ERJU SYSTEM PILLAR

T3 - Federated model - GAP Analysis

T3 - Federated model - GAP Analysis

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1 Preamble

1.1 Scope and intended audience

The document establishes a correlation between the "Federated model for CMS and TMS" as defined by Task 3, and compares it with the legal frameworks and the "common business objectives" to identify GAPs for future work in the sector/ERJU. **[**SPT3TMS-16848 **]**

This document is intended for all stakeholders involved in the development, implementation, and operation of TMS and CMS systems (e.g. Business stakeholders, End users, Development and engineering teams, Assessors, etc.) **[**SPT3TMS-16847 **]**

1.2 Purpose

The main goal of this document is to perform a GAP analysis comparing the principles of the Federated Model with the regulatory framework. **[**SPT3TMS-16852 **]**

The detected GAPs are:

- Elements from the regulatory framework for which no harmonised processes, data elements/ systems exist on EU level, and that require work to be started from the rail sector.
- The CBOs (as defined by the system pillar task 1 - version of 3 March 2025) that are not covered by the work of Task 3 (Common Business Objectives)

[SPT3TMS-16851 **]**

1.3 Glossary

1.3.1 Terms and definitions

N.A.

1.3.2 Abbreviations

In this document, the abbreviations "IM" for Infrastructure manager" and "RU" for Railway Undertaking are used due to their widespread use in the rail sector. The equivalent terms are "RIM" for Rail Infrastructure Managers" and "ROC" for Railway Operating Company. **[**SPT3TMS-16854 **]**

EC	European Commission
ETA	Estimated Time of Arrival
ETH	Estimated Time of Handover
ETM Network	European Traffic Management Network
EU	European Union
EUC	EU Coordination
ECT	EU Coordination Tool
CMS	Capacity Management System
CBO	Common Business Objectives
CCS	Command Control Signalling
ENIM	European Network of Infrastructure Managers
ETMN	European Traffic Management Network
RIM	Rail Infrastructure Manager
IM	(rail) Infrastructure Manager
IT	Information Technology
NTCC	National Traffic Control Centre
R-CDM	Railway Collaborative Decision Making
ROC, RU	Rail Operating Company, Railway Undertaking

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RTCC	Regional Traffic Control Centre
TCC	Traffic Control Centre
TMS	Traffic Management System
TSI	Technical Specifications for Interoperability
XS - S - M – L - XL	Extra Small - Small – Medium – Large – Extra Large
TCC	(IM) Traffic Control Center
TCR	Temporary Capacity Restriction
UI	User Interface
short – medium – long	Referring to implementation period in sub-chapter *"Summary Assessment of Feasibility"*
ENIM	European Network of Infrastructure Managers

2 History Of Changes

Nr.	Date	Changes	Leaders/Authors
1.0	2025-02-10	First draft	Patrick Konix
1.1	2025-05-27	Modifications after comments from the core team	Patrick Konix

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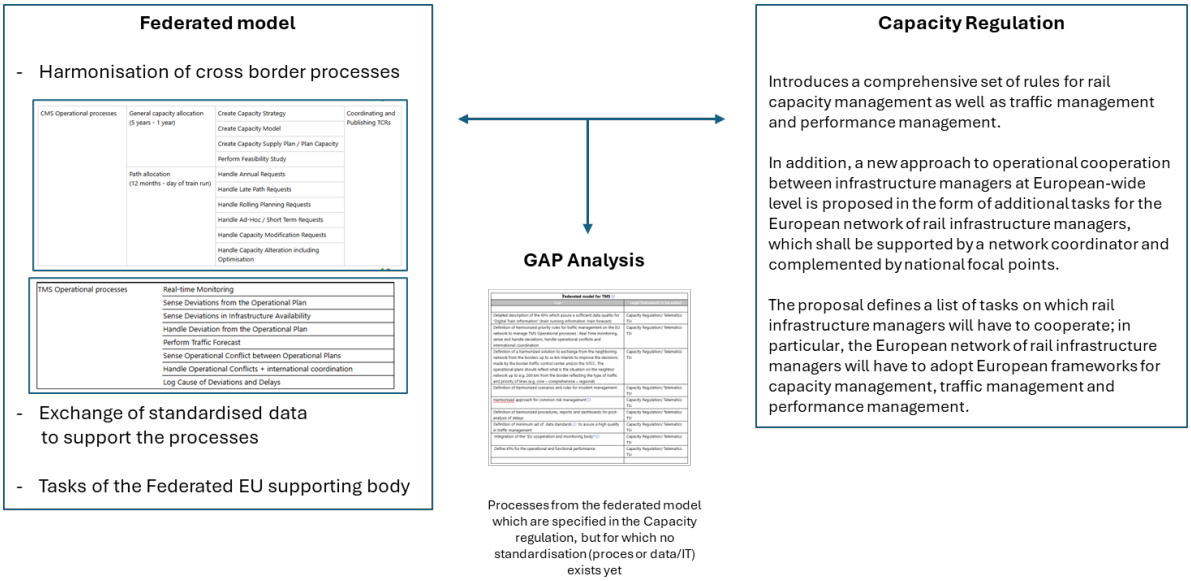
3 Introduction

The GAP analysis checks which processes (with the supporting data/it) that are part of the "Federated" model, and that are mentioned in the legal framework "Capacity Regulation", do not yet have a standardization/harmonization on EU level. The capacity regulation outlines the principles and governance of the capacity management and the traffic management. The TSI define the technical messages and the detailed processes. Some processes are mentioned in the Capacity regulation or in the federated model but no harmonised procedures (and the supporting data/IT solutions) exist yet. It is the aim of the GAP analysis is to list these points. **[**SPT3TMS-16853 **]**



[SPT3TMS-16857]

Figure 1: Schema of gap analysis process

4 Content of the "Capacity Regulation" with regards to Capacity Management

The points from the "Capacity Regulation" come from the "Commission Proposal 2002 443/2" which is based upon the first draft for the Capacity Regulation (https://www.europarl.europa.eu/RegData/docs_autres_institutions/commission_europeenne/com/2023/0443/COM_COM(2023)0443_EN.pdf)
[SPT3TMS-16850]

Federated Model - Process	Capacity Regulation - Reference	GAP
• Create Capacity Strategy • Create Capacity Model • Create Capacity Supply Plan / Plan Capacity • Perform Feasibility Study • Handle Annual	Art. (8.3)Infrastructure managers shall plan and allocate scarce capacity to the largest extent possible through the consensual conflict resolution mechanism referred to in Article 36 involving the applicants concerned and resulting in consensual solutions to conflicting capacity needs and requests	Conflict resolution with (automated) IT tool support

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Federated Model - Process	Capacity Regulation - Reference	GAP
Requests • Handle Late Path Requests • Handle Rolling Planning Requests • Handle Ad-Hoc / Short Term Requests • Handle Capacity Modification Requests • Handle Capacity Alteration including Optimisation		
• Handle Annual Requests • Handle Late Path Requests • Handle Rolling Planning Requests • Handle Ad-Hoc /	Art.(8.4) If the mechanism referred to in paragraph 3 does not result in a satisfactory resolution of conflicting capacity needs and requests, infrastructure managers shall manage scarce capacity or resolve conflicts through objective, transparent and non-discriminatory procedures. Those procedures shall assess alternative options for the use of infrastructure capacity, based on the following socioeconomic and environmental criteria, subject to the availability of data:	There is no KPI standard in regards to the weight of the below indicators

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Federated Model - Process	Capacity Regulation - Reference	GAP
Short Term Requests		
• Handle Annual Requests • Handle Late Path Requests • Handle Rolling Planning Requests • Handle Ad-Hoc / Short Term Requests	(a)operating cost for operators of rail transport services and the resulting impact on prices for customers of rail transport services;	There is no data available or data provision process or IT tool capable handling related set of data from operators
• Handle Annual Requests • Handle Late Path Requests • Handle Rolling Planning Requests • Handle Ad-Hoc / Short Term Requests	(b)time-related cost for customers of rail transport services;	There is no such data provision process or IT tool capable handling related set of data from operators
• Handle Annual	(c)connectivity and accessibility for people and regions served by the rail transport services;	

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Federated Model - Process	Capacity Regulation - Reference	GAP
Requests • Handle Late Path Requests • Handle Rolling Planning Requests • Handle Ad-Hoc / Short Term Requests		Currently such data is not integrated into the common Timetabling tool where post allocation processes are handled
• Handle Annual Requests • Handle Late Path Requests • Handle Rolling Planning Requests • Handle Ad-Hoc / Short Term Requests	(d)emissions of greenhouse gases, local air pollutants, noise and other external cost of rail transport services and by their likely alternatives;	Some railway operators already provide CO2 emission savings compared to alternative modalities but its method of calculation is not standardized, and does not extend to other gases, pollutants or noise. Neither is this data included in messages for timetabling tools
• Handle Annual Requests • Handle Late Path Requests	(e)safety and public health implications of rail transport services and their likely alternatives	There are no KPIs identified for such compliance expectation

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Federated Model - Process	Capacity Regulation - Reference	GAP
• Handle Rolling Planning Requests • Handle Ad-Hoc / Short Term Requests		
• Handle Annual Requests • Handle Late Path Requests • Handle Rolling Planning Requests • Handle Ad-Hoc / Short Term Requests	Art (8.5)ENIM shall prepare and adopt the procedures referred to in paragraph 4 and include them in the EU framework for capacity management referred to in Article 6. The procedures shall involve the following steps:	EU Framework for capacity management is yet to be designed
• Handle Annual Requests • Handle Late Path Requests • Handle Rolling Planning Requests • Handle Ad-	(a)design alternative scenarios to partition the capacity available for different types of rail transport services, involving, where possible, the provision of alternative capacity on other routes or alternative timing with comparable characteristics;	Widespread adoption of model variant publication

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Federated Model - Process	Capacity Regulation - Reference	GAP
Hoc / Short Term Requests		
• Handle Annual Requests • Handle Late Path Requests • Handle Rolling Planning Requests • Handle Ad-Hoc / Short Term Requests	(b)evaluate and rank the scenarios on the basis of objective and transparent methodologies taking into account the socio-economic and environmental criteria set out in paragraph 4;	Ranking methodology is yet to be designed
• Handle Annual Requests • Handle Late Path Requests • Handle Rolling Planning Requests • Handle Ad-Hoc / Short Term Requests	(c)select the highest ranked scenario on the basis of the evaluation referred to in point (b) and amend the definition of the capacity model and the capacity supply plan accordingly.	Ranking methodology is yet to be designed
	Art. (13) ... Applicants should also be able to request rail infrastructure capacity with greater advance for stable,	

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Federated Model - Process	Capacity Regulation - Reference	GAP
• Handle Annual Requests • Handle Late Path Requests • Handle Rolling Planning Requests • Handle Ad-Hoc / Short Term Requests	multi-annual rail services through framework agreements. Finally, applicants should be able to request capacity close to the time of operation for individual trains through ad hoc capacity requests or for repeated train services through rolling planning requests	The process and IT is yet to be finalised for framework agreements
• Handle Annual Requests • Handle Late Path Requests • Handle Rolling Planning Requests • Handle Ad-Hoc / Short Term Requests	Art. (16)The rules on management of cross-border rail traffic under normal conditions and in the case of disturbances should promote smooth, resilient and seamless operation of rail transport services. They should provide for a system of structured coordination between infrastructure managers and other stakeholders.	The adoption of the Border Harmonization Tool is still in pilot phase between two IMs single border point.Even access rights on border PLCs for both operating IMs are not yet implemented although respective bilateral agreements of capacity planning are already in place.
• Handle Annual Requests • Handle Late Path	Art. (17) The operation of railway infrastructure not only requires close cooperation between infrastructure managers, but also a strong interaction with railway undertakings and other stakeholders directly involved in rail and multimodal transport and logistic operations. Therefore, it is necessary to provide for structured	Stakeholders of different modality operators other than railway, are yet to be connected to common interface tools. The processes of their involvement are yet to be deignedConnection of other stakeholders to central systems can only be done in a second step and the scope as well as access rights of these have to be clearly defined

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Federated Model - Process	Capacity Regulation - Reference	GAP
Requests • Handle Rolling Planning Requests • Handle Ad-Hoc / Short Term Requests	coordination between infrastructure managers and other stakeholders.	

[SPT3TMS-16849]

5 Content of the "Capacity Regulation" with regards to Traffic Management

The points from the "Capacity Regulation" come from the "Commission Proposal 2002 443/2".
[SPT3TMS-16856]

Federated Model - Process	Capacity Regulation - Reference	GAP
• Real time monitoring • Sense deviations from operational plan • Sense operational conflict • Handle operational conflict	Chapter III introduces obligations concerning traffic management, disruption management and crisis management and requires infrastructure managers to jointly develop a European framework for cross-border coordination on these issues.	- jointly develop European Framework
• Sense deviations in Infrastructure availability	Infrastructure managers shall put in place and implement a continuous process of contingency planning to prepare for disruptions of network operations and for other crisis situations affecting rail traffic	- introduce a process for contingency planning to be prepared for contingencies Existing contingency handbooks from RFCs should be used as a basis , as well as respective function in CIP.
• Sense deviation	Contingency planning shall provide the basis for traffic management, disruption management and crisis management in accordance with Article 42, with a view to	- contingency planning must cover traffic, disruption and crisis management

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Federated Model - Process	Capacity Regulation - Reference	GAP
s in Infrastructure availability • Handle operational conflict	enabling a fast reaction in such situations and to minimize their impact on rail traffic.	
• Sense deviations in Infrastructure availability • Handle operational conflict	Infrastructure managers shall document the results of contingency planning in a contingency plan.	- prepare contingency plans
	Contingency planning shall involve in particular:	
• Sense deviations in Infrastructure availability • Handle operational conflict	(a) the designation of alternative routes allowing to re-route traffic in the event of non-availability of the lines included in the core and extended core TEN-T network as set out in Article 6 of and Annex I to [new TEN-T Regulation];	- define alternative routes for the TENT (outside the scope of the SP)
• Sense deviations in Infrastructure availability • Handle operational conflict	(b) an indicative planning of the infrastructure capacity available on the alternative routes designated in accordance with point (a) providing transparency about infrastructure capacity available on such lines, which can be utilised in the case of incidents and, in particular, network disruptions in accordance with Article 46;	- calculate capacity during pre-planning in a unified way on EU level for alternative rules which can be utilised in case of rerouting
• Sense deviations in Infrastructure availability	(c) the definition of rules and procedures for traffic and crisis management, including on the sharing of information between infrastructure managers, other operational stakeholders and other stakeholders such as public authorities in charge of rail or security and emergency response, as well as criteria for the activation of these procedures;	- IMs to define rules and procedures for TM and crisis management to share information with stakeholders - IMs to define criteria to activate such procedures

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Federated Model - Process	Capacity Regulation - Reference	GAP
• Handle operational conflict		
• Sense deviations in Infrastructure availability • Handle operational conflict	(d) the identification and listing of bodies to be informed in the event of serious incidents or serious disruptions to train movements;	- Define the bodies to be informed in case of contingency (governance issue outside the scope of SP)
• Sense deviations in Infrastructure availability • Handle operational conflict	(e) any other preparations necessary to perform disruption management and crisis management in accordance with Article 42 and with the European framework for the cross-border coordination of traffic management, disruption management and crisis management referred to in Article 44.	- cover all necessary procedures and rules in case of contingency
• Sense deviations in Infrastructure availability • Handle operational conflict	Infrastructure managers shall ensure the consistency of contingency planning with strategic capacity planning, in particular the capacity strategy, the capacity model, the capacity supply plan and with the planning for infrastructure works as referred to in Article 10.	- define a process which ensures alignment between contingency planning and strategic capacity planning reflecting infrastructure works
• Sense deviations in Infrastructure availability • Handle operational conflict	The results of contingency planning, in particular the designation of alternative lines in accordance with paragraph 2, point (a) and the indicative capacity planning on alternative lines in accordance with paragraph 2, point (b) shall be included in the capacity model and in the capacity supply plan.	- transfer contingency plans to capacity model and supply plan
• Real-time monitoring	- perform traffic management in accordance with this Regulation and Directive (EU) 2016/797 and the specifications laid down in implementing acts adopted under that Directive	- follow the OPE TSI requirements in traffic management

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Federated Model - Process	Capacity Regulation - Reference	GAP
• Perform traffic forecasting		
• Sense deviations from operational plan	- IMs shall put in place rules and procedures to manage deviations of train movements from the working timetable. Those rules and procedures shall be published in the network statement	- put in places and publish in the network statement rules and procedures to manage deviation from the timetable
• Sense deviations from operational plan	- IMs rules and procedures referred to in paragraph 1 shall aim at minimising the overall impact of deviations from the timetable on rail traffic, taking into account the needs of all types of transport.	- minimise the overall impact of deviations from the timetable on rail traffic, taking into account the needs of all types of transport
• Handle deviation from the operational plan • Handle operational conflicts + international coordination	- The principles may involve priority rules for the management between the different types of traffic and the specific procedures, criteria and targets to be applied in an optimisation-based approach that relies on the optimisation of a target function, such as the minimization of the delay minutes or of the time to return to normal operations, rather than explicit priority rules	- define priority rules
• Handle deviation from the operational plan • Handle operational conflicts + international coordination	In the event of a disruption to train movements caused by technical failure or accident, the infrastructure manager shall take all necessary steps to restore the situation to normal.	- for the disruption event define necessary procedures to restore the situation to normal
• Handle deviation from the operational plan	- IMs shall implement a contingency plan	- define and implement a contingency plan

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Federated Model - Process	Capacity Regulation - Reference	GAP
• Handle operational conflicts + international coordination		
• Handle deviation from the operational plan • Handle operational conflicts + international coordination	- IM shall explain in the network statement the reason for any deviation from the common rules and procedures established in the European framework	- explain all deviations from common rules in the network statement
	In case of force majeure, and, where absolutely necessary, on account of an incident making the infrastructure temporarily unusable, allocated capacity rights may be withdrawn without waring for as long as is necessary to repair the system	
• Handle operational conflicts + international coordination	- EF shall provide guidelines for the coordination between infrastructure managers, railway undertakings and other operational stakeholders.	- define a guideline for coordination between stakeholders
	ENIM shall define a harmonised method to estimate the likely duration and impact of network disruptions and include it in the European framework for the coordination of traffic and crisis management referred to in Article 44	
• Real-time monitoring • Perform traffic forecast	IM shall ensure that international rail services operate with minimum disruptions both under regular operations and in disturbed situations	- give the priority in common rules for international rail services

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Federated Model - Process	Capacity Regulation - Reference	GAP
• Real-time monitoring • Perform traffic forecast	IM shall ensure specific challenges related to cross-border sections resulting, inter alia, from limited interoperability in terms of infrastructure, technical equipment and operations, language and training requirements related to staff, administrative or border formalities are properly taken into account	- improve and simplify processes and rules related to cross-border sections resulting, inter alia, limited interoperability in terms of infrastructure, technical equipment and operations, language and training requirements related to staff, administrative or border formalities are properly taken into account
• Real-time monitoring • Perform traffic forecast • Log Cause of Deviations and Delays	IM shall ensure an efficient exchange of up-to-date and relevant information between infrastructure managers, applicants, railway undertakings and other operational stakeholders, as well as any EU-level relevant crisis management governance structures	- define procedures, rules and forms to ensure an efficient exchange of up-to-date and relevant information between stakeholders (not in the scope of SP)
• Log cause of Deviations and Delays	the affected infrastructure managers shall assess the likely duration and impact of the incident on the basis of all available information and previous experience.	- obligation to be able to assess the likely duration and impact of the incident
• Handle operational conflicts + international coordination	where is impacts on more than one network, the infrastructure manager where the incident took place shall declare a multi-network disruption and coordinate actions	- add a task for IM to recognise and manage multinetwork disruption
• Handle operational conflicts + international coordination	The infrastructure manager shall inform, as soon as possible, interested parties about the unavailability of infrastructure capacity, in particular due to an incident	- add a task to IMs to inform stakeholders about the unavailability of capacity in case of an incident
	The Network Coordinator shall collect information on network disruptions, analyse the response, draw conclusions on the effectiveness of the management of such incidents and	

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Federated Model - Process	Capacity Regulation - Reference	GAP
	consult operational stakeholders in accordance with Article 54 and report to ENIM and the Performance Review Body.	
• Log cause of Deviations and Delays	The infrastructure manager shall appoint a focal point in the meaning of Article 60, which shall provide information to the Commission, ENIM, other infrastructure managers and other interested parties about the emergency measures and shall help coordinate such measures.	- define an approach to appoint a focal point to provide information about the measures to coordinate emergency situation
• Handle operational conflicts + international coordination	Where emergency measures have a significant impact on cross-border traffic, infrastructure managers shall coordinate between themselves in accordance with Articles 53 and 54 .	- ensure cross border coordination where it is relevant
• Real time monitoring • Log cause of Deviations and Delays	All operational stakeholders directly involved in the operation of a rail transport service shall have the right of access to the information concerning this rail transport service set out in Annex VIII	- guarantee a right for operational stakeholders to have access to information according to Annex VIII
	The information shall be made accessible in accordance with Article 62	- define access to information according to Article 62

[SPT3TMS-16859 **]**

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6 CBO analysis

The CBO are derived from the identified impacts from the EU-Rail Master Plan, see chapter 4.3, and are based on the importance of delivering an overall system view, strengthening the delivery of the SERA.

The Master Plan impacts are used to derive the common business objectives.

For each Master Plan impact

- A contextual description is provided
- The high level objectives to achieve this impact are described (for example the objectives listed in section 5.1)
- The common business objectives are the listed steps necessary to achieve these high level objectives. (for example the common business objectives listed in 5.1.1)

The CBO have been derived from a consolidated view of the source documents.

The business objectives described in the following chapters have to be managed in combination and not in isolation. E.g. increased cost efficiency and quicker rollout of solutions with increased performance shall be achieved in a combined way. Pure cost reductions will not lead to higher system performance and without an accelerated rollout it will take too long to achieve a relevant modal shift.

CBO	CBO - Detail	Link with federated model	GAP
4.1 Meeting evolving customer requirements			
4.1.1 Strengthen the ability to sustain a given service quality, punctuality, and safe operation			
completeness of planning and live update	Making sure all trains are timetabled and making sure that the operational plan can be updated on demand (real time)	Federeted model CMS assures a real-time connection between national and the central - EU - tools for planning and allocating - cross - border capacity	
enhanced information for plan optimisation(1)	Adequate level of information to enable plan optimisation and increase the sum of RU train path request can be accommodated in a reliable timetable. Extend, coordinate this information with other entities	In the federated model CMS processes and tools enable variant creation of the capacity model based on TCR-s as well as importing Intentded Capacity Usage lines to indicate congestion levels upfront	
rapid response to capacity request	Rapid responses to capacity requests and planning changes	Short term ad-hoc, and post allocation processes as well and the supporting tool caters for this requirement	
continuous supervision	Continuous supervision and detection of conflicts and resolution potentially leveraging on data sharing	The TMS system requirements uses automated and EU harmonised algorithms for conflict detection. The federated TMS model foresees a central datahub which contains the data to assure cross-border conflict detection	

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smart/assisted incidence handling	Reducing the impact of disturbances - intelligent incident handling as well as process and functional assistance of works enabling a smooth operation	The Federated model TMS foresees a EU processes for incident management which applies on cross-border trains	
availability, robustness, reliability	Improving train and trackside availability, reliability and performance (example ETCS Level 3 and ATO)	Not applicable	
efficient train compositioning and integrity monitoring(1)	Improving freight train composition, operation and capacity allocations of paths, stabling tracks (f.e. waiting for terminal slots) and shunting (yard) work.	In the federated model the train composition is a mandatory field which is available on a centralised platform (as described in the Telematics TSI)	
enhanced information for plan optimisation(2)	Every use should be planned, with different details during time, to sustain quality. All trains for passengers or every movement/use of track also on stabling tracks and movement to and on yards must be included in the planning. The latter makes the plan complete. It shall also consider the use of infra for maintenance.		Current processes and supporting tools on the federated level lack this capability
enhanced information for plan optimisation(3)	All trains for passengers or every movement/use of track also on stabling tracks and movement to and on yards. It is also about use of infra for maintenance. Every use should be planned to sustain quality. In different details during time.{	In the federated model the train composition is a mandatory field which is available on a centralised platform (as described in the Telematics TSI)	
4.1.2 Leverage on real-time information and data sharing to provide accurate status within the full transport system (end-to-end) and allow an overall			

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optimization of the transport offer			
rapid deviation information/ solution	Provide to customer rapid alerts of traffic congestion, including rerouting options.	The federated model TMS describes both a centralised IT tools which serves as a data hub and a bilateral data exchange between Relevant stakeholders within a transport to assure that the relevant data needed to support and improve the decision making process is shared	
multi-modal mobility(1)	Leverage on the emergence of new transports- and communication possibilities allowing cities and regions to propose agile multimodal mobility-as-a-service solutions for passengers and freight operators.		Current processes and supporting tools on the federated level lack this capability
tools support new services	Develop tools for public administrations which can be leveraged by different stakeholders to stimulate new types of services.	The federated model TMS / CMS describes both a centralised IT tools which serves as a data hub	
analytical information for passenger flow/ incident(1)	Provides valuable information to optimize the layout of stations.	The federated model TMS describes a centralised IT tools which serves as a data hub	
analytical information for passenger flow/ incidents(2)	Provides valuable information to refine the procedures for incidents.	The federated model TMS describes both a centralised IT tools which serves as a data hub	
multi-modal connections(2)	Provide connectivity and data streams to enable end-to-end journeys, through-ticketing and integrated connection of the railway with other transport modes.	Through the standardised data interface which they are part of the federared model (Telematics TSI), it is easy to connect new stakeholders such as cities	

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SERA	Single European Railway Area. Provide connectivity and data streams to enable end-to-end journeys, through-ticketing and integrated connection of the railway with other transport modes	Foreseen through the Telematics TSI	
reliable European reference data	Provide reference data which is highly reliable, updated automatically, that can be used by the whole sector and accessed by its systems.		It should be specified which reference data are required for the federated model
4.1.3 Enable railways to deploy digital solutions by simplifying the access to information available in the standardized architectures	Digital technologies are the enablers to realized customer-specific digital solutions in the railway sector. Digital technologies generate large amounts of information that shall be organized and exchanged to deliver customer value. The System Pillar introduces standardized architectures which also shall provide in the physical architecture a simplified and standardized access to the information available on its standardized interfaces. This includes the specification of		
Standardized description methods for information access methods and interfaces		Foreseen through the Telematics TSI	
Definitions for operational processes for the business2business information exchange		Foreseen through the Capacity Regulation Telematics TSI	
Standardized specifications for information		Foreseen through the Telematics TSI	

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services that are in scope of the System Pillar			
4.2 Improved performance and capacity			
4.2.1 Increase capacity utilisation of the rail			
precise control of traffic flow, short train-ahead time	CCS to increase numbers of trains per hour.	Not applicable	
deep/optimized plan	TMS/CMS (Capacity Management System)(CMS or DCM (Digital Capacity Management) is a sectorinitiated concept which has been launched for several years by European institutions.) to enable more efficient infrastructure usage.	Is the basis concept of the federated model for CMS	
4.2.2 Increase transport capacity agility			
vehicle: commercial space	Maximise space in vehicles that can be commercially deployed or integrate systems in a given (cramped) physical environment	Not applicable	
wagon: efficient change of goods	For rail freight - modular, freight wagon designs to allow a seamless and efficient horizontal change of goods and loading units.	Not applicable	
predict capacity needs(1)	Long-term planning processes need to consider future capacity requirements.	Common process for capacity strategy is part of CMS	
4.2.3 Reduce the dwelling time between trains			

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vehicle design/ performance	Optimize the vehicle design and performance parameters. (eg braking curves optimization and braking performance, Localisation accuracy, Movement Authority automated extensions).	Not applicable	
efficient train compositioning and integrity monitoring(2)	Support ETCS L3 functionalities (end of train, train length, integrity) for freight trains (i.e., through introduction of DAC/ FDFTO1)	Foreseen through the Telematics TSI	
4.2.4 Reduce the travelling and transit time			
optimize timetables	Improving timetable structure, railway network topology	Part of CMS compliance with the draft capacity regulation	
optimize topology	Improving railway network topology		The link with the topology should be integrated in the Federated Model
ATO(1)	Automatic Train Operations optimisation.	Not applicable	
optimize regulation	Improve regulations.	the federated model for TMS/CMS is meant for compliance with the draft capacity regulation and telematics TSI regulation revisions which aims this purpose	
reduce human elements and factors	Reducing the human element in train operation.	Federated model supports digitalisation and automation	
ATO(2), automated shunting	Unmanned train operation on, at least selected, sections of heavy rail networks, especially high traffic density lines, or for specific transportation functions like shunting.	Not applicable	
4.2.5 Better predict capacity			

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needs of infrastructure			
predict capacity needs(2)	Better prediction of demand needs to support future investment.	the federated model in CMS better supports previous prediction models due to its harmonized nature	
flexible use of infra capacity	Bringing flexibility to adjust viable railway service in regard of capacity.	processes like the short term ad-hoc or framework agreements bring flexibility both short and long term	
4.2.6 Make more efficient capacity use of lower used lines			
RU transport efficiency/volume/ timing	Improve efficiency of RUs to move the volume of passengers and freight according to end customer needs in real time.		This relates to conflict resolution by socioeconomic criteria which as of now is not part of the federated model (definition out of the scope of SP)
systems: extensible capacity, scalability(1)	Maintain lower used lines availability and compatibility for main line recovery situation, enabling affordable solution that achieves the compatibility requirement.	Part of the contingency management of the federated TMS	
4.3 Reduced costs			

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	For deployment and change within railway systems, cost is a constraint to adaptation and faster deployment. For digital solutions, there is a need to allow flexibility, scalability, and the ability to migrate as business needs change. Affordable system updates are an enabler for rapid system modernisation, ensuring continuous increase of rail performance. IT deployments that amortise over a 40-year period (e.g. the lifespan of a train) are not an option. The objective is to: Reduce life cycle cost, deliver affordable system updates, produce solutions that are economically attractive	Federated model supports standardisation of IT components for an easier and cheaper connection	
	Harmonize operations (including for example in shunting yards) and strengthen interoperability, standardize architecture, Increase flexibility and adaptability of systems, Optimize Safety strategies and standards, Facilitate the transition from legacy systems	both CMS and TMS will rely on Telematics TSI standards that support this approach	

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4.5.1 Harmonise operations (among others on main lines and in shunting yards) and strengthen interoperability			
operational harmonisation, unique requirements	Deliver a common and sufficiently detailed set of operational rules – enabling the use of based on radio-based ERTMS alone systems – to support a much greater degree of operational harmonisation, including functions beyond CCS such as traffic management and capacity management, train composition (considering for example DAC/FDFTO1) or energy management. To reach this high ambition processes, security, safety considerations and operational message/data exchanges (i.e. text messages, written orders) both for nominal but also degraded operation will be harmonised, allowing that unique operational and engineering requirements are set to standardized CCS, CMS and TMS systems, products and services	Federated model is basd upon harmonised procedures	

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[SPT3TMS-16858]

7 Summary - GAP s

The following summary table lists the GAP s to be elaborated and to be added in the legal frameworks:

Federated model for CM and TM

Gap

Detailed description of the KPIs which assure a sufficient data quality for “Digital Train Information” (train running information, train forecast)

Definition of recommendation for harmonised approach for traffic management on the EU network to manage TMS Operational processes : Real Time monitoring, sense and handle deviations, handle operational conflicts and international coordination
Definition of a harmonised solution to exchange from the neighbouring network information relating to trains passing the border, up to xx km inland to improve the decisions made by the border traffic control center and/ or the NTCC
Definition of harmonised scenarios and rules for incident management
Harmonised approach for common risk management. Mitigate disruptions and enable quicker recovery from unexpected events
Definition of harmonised procedures, reports and dashboards for post-analysis of delays
Definition of the minimum set of data standards to assure a high quality in traffic management. These data standards must comply with the applicable TSI standards and cover all the needs for data/information in the related business processes to improve the decision-making process
Integration of the “EU cooperation body”
Define KPIs for the operational and functional performance

The link with the topology reference data should be integrated in the Federated Model
It should be specified which reference data is required for the federated model
[SPT3TMS-16855 **]**

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