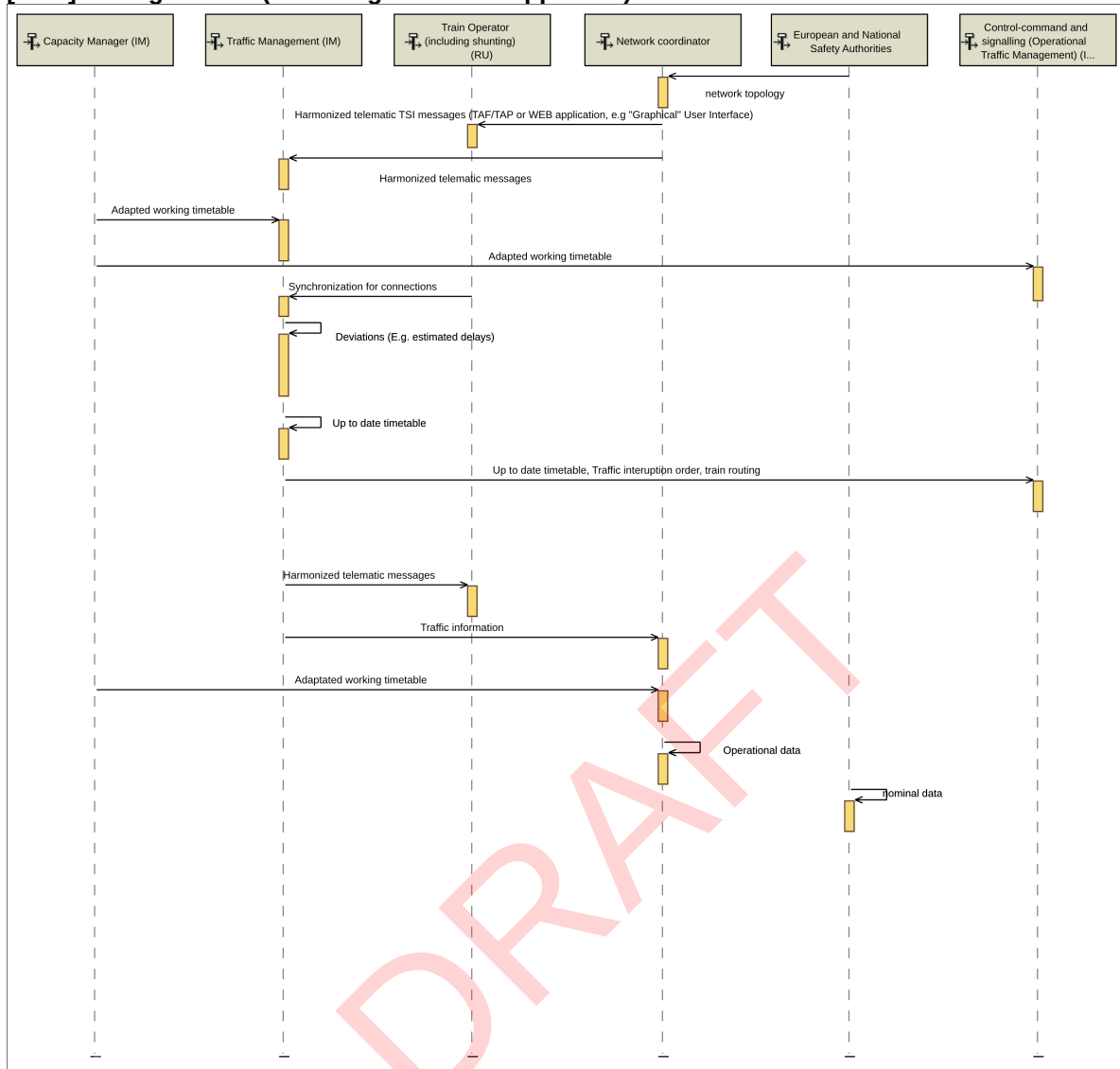


Figure 40 Diagram [OES] Manage traffic (including federated approach)

[SPMS-7153]

3.2.4 Recommendations

Recommendations are issued on certain aspects of the TO-BE architecture, the recommendations are organized according to the aspect they contribute to. These recommendations are written using the following template:

- Task 1 recommends that <Operational Entity/ Activity or interaction> should <Level of performance> to contribute to <associated CBO>.

3.2.4.1 Recommendations issued from the pain point list







Problem statement: Pain points from Linx4Rail : Different operating rules for an international train + Driver authorization for rolling stock and operating rules takes time + Lack of adaptation of operational rules when crossing borders/handover between IMs. + Non-harmonized orders to driver in degraded situations + Movement authorization would be more generic (not only ERTMS)

Hypothesis: The interactions currently exist in many different forms across Europe. In the TO-BE architecture the exchanged messages could be harmonized further than the necessary application of Annex A of TSI OPE

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

Task 1 recommends that the operational harmonization work takes place, provided the current safety levels are maintained everywhere based on the Common Safety Method.

This recommendation does not imply harmonizing the technical systems and the associated procedures that are transparent from the driver's perspective.

Status	 Open
Linked Work Items	<p>is derived from :  SPT1RS-726 - Different operating rules & signalling systems between countries</p> <p>is derived from :  SPT1RS-708 - Driver habilitation for rolling stock & operating rules takes times</p> <p>is derived from :  SPT1RS-694 - Lack of adaptation of operational rules</p> <p>is derived from :  SPT1RS-730 - Non-harmonised orders to driver in degraded situations</p> <p>has parent :  SPT1RS-789 - Recommendations issued from the pain point list</p>
ID	SPT1RS-788

Problem statement: Pain point from Linx4Rail : Lack of knowledge of route book

Hypothesis: Today the cross border traffic with one driver is limited by the necessity of knowing the route.

Task 1 will exchange with Task 2 and FP2 R2DATO to analyse the impact of route knowledge on automatic operations and cab signalling to issue the adapted recommendation.

Problem statement: Pain point from Linx4Rail : Processing times are too long during preparation

Hypothesis: We have identified 2 use cases :

- UC1 : Preparation of freight train consist or modification of train consist
- UC2 : For passengers train, change of driver cabin and restart of the CCS equipment




Task 1 considers that the sector would need a better automation in the freight sector and then task 4 and FP5 could fulfill this need.

Task 1 will exchange with Task 4 and FP5 FDFTO to analyse this need and the recommendation to be issued.

Task 1 recommends that the Task 4 System Pillar and FP 5 innovation pillar should automatise manual process of data processing (braking sheets..)

Task 1 considers that the sector would need a better automatisisation and Task 4 and FP5 could fulfill this

need for the freight sector. Task 1 will exchange with task 4 and FP5 FDFTO to analyse this need and the recommendation to be issued

Status	 Open
Linked Work Items	is derived from :  SPT1RS-681 - Processing times are too long during preparation has parent :  SPT1RS-789 - Recommendations issued from the pain point list
ID	SPT1RS-791




Problem statement: Pain point from Linx4Rail : Different operating rules for composing a train

Hypothesis: Task 1 considers that harmonisation of operational train categories could facilitate the cross border traffic and the migration to ETCS.

Task 1 will exchange with task 2 to analyse this need and the recommendation to be issued.

Task 1 recommends that a common work should be led with task 2 to analyse the need for harmonisation of operational train categories.

Task 1 recommends that a common work should be led with task 2 to analyse the harmonisation of operational train categories for migration issue in particular, and adapt the speed limits and braking curves to these categories in each country.

Status	 Open
Linked Work Items	is derived from :  SPT1RS-688 - Different operating rules for composing a train has parent :  SPT1RS-789 - Recommendations issued from the pain point list
ID	SPT1RS-790





Problem statement: Pain point from Linx4Rail : No single responsibility – especially in terms of door-to-door trips + No global door-to-door service (guaranteed arrival in case of delay, ...) + Insufficient information of travellers in case of delay and solution finding

Hypothesis: Task 1 considers that information and door to door efficiency is not tackled today and as multiple companies are involved, a coordination could be organised.



Task 1 recommends that the door-to-door service and service information should be tackled in System Pillar and Innovation Pillar.

Task 1 recommends that the door-to-door service and service information should be tackled in System Pillar and Innovation Pillar, in terms of responsibility for arriving at final destination and intermodal information before and during the trip.

Status	 Open
--------	--

Linked Work Items	is derived from :  SPT1RS-721 - No single responsibility – especially in terms of door-to-door trips is derived from :  SPT1RS-714 - No global door to door transportation service – inefficient transportation from home to station (bus, metros, hotels) is derived from :  SPT1RS-722 - Insufficient information of travellers in case of delay and solution finding has parent :  SPT1RS-789 - Recommendations issued from the pain point list
ID	SPT1RS-792

The recommendations should improve the performance of the railway network relative to the following CBOs:




-  SPT1RS-102 - Manage more efficient energy consumption
-  SPT1RS-111 - Standardize architecture

Problem statement: Linx4Rail Pain point: Lack of asset availability

Hypothesis: The Maintenance methods should be adapted to the context and make best use of innovative maintenance methods being developed within System Pillar (Task 5) & Innovation Pillar.


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.

The tradeoff between maintenance cost and asset availability should be informed depending on the context and be explicit. More accurate criteria for this tradeoff needs to be studied in greater detail by developing the infrastructure capabilities ('Maintain & monitor Infrastructure' capabilities, and 'Upgrade and renew infrastructure network capabilities').

Status	 Open
Linked Work Items	is derived from :  SPT1RS-680 - Lack of asset availability has parent :  SPT1RS-789 - Recommendations issued from the pain point list
ID	SPT1RS-805



3.2.4.2 Recommendations issued from the CBO list

Common Business Objective statement: Leverage on real-time information and data sharing to provide accurate status within the full transport system (end-to-end) and allow an overall optimization of the transport offer


 SPT1RS-88 - Leverage on real-time information and data sharing to provide accurate status within the full transport system (end-to-end) and allow an overall optimization of the transport offer

Task 1 recommends that the Task 3 should determine the required accuracy level for traffic information data (EG localization, refresh frequency, ...) needed to take relevant decision.

Status	 Open
--------	--

Linked Work Items	is derived from :  SPT1RS-88 - Leverage on real-time information and data sharing to provide accurate status within the full transport system (end-to-end) and allow an overall optimization of the transport offer has parent :  SPT1RS-816 - Recommendations issued from the CBO list
ID	SPT1RS-890




Common Business Objective statement: Increase capacity utilisation of the rail

 SPT1RS-91 - Increase capacity utilisation of the rail

Hypothesis: If a solution derived from system pillar solves a capacity problem, it will have to be physically implemented. This needs a overall and a linked local migration strategy and a balance between innovation and stability.

Nevertheless, an investment and deployment strategy, with commensurate resources, is necessary.

Task 1 recommends to make a deep-dive on this topic.








Status	 Open
Linked Work Items	is derived from :  SPT1RS-91 - Increase capacity utilisation of the rail has parent :  SPT1RS-816 - Recommendations issued from the CBO list
ID	SPT1RS-891

Common Business Objective statement: Waiting time due to limited network capacity - improve safety regulations to reduce "headway"

 *SPT1RS-113 - Optimize safety strategies and standards*

Hypothesis: More precise train data input can lead closer to the actual train characteristics ETCS, braking curves for example. Safety standards should be maintained. As we will have less margin eg. in the braking curves, the data preparation should be made more reliable. To increase reliability that the real data are taken into account, the train data entry process should be also automated.

Task 1 recommends that a common work should be led with task 2 to analyse the possibilities of improvement.

Status	 Open
Linked Work Items	is derived from :  SPT1RS-232 - simplified standard safety components is derived from :  SPT1RS-228 - vehicle is interoperable without local integration test is derived from :  SPT1RS-229 - seamless and selective exchange of components under production is derived from :  SPT1RS-230 - safety logic with generic safety approval is derived from :  SPT1RS-231 - validated system performance, robust PRAMSS framework has parent :  SPT1RS-816 - Recommendations issued from the CBO list
ID	SPT1RS-892

DRAFT

4 Conclusion

4.1 Conclusion SC2.3

The deep-dive into the AS-IS architecture, the study of the feedback from the sector about the version 1, the mapping of the link for rail pain points and the CBO from EU-Rail led to a consolidated description of the overall architecture.

The conclusion of this description of the architecture at a high level has mainly been that the overall organisation of entities and activities from the AS-IS to the TO-BE architecture will be very similar. The changes implied in reaching the CBOs will mainly be in relation to the levels of performance associated to the various activities and interactions, even if some interactions could be optimized after discussions with Task 2, 3 & 4.

Task 1 has worked to add descriptions and definitions to the various entities and activities referenced in the model. These include the legislative references where relevant. Eventually, the definitions of entities and activities should be harmonised within System Pillar and this is an ongoing activity for the Glossary working team in EET. Through the definitions given, Task 1 has contributed to this work and will need to ensure in the next developments that this work is taken into account.

A key achievement in this year has been the integration of the Task 1 model in the Reference Model developed by EET. The Reference Model aims at merging the different Task models in development. Now that Task 1 is involved in this process, it should facilitate collaboration and integration with the different tasks and possibly Flagship projects.

DRAFT

4.2 Conclusion SC2.4

In line with the defined milestones, during S.C 2.4 the Operate Train Capability focused on consolidating and further maturing the To-Be architecture developed last year. The Operate Train Capability primarily interfaced and interacted with Task 3 and took into account the Task 3's suggested Federated approach in the To-Be architecture.

With the involvement of Werner Ried (Task 2 OD) , Operate Train Capability also established interactions with Task 2 OD and Task 2. It was jointly agreed that interactions with Task 4 would be addressed in the following contracts.

In addition, studies were undertaken to consolidate the architecture based on the defined operational scenarios to validate the To-Be Architecture.

As a result of these activities, the Operate Train To-Be architecture was further matured, incorporating the Mirror Group's comments on last year's deliverables. The To-Be architecture has been integrated into Capella to enable interactions with other tasks in alignment with the SEMP.

5 Annex

5.1 AS-IS Version 1

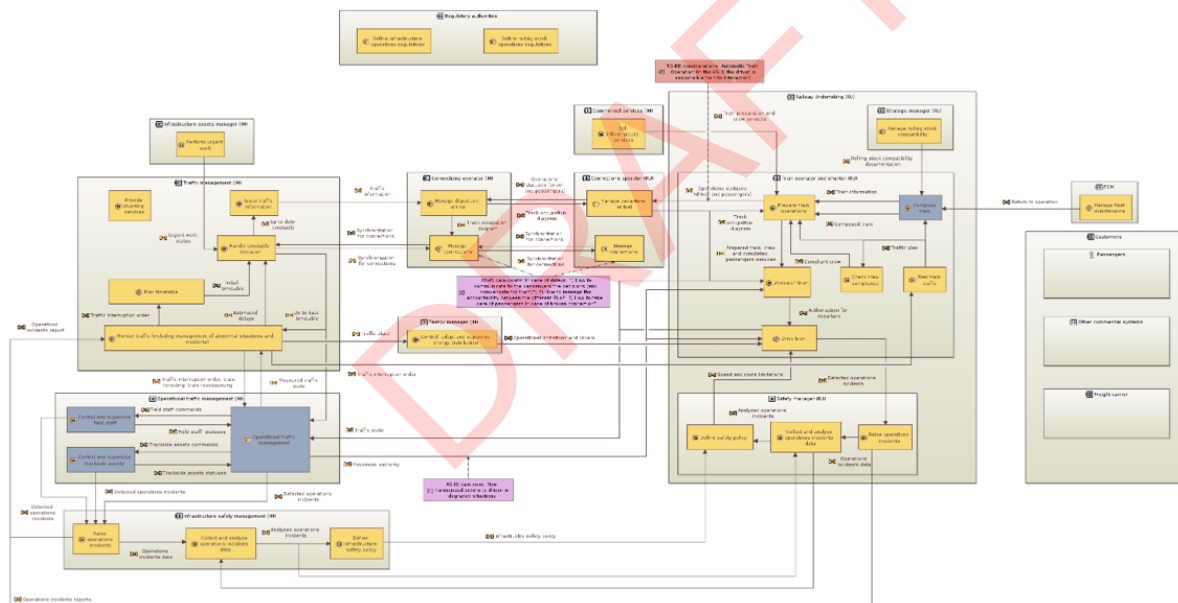


Figure 41 : Operate Train AS-IS Version 1

5.2 Pain Point Mapping

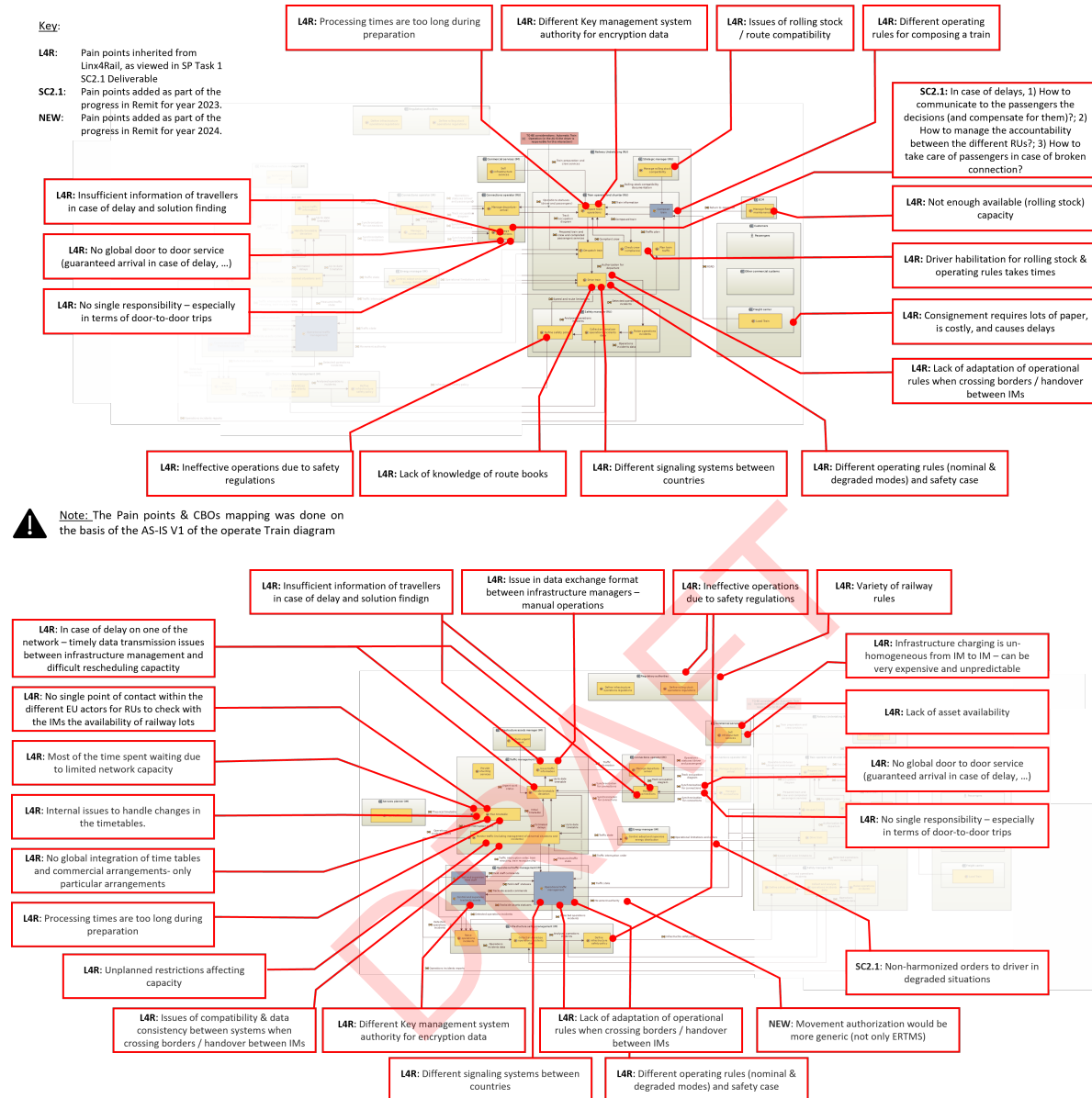


Figure 42 : Pain Points mapping

5.3 CBOs Mapping

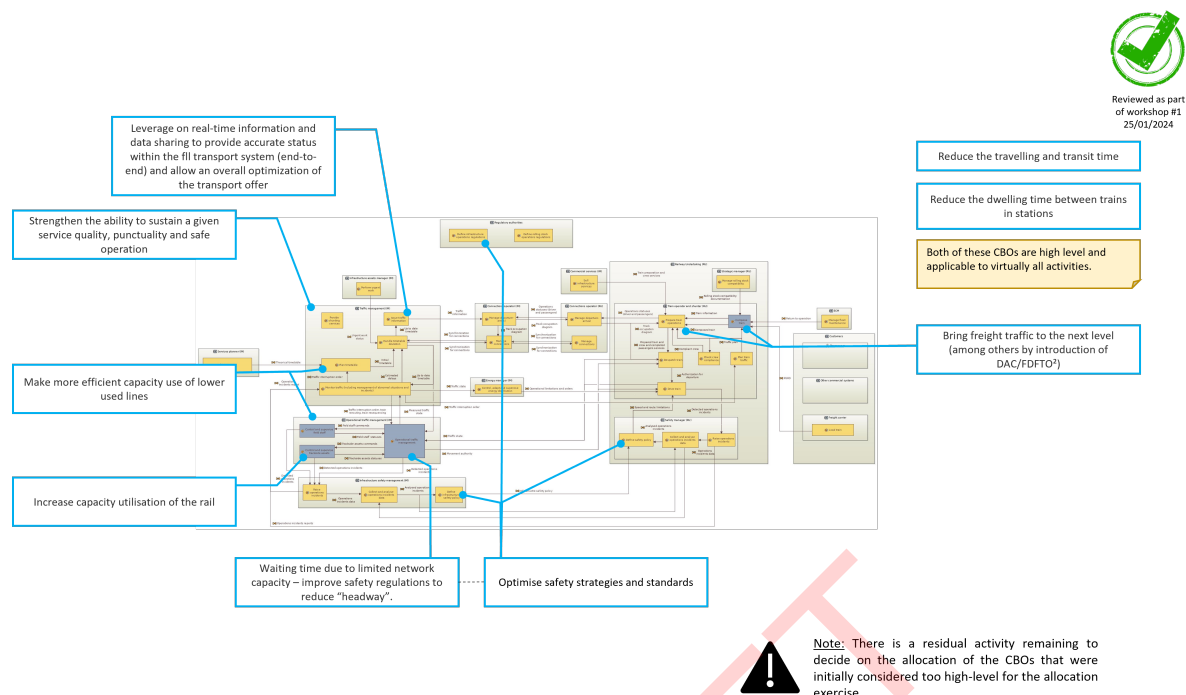


Figure 43 CBOs Mapping

5.4 TSI & other regulations mapping

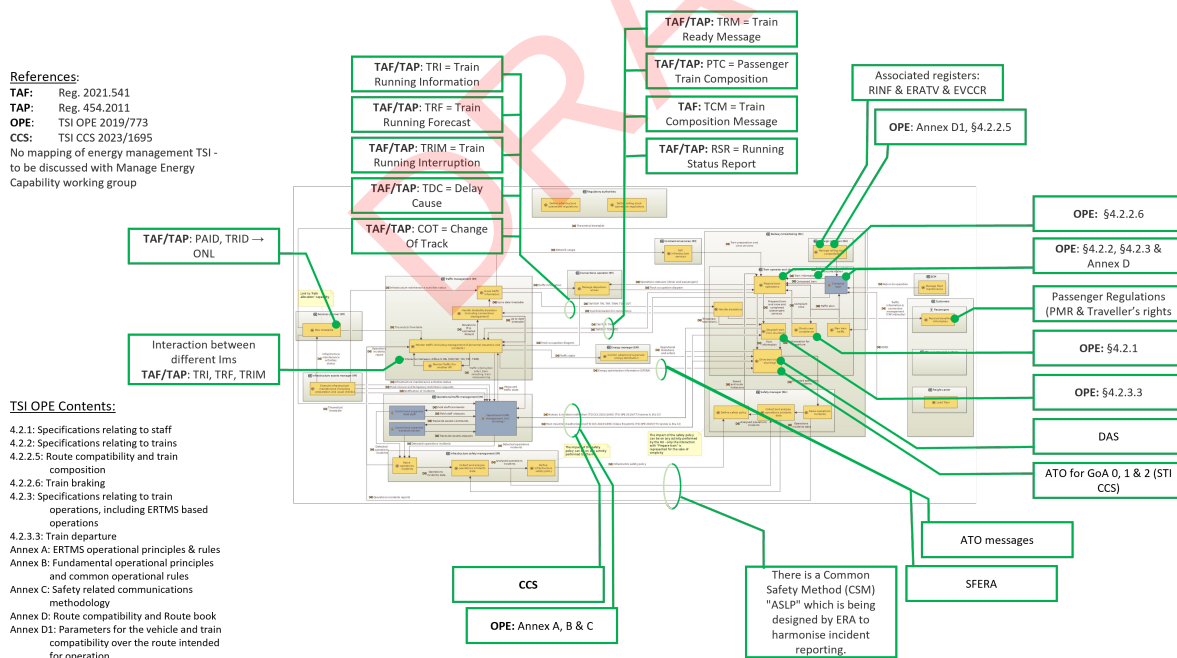


Figure 44 TSI & other regulations mapping