ERJU SYSTEM PILLAR

System Concept_Central Instance - Part C WP4_5

System Concept_Central Instance - Part C WP4.5

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Abstract	The purpose of this document is to propose a concept for organisation and processes of a Central Instance managing FDFTO data and acting as a FDFTO system authority
Config Item	System Concept
Document ID	WP4_5 Proposal for the organisation/System Concept_Central Instance - Part C WP4_5#721715 System Concept_Central Instance - Part C WP4_5
Classification	Public
Status	In Progress (started work of the authors)
Version	0.4
Revision	721715
Last Change Date	02.10.2025
Copyright	Brussels: Europe's Rail Joint Undertaking, 2025

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Approval by reviewers (captured at end of 'In Review by System Pillar')

Type of Approval	Document Review

Approval by approvers (captured at end of 'In Approval by System Pillar')

Type of Approval	Document Approval

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1 Preamble

SPT4DAC-794 - The European railway sector are in the process of developing an innovative system to increase efficiency for freight train operation. The DAC (digital automatic coupler) provides automatic coupling and decoupling as well as energy supply and data connection between the rolling stocks. It transforms the formerly mechanically coupled freight train in a full digital freight train (FDFT), which allows a wide range of new functionalities/services for improving the operation in the shunting yard as well as on the mainline.

FDFT provides a wide range of telematic functionalities related to operation of the train such as automatic shunting, capacity increase with ATO and ETCS Level 2 Moving Block and Hybrid Train Detection but also increased information flow for operators and shippers along the logistic chain for more competitive efficiency.

The operation of a FDFT requires coordination between the various stakeholders such as railway undertakings, infrastructure managers, wagon keepers and the manufacturers of the various systems on the vehicles. Access to train data, access to control of the system are safety and business critical data, which must be controlled in an appropriate manner. The DAC system as an interoperable component requires coordination and standardisation of the interface and functionalities to ensure unrestricted operation of all assets over the lifetime of the product. For that an independent organisation is proposed which can manage the legal and organisational aspects of the operation of the FDFT.

1.1 Purpose

SPT4DAC-795 - The purpose of the document is to specify in detail the FSO with their three main pillars :

1. FDFTO System Authority (FSA), managing the FDFTO system oversees and authorises the process steps of Change Requests related to the whole FDFTO system and to the major components such as Software, Mechanical and Electronic hardware and organising further development activities. Software Change Requests has been solved in an internal document but is not described and referred to here.
2. FCI platform management with a data broker and a proposed multilayer IT architecture
3. FCI contractual management, managing contracts and financial issues between the involved stakeholders

1.2 Intended audience

SPT4DAC-791 - Intended audience of the document is the whole European Rail freight sector interested in the transition of rail freight operations to Full Digital Freight Train operations enabled by DAC.

1.3 Document context

SPT4DAC-799 - The scope of this document is to recommend an organisational structure named FSO (FDFTO system organisation) which manages three aspects of the FDFTO. Nevertheless the ultimate organization detailed structure shall be defined and agreed between all the stakeholders during the process of buildup of the FSO.

1. System authority of the FDFTO
2. The FCI (FDFTO Central Instance) platform management
3. The FCI (FDFTO Central Instance) contractual management

SPT4DAC-798 - Note: Scope of authorisation for FCI is limited to FDFTO specifications only but not related to the vehicle authorisation, which stays in the remit of Authorising entities (ERA and NSAs).

SPT4DAC-801 - Hereunder are the primary objectives of the FSO:

- The FSO is acting as System Authority for the FDFTO.
- The FSO is acting as Data Broker for the exchange of data.
- The FSO is managing and organising the FDFTO Software download to the vehicles. This is done according to the processes defined in WP 4.3 [3] for the Use Cases there described.
- The FSO is managing the real-time access rights to the FDFT system on the vehicles.

1.4 Glossary

1.4.1 Terms and definitions

Term	Status	Definition
SPLI-96 - European DAC Delivery Program	In Progress	European DAC Delivery Program Referenced by: SPT4DAC-849
SPT4DAC-692 - FDFT: Full Digital Freight Train	Open	FDFT: Full Digital Freight Train : designates the rolling stock operated according to FDFTO Referenced by: SPT4DAC-794
SPLI-1311 - Human Machine Interface	Open	Human Machine Interface Referenced by: SPT4DAC-796
SPLI-113 - Full Digital Freight Train Operations	In Progress	Full Digital Freight Train Operations Referenced by: SPT4DAC-794, SPT4DAC-803
SPT4DAC-178 - FDFTO Central Instance	Open	FDFTO Central Instance Referenced by: SPT4DAC-794
SPT2TRAIN-626 - DAC - Digital Automatic Coupling	Open	DAC - Digital Automatic Coupling Referenced by: SPT4DAC-794

FSO : FDFTO system organization

FSA : FDFTO System Authority

White Label Gateway

1.4.1.1 Extended definition of “Interoperability”

SPT4DAC-234 - Definition as per DIRECTIVE (EU) 2016/797 of 11 May 2016 on the interoperability of the rail system within the European Union:
Article 2

Definitions
For the purposes of this Directive:

1. …
2. **'interoperability'** means the ability of a rail system to allow the safe and uninterrupted movement of trains which accomplish the required levels of performance.

Definition as per Wikipedia (https://en.wikipedia.org/wiki/Interoperability, downloaded 21.09.23 17:47)**:**
Interoperability is a characteristic of a product or system to work with other products or systems. While the term was initially defined for information technology or systems engineering services to allow for information exchange, a broader definition takes into account social, political, and organizational factors that impact system-to-system performance.

Understanding of "interoperability" in the context of this document:
The aspects of **interoperability** in the context of this document is focused on software, and is understood as related to the interfaces between:

- wagon and wagon,
- wagon and locomotive and
- vehicles (wagon / locomotive) FDFTO devices, FDFTO devices supplier's Cloud, Central Instance cloud.

that are necessary to be harmonized to allow the safe and uninterrupted movement of freight trains (also known as FDFTO).

1.4.2 Abbreviations

Abbreviation/Acronyms	Description
ASO	Automatic Shunting Operation
ATO	Automatic Train Operation
CCB	Change Control Board (of the FCI - to be checked with global Glossary)
CCM	Change Control Management (of the FCI - to be checked with global Glossary)
CEN, CENELEC, CLC	European Committee for Electrotechnical Standardisation
C/U	Coupled/Uncoupled
CI	TAF TSI Common interface (CI) see TAF TSI - ANNEX D.2: APPENDIX E - COMMON INTERFACE
CR (E-CR, I-CR)	Internal or External Change Request
DAC	Digital Automatic Coupler
ECM	Entity in Charge of Maintenance
EN	European Norm as European Standard
ERA	European Railway Agency
ERTMS	European Rail Traffic Management System
ESO	European Standardisation Organisation, being CEN, CENELEC and ETSI
ETCS	European Train Control System
FCI	FDFTO Central Instance
FCM	FSO Contract Management
FDFT	Full Digital Freight Train

Abbreviation/Acronyms	Description
FDFTO	Full Digital Freight Train Operations
FP	Flagship Project (within the ERJU Innovation Pillar)
FPM	FSO Platform Management
FSO	FDFTO System Organisation
HMI	Human machine Interface
IEC	International Electrotechnical Commission
IP	Innovation Pillar within the ERJU
ISB	International Standardisation Body, being ISO and IEC
ISO	International Organisation for Standardisation
LCDF	Last Coupler Detection Function
MCG	Mobile Communication Gateway
NOBO	Notified Body
OTIF	Intergovernmental Organisation for International Carriage by Rail
RACI	Assessment of stakeholders roles into: Responsible, Accountable, Consulted and Informed
RID	Regulation concerning the International Carriage of Dangerous Goods by Rail
SC	Subcommittee (within ESOs and ISBs)
SIL	Safety Integrity Level acc. To EN 50126
SP	System Pillar with the ERJU
TCG	Technical Coordination Group
TCN	Train Communication Network
TSI	Technical Specification for Interoperability
TSI CCS	TSI Command Control and Signalling
TSI LOC&PAS	TSI Locomotives and Passengers
TSI OPE	TSI Operations & Traffic Management
TSI TAF	TSI Telematics Applications for Freight services
TSI WAG	TSI Freight Wagons
TWG	ERA Topical Working Group
TCG	Technical Coordination Group
VK	Vehicle Keeper: Wagon Keeper and Traction Unit Keeper
WG	Working Group (within ESOs and ISBs)

2 Background/Context

2.1 Introducing a Full Digital Freight Train to the sector

SPT4DAC-803 -
Background to this work is the introduction of a Digital Automatic Coupler [DAC] system on commercial freight rolling stock as part of the Full Digital Freight Train [FDFT] that is aimed at introducing new business capabilities to freight rail operations and leap forward freight rail technologically. This will be done based on enabler technologies (Digital Automated Coupler and related automation components), additional sub-systems and components (e. g. systems for the intelligent freight train such as, energy management distributed systems (harvester and storage) as well as freight wagon development and the upgrade of the locomotives for the related DAC-functionalities including the interfaces to ATO technologies [SPT4DAC-691]. Combining both the DAC enabled FDFT with a new set of operational procedures results in Full Digital Freight Train Operations [FDFTO].
This chapter will provide a closer look at the environmental factors that play a role when introducing FDFTO to the rail sector.

2.1.1 Assessment

SPT4DAC-814 - Expected advantages after the sector switches to FDFTO will also usher in a new level of safety and performance to the rail industry. Furthermore FDFTO will make operations faster while reducing the need of personnel in the yard significantly. Meanwhile many of the envisioned business capabilities that can be enabled through FDFT, rely on an equally digital processing procedure on the land side of operations. A land side based system that provides data communications to and from FDFT equipped rolling stock, is being developed in alignment with the DAC. Interoperability between the deployed vehicle equipment and land side back end systems must be achieved. Beyond initial deployment, both vehicle equipment and land side systems must be further developed in conjuncture in the future. An authority in charge of developing and maintaining system specifications is therefore needed after all initial programmes have ended.

2.1.2 Stakeholder analysis

SPT4DAC-813 - The rail freight sector in Europe is vast and faceted in business types. In order to accommodate all interests it is crucial to understand which players are shaping the market for freight rail operations as well as freight rail equipment.
FDFTO mainly concerns the following stakeholders:

SPT4DAC-816 - Wagon Keepers own the freight rail assets and have an incentive to allocate their assets to their customers with little to none without being leased to a customer, while keeping asset related costs as low as possible. An increasingly important aspect is vehicle performance monitoring which is likely to exceed current telematic solutions once FDFT technology has been adopted.

SPT4DAC-815 - A somewhat similar assessment can be made for **locomotive leasing** companies. Locomotives will likely be retrofitted with hybrid coupler systems in order to remain interoperable, especially during migration phases towards the DAC. Locomotive leasing companies have not yet been involved in asset data sharing as have been wagon keepers (e.g. through the GCU) which may require a different approach strategy towards locomotive leasing sector associations.

SPT4DAC-812 - Railway undertakings are key players within the sector and represent the core entities operating the freight vehicles (both owned and leased). Cross border interoperability among all employed assets is key, while asset tracking and performance monitoring are an essential aspect to the business.

SPT4DAC-818 - Infrastructure managers will be able to design and implement new generation of trackside protection system with moving block and no or limited number of train detection devices. This – thanks to the freight train integrity monitoring by FDFTO – will also contribute to the network capacity increase, much needed for the system efficiency and demand growth expected in future.

SPT4DAC-817 - Yard managers can expect significant opportunities from the FDFTO deployment. It will enable significant efficiency gains in terms of automated wagon sorting up to train preparation. The remote control of shunting movement will dramatically improve the overall safety level.

SPT4DAC-820 - The freight rail equipment manufacturers or **suppliers** pose another group of stakeholders before, during and after migration to FDFTO. Since operators and owners demand seamless interoperability between assets, it is paramount that standardsguaranteeing backward compatibility are preserved when further development of the DAC or the FDFT environment take place. Furthermore suppliers have a strong incentive to gather data from their deployed equipment in order to learn and improve on the performance of their products. Negotiation with each wagon or locomotive owner can be onerous, despite EU regulations in favour of open data policies. Therefore predefined communication pipelines along data ownership lines, may be beneficial when accessing the suppliers own proprietary performance data from deployed equipment. Especially in an interoperable environment.

2.1.3 Example to illustrate part of the assessment: Use case - train composition

SPT4DAC-819 - Freight rail operations rely on meticulous planning of train compositions and verification upon train run preparation procedures. In the future, the FDFTO will enable highly automated train composition detection within the train. This scenario serves as a handy example to illustrate how trains will be composed and readied for running onto the main line.

SPT4DAC-796 - After the wagons have been sorted and coupled, the train composition must be confirmed before commencing main line operations. It is crucial that all assets are accounted for and are composed in the right order. In today's operations the yard personnel cross check the physical wagon order and numbers with a reference list, compiled by the RU's backend service. The FDFT can detect its composition digitally and compile the actual train data for cross referencing with the planned composition data. This requires both actual data and planned data to be transmitted digitally between the train and the RU's landside planning system. This approach means that planned train composition data is downloaded to the driver cab FDFT HMI device. The actual and planned composition datasets are then compared automatically. Upon confirmation of the composition the aggregated information can be reported back to landside stakeholders (e.g. RU planning system).

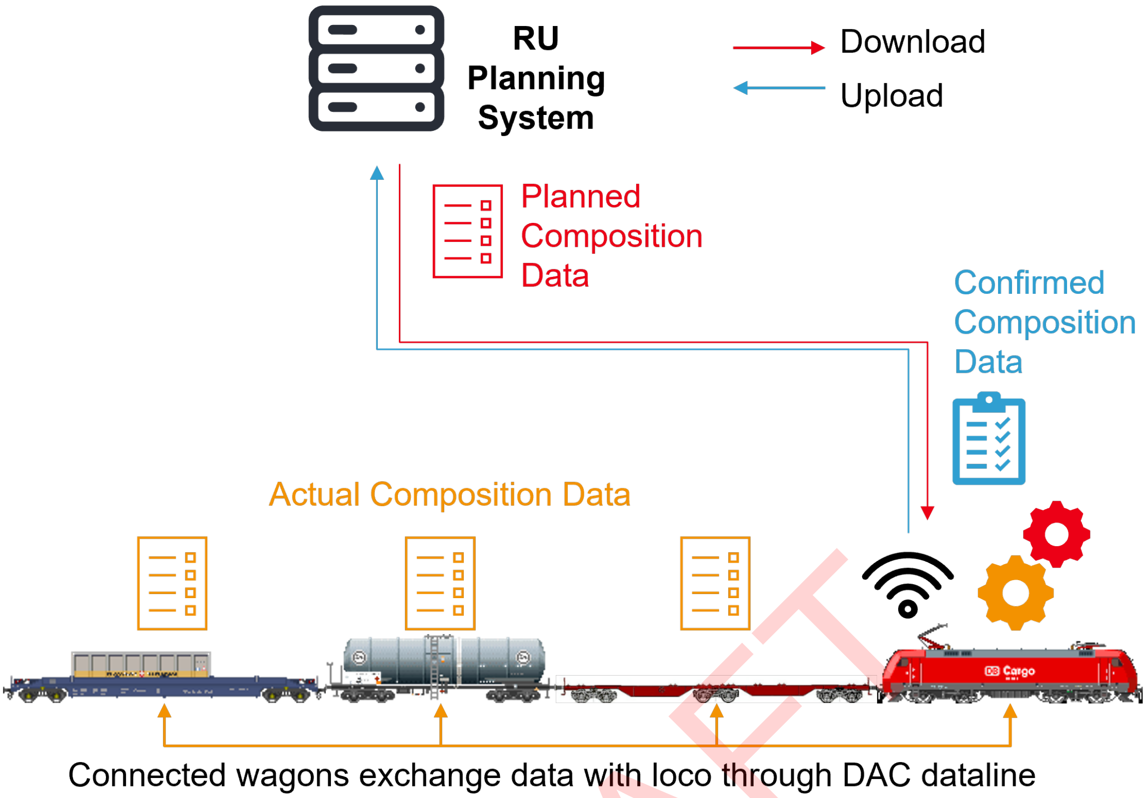

Figure 1 Connected wagons exchange data with loco through DAC dataline

2.1.4 Consequences and Proposed Approach

SPT4DAC-822 - With the widespread installation of electronics and operational software in freight rail vehicles upon migration to a DAC enabled system, there will be an essential need to keep these assets synchronously up-to-date and thus interoperable.
It is expected that this technology shift will produce large quantities of data, both operationally required and value added. This FDFTO environment will therefore require a well structured and efficient handling of data. Especially when considering the distributed nature of freight rail assets, the distribution of information throughout the system becomes a key aspect when managing operations. A set of rules must therefore be in place to assure safe, discrete and efficient data communication, based on sector wide agreed upon rules.
The aspect of interoperability and distributed asset allocation becomes increasingly important when considering a multi-vendor equipment landscape, that not only is dispersed throughout freight asset fleets but even within assets themselves, as wagons and locomotives may be equipped with a multitude of interoperable devices. Due to this complexity the vehicle to landside communication system should follow a simple design approach.
The proposal in this document highlights this simplicity aspect with a tailored approach suitable for the sector and with marketability in mind.

2.2 Reasoning

SPT4DAC-825 - In conclusion the shift from screw coupler to digital automatic coupler technology will lead to higher efficiency, operational safety and better information availability throughout the rail freight sector.

More sophisticated technology does however entail more complexity in maintenance, management and operations. Introducing fully digitalised and highly automated technology to a previously notoriously analogue environment will demand better oversight throughout the sector and better management that ensures interoperable operations as well as true to standard maintenance of the deployed technology. Since the sector is comprised of many different stakeholders, the FDFTO system will require an efficient framework that can manage all issues related to both, operational technology as well as information technology. Tying the two aspects together into a contractual base, that all market players can rely upon creates a management task of its own. By providing and managing the contractual framework for a system that enables data communication, defines information flow, handles access rights and supplies software updates in coordination with freight rail operations, a FDFTO system organisation [FSO] is needed to execute these tasks.

FDFTO is a technology and operations environment for and by the freight rail sector. Therefore it makes sense that an organisation that manages, develops and maintains the FDFTO standard represents the sector stakeholders while remaining neutral to individual interests, while being committed to preserving seamless, interoperable and safe FDFTO.

3 Concept

3.1 Analysis of existing and functioning similar organisation [FF.]

3.1.1 ERTMS Change Control Management procedure

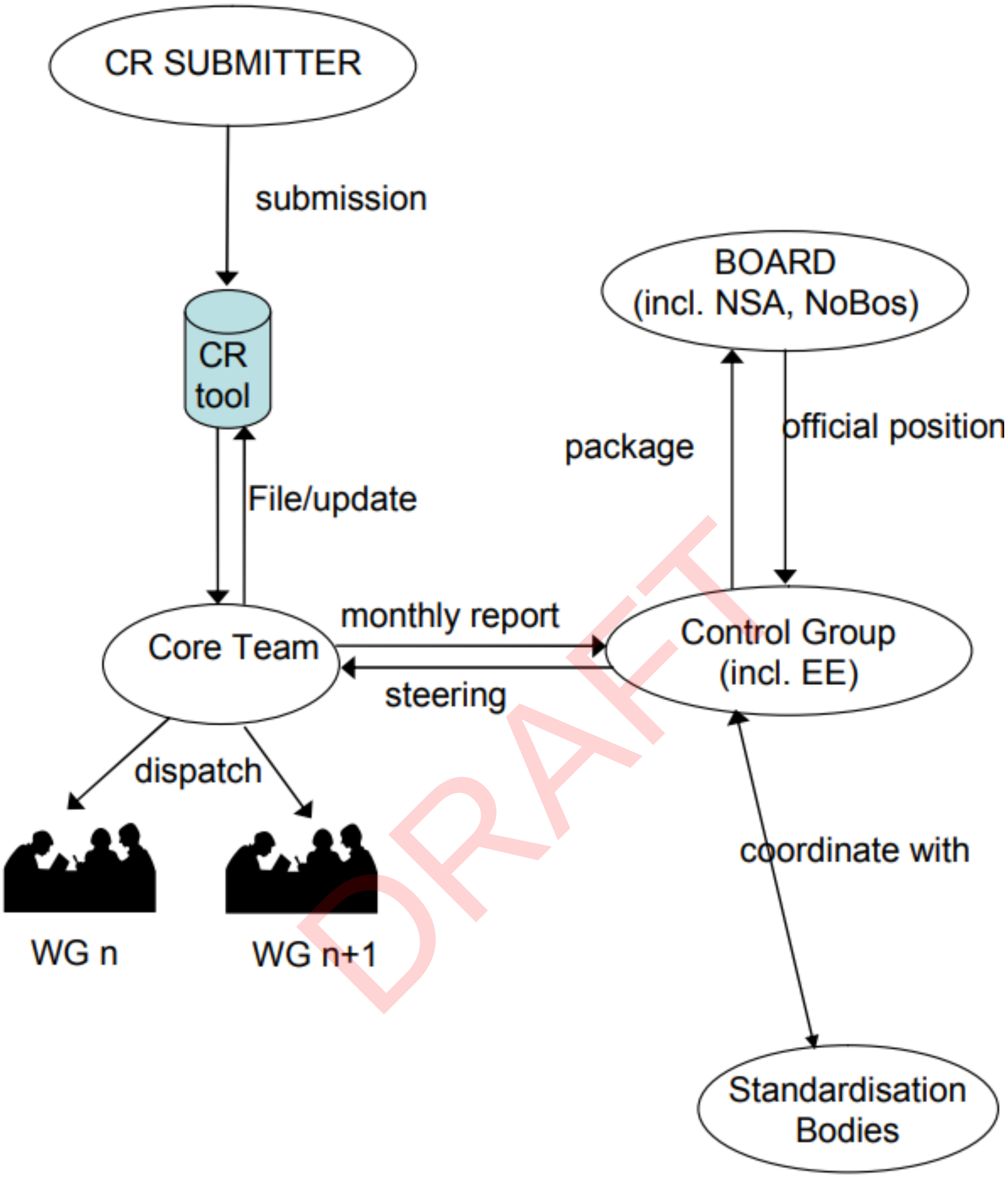

Figure 2 Organisational structure of the CCM

SPT4DAC-805 -
Organisation of the ERTMS Change Control Management (CCM) (summarised from ERA's Procedure Change Control Management PRO_CCM_002 V 2.1) :

The ERTMS Change Control Management (CCM) procedure ensures structured and transparent handling of changes to non-IT related products and services within the European Rail Traffic Management System. It supports the evolution of system baselines while maintaining interoperability, safety, and legal compliance. Baselines represent stable configurations of system functionality and performance. Change Requests (CRs) are the formal mechanism for proposing updates, which are processed through a defined workflow from submission to endorsement.

Chapter 2.2 – Organisation of the CCM

The CCM process is governed by a structured organisation comprising several key entities, each with defined roles and responsibilities to ensure effective change management.

CR Submitters

Recognised organisations authorised to submit CRs include National Safety Authorities, Member States, the European Commission, and the ERA. CRs must be submitted via the ERA CCM tool with complete and accurate documentation.

Core Team

Led by the Change Manager, the Core Team comprises ERA staff and sector experts. It validates, classifies, and assigns CRs to technical Working Groups (WGs), and coordinates technical activities.

Control Group

The Control Group steers the CCM process, defines planning and policy for baseline releases, aggregates CRs into packages, and ensures resource alignment. It also evaluates cost-benefit aspects and coordinates with standardisation bodies.

Board

Composed of representatives from the sector and ERA staff, the Board endorses CR packages and provides strategic oversight. It evaluates deployment policies and funding needs, aiming for consensus on proposals submitted to the Commission.

Technical Working Groups (WGs)

WGs consist of external experts and ERA representatives. They develop solutions for assigned CRs under a defined remit and may be expanded as needed.

Standardisation Bodies

CEN, CENELEC, and ETSI coordinate with the Control Group to ensure alignment with relevant standards. They do not have direct responsibilities in the CCM process.

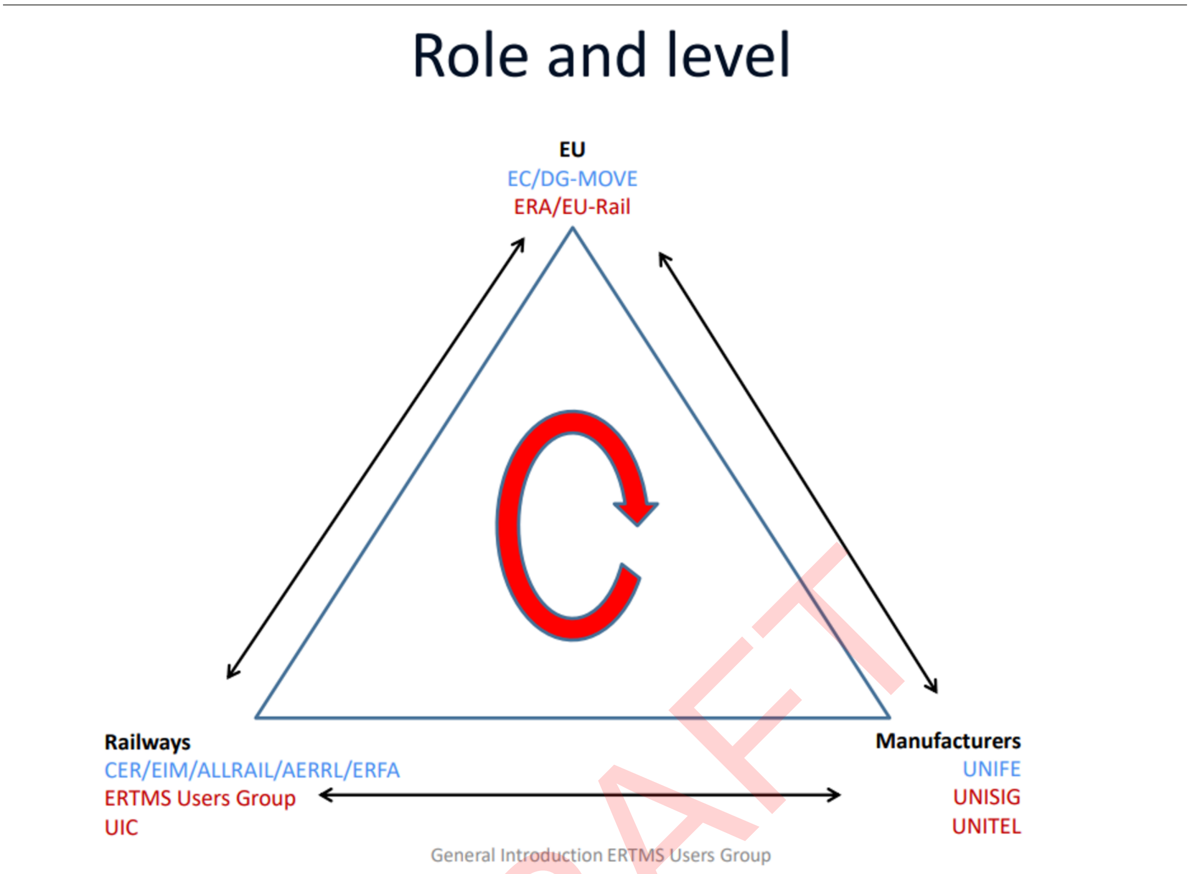

Figure 3 Role and level in ERTMS change management system

3.1.2 GCU

SPT4DAC-828 -

The multilateral GCU contract specifies the mutual rights and obligations between RU and Keepers in the use of wagons as a means of transporting across Europe and beyond. Continuous improvement and supervision of the contract is achieved through a structure established by three associations and their members, which are also signatories of this contract. The three associations are ERFA, UIP and UIC.

Supervision and ‘operation’ are carried out by an independent office (GCU Bureau), which is responsible for administering the contract, financial management, resolving administrative issues with the signatories and managing the admission or withdrawal of members. In addition, the GCU Bureau manages the website where all documents and reports are uploaded, as well as the GCU Broker, a platform for the exchange of information such as the Wagon Damage Report (WDR), Wagon Performance Information, and technical queries about wagons.

All initiatives, proposals for continuous improvement, modifications to the contract and its various appendices are managed by the working groups and resolved (approved or not) by the association’s members and then by the highest hierarchical body, known as the Joint Committee. The Joint Committee is made up of seven delegates: two from ERFA, five from the UIP and five from the UIC; three ‘Rapporteurs’ (one for each association) and finally one ‘Trustee’ who is in charge of the GCU Bureau.

All proposals must be supported by at least 25 signatories. Proposals are drawn up in the various working groups organized by the UIC, which are composed not only of UIC members, but also by invited members of the UIP and ERFA. When the proposals are ready, they are first submitted for approval by each association (UIP GCU Expert Group, UIC Wagon User Study Group and Consultation with ERFA members) before being submitted for validation to the Joint Committee.

Once a proposal has been approved by the Joint Committee, it is published on the GCU Bureau website and submitted to a referendum of all signatories (around 824 signatories) over a two-month period (September-October). If the result is favourable, the amendments are finally incorporated into the following year's version of the contract and published on the GCU Bureau website.

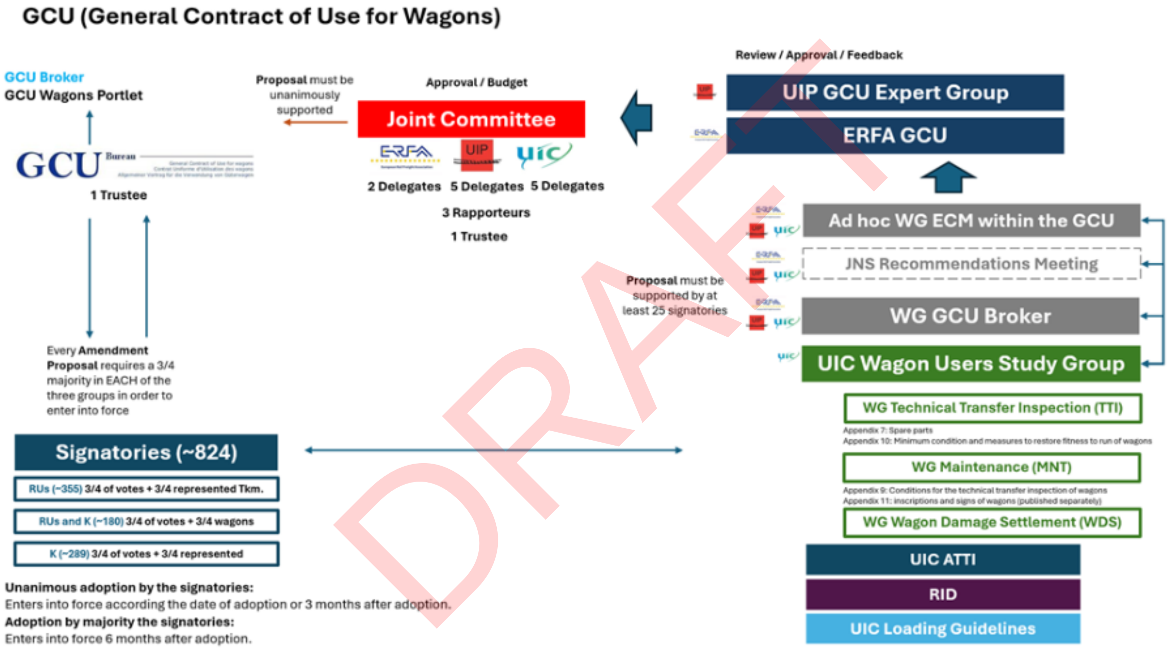

Figure 4 GCU organisation (General Contract of Use for wagons)

3.2 Structure, Organisation and Governance of the FSO

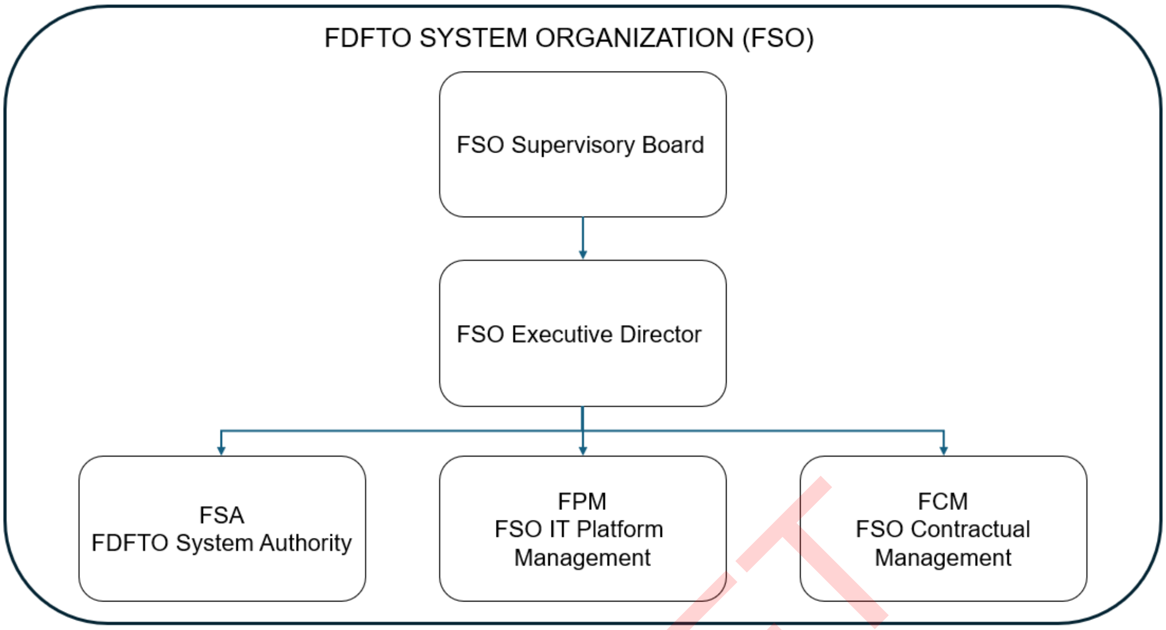

Figure 5

The FSO interacts constantly with the signatory members, identified as the main stakeholders of the FDFTO: Railway Undertakings, Vehicle Keepers, Infrastructure Managers, Suppliers, Workshops (ECM-4) and Freight Terminals.

ERA is also identified in the tasks related to the safety and interoperability specifications (TSIs) and vehicle authorization.

SPT4DAC-836 - The FDFTO System Organisation (FSO) is made up of three main pillars, representing the three main roles required for the management of the FDFTO:

- The FSA: FDFTO System Authority
- The FPM: IT platform management
- The FCM: FCI contract management

On top of the three pillars there are the FSO Supervisory Board and the FSO Executive Director supported by the FSO office

3.2.1 FSO Supervisory Board

SPT4DAC-835 - The FSO Supervisory Board is made of Stakeholders and associations members. It's roles are

- Representing the interests of the stakeholders
- Approval of major / high level decisions
- Election of the Executive Director
- Review of accounts, financtial statements

3.2.2 FSO Executive Director

SPT4DAC-838 - Roles of the FSO Executive Director are:

- Implementing the Supervisory Board decisions
- Leading the FSO staff
- Taking care of daily FSO operations
- Managing the FSO budget

3.2.3 FSO office

SPT4DAC-864 - Role of the FSO office is to support the Executive Director in the day-to-day business activities

3.2.4 FDFTO System Authority (FSA)

SPT4DAC-837 -
At present, the development of the FDFTO system, FDFT operations and the related maintenance, are under full responsibility of the organization of the Innovation Pillar Project FP5-TRANS4M-R.

Nevertheless, it is assumed that there will be opportunities and/or needs to make evolutions and/or modifications to the FDFTO system in the years following the end of the EU-Rail FA5 project.

The scope of this chapter is to describe an organization acting as System Authority that can take over from the EU-Rail FA5 project when it comes to an end, able to guarantee continuity of evolution to the FDFTO system, representing all the competent stakeholders of the European rail-freight sector.

3.2.4.1 Structure and entities

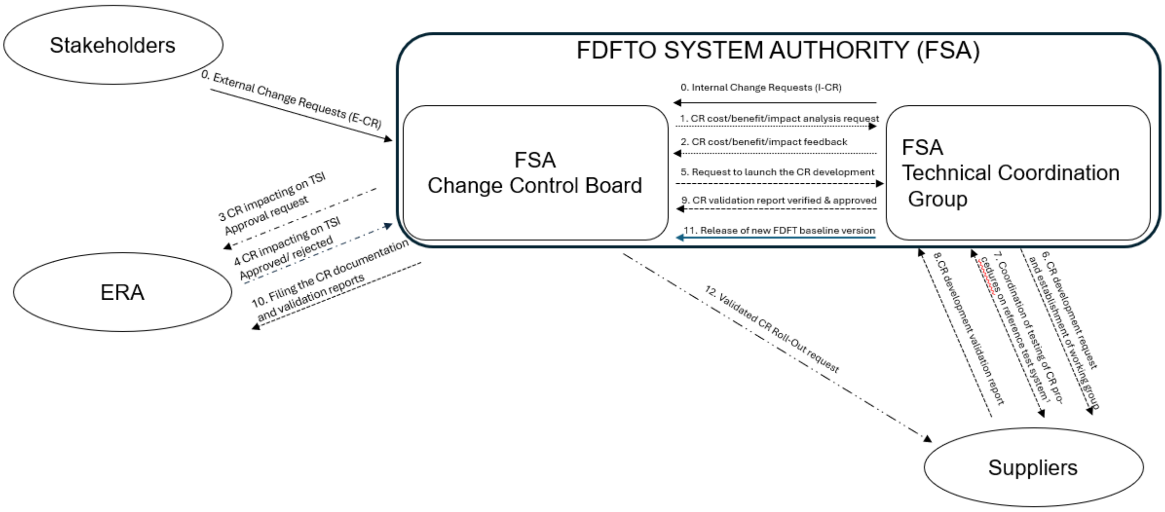

Figure 6 FSA Structure and entities

SPT4DAC-831 - The FDFTO System Authority is made up of two entities:

- The FDFTO Change Control Board, leading the FSA.
- The FDFTO Technical Coordination Group.

SPT4DAC-834 - According to respective roles and responsibilities, reported in the following chapter, they interact with external entities:

- ERA
- Stake holders: Operators, Infrastructure Managers, Vehicle keepers, Railways-related Organizations
- Suppliers

3.2.4.2 Roles and Procedures

SPT4DAC-833 - The FSA Change Control Board leads the FSA. It oversees and approves the process steps of Change Requests related to the whole FDFTO system and to the major components such as Software, Mechanical and Electronic hardware.
It may also maintain the FDFTO operationnal Rulebook : this decision has not been made yet and is pending the responsibility definition for Rulebook.

SPT4DAC-839 - Hereafter the description of the complete process, shown in Figure 3, is reported step-by-step

Step 0: A Change Request is submitted to the Change Control Board by Stakeholders as External Change Request, or by the Technical Coordination Group as Internal Change Request. The Change Control Boards performs a preliminary analysis evaluating the appropriateness to implement the Change Request

Step 1: In case of positive analysis results, the Change Request is sent to the Technical Coordination Group for a detailed Change Request cost/benefit and global impact analysis.

Step 2: the Technical Coordination Group releases the cost/benefit and impact analysis report to Change Control Board. Based on the said report, the Change Control Board takes the decision to approve/reject the Change Request.

Step 3: in case the Change Request is approved and an impact on TSI is detected, the Change Control Boards forwards the Change Request draft and Impact analysis to ERA, for Change Request approval, accompanied with a filled ERA pre-assessment template.

Step 4: ERA performs analysis about Change Request impact on TSI and releases approval/rejection to the Change Control Board according to ERA procedures and schedule

Step 5: Whether Step2 was followed by a Change Control Board positive decision without TSI impacts, or Step4 provided an ERA approval to proceed, the Change Control Board releases the request to launch the development of the solution related to the Change Request, by the Technical Coordination Group.

Step 6: The Technical Coordination Group identifies the needed expertise, involves the Suppliers concerned and launches the Change Request development.

Step 7: Before/during the Change Request development, the Technical Coordination Group and Suppliers coordinate to generate the Change Request Validation Test procedures, to be carried out in a laboratory and/or on the Reference Test System and/or on Train Test Lab.

Step 8: Following Change Request development conclusion, the Suppliers release the implemented Change Request documentation, including the Validation Test Report to the Technical Coordination Group for approval.

Step 9: Upon internal assessment, the Technical Coordination Group submits the implemented Change Request documentation, and the Validation Test Report to the Change Control Board

Step 10: Following Step 9, the Change Control Board submits the Change Request documentation, and the Validation Test Report to ERA, for conclusive TSI related procedures

Step 11: Formal release of the new System Base-Line version updated by TCG and issued by CCB.

Step 12: Change Control Board requests the Stakeholders concerned to roll-out the technical solution developed according to the Change Request

Step 13 (not shown in figure 3): As Change Request implementation Roll-Out is completed, the Vehicle Keepers concerned release the final report to inform the Change Control Board accordingly.

3.2.5 FCI-Platform Management

3.2.5.1 IT Architecture of the FDFTO system

SPT4DAC-842 - The platform operator must ensure the correct and continuous functioning of the data exchange platform. This includes ensuring the operation of the system as well as managing the maintenance, updating and management of the assets associated with the FCI, including fulfilling Cybersecurity requirements.

SPT4DAC-841 - IT interface architecture:
The architecture between all identified interfaces arose from the need to exchange information between all the stakeholders. That means in practice between trains and vehicles, and different backends (land side) taking into consideration the context of how the railway system itself works. The use cases for data exchange include at least the following:

SPT4DAC-844 -

- Operations related data
- Command issuing
- Status information
- Cyber Security Updates
- Diagnostics
- Software download

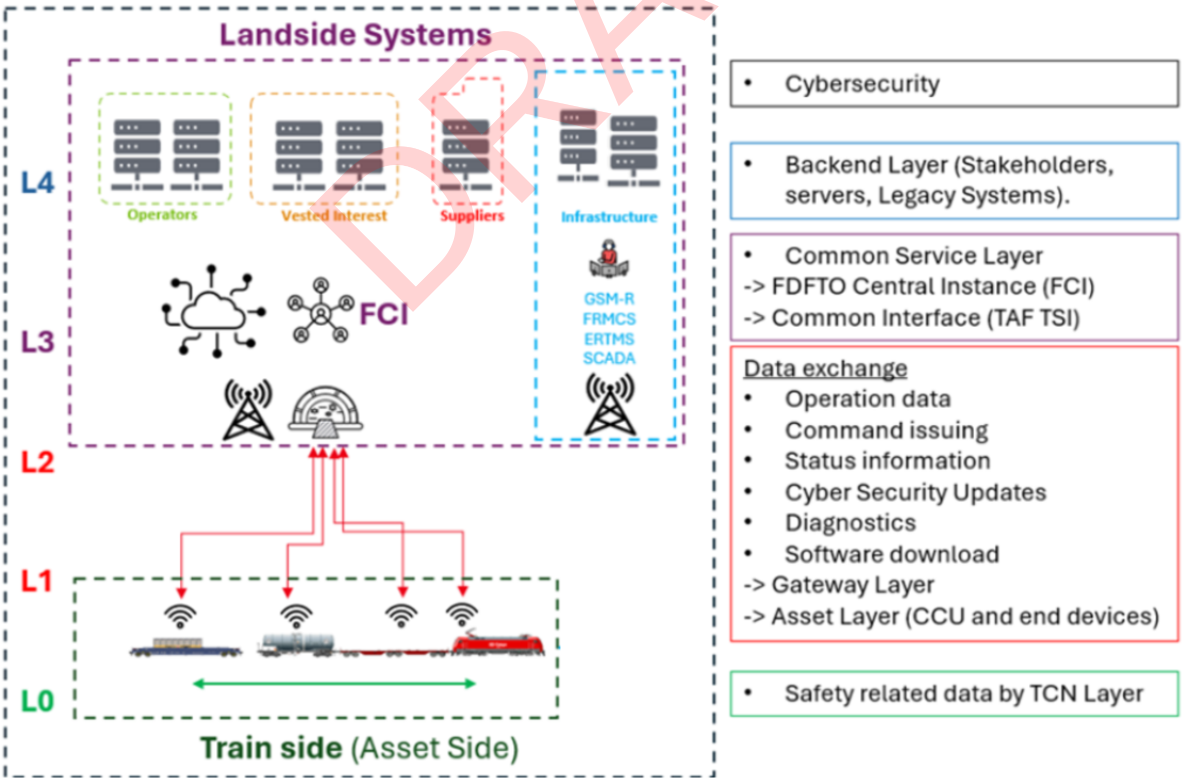

Figure 7 Abstract IT Architecture of the FDFTO system

SPT4DAC-840 - The architecture is divided into five main layers:

- Layer L0: Corresponds to the TCN layer associated with the freight train's Ethernet bus including all connected devices, VLAN's, Zones and Conduit within a consist or on the whole train, and based on IEC61375
- Layer L1: Corresponds to the Train-to-Landside Communication or "FDFT-Link" between Layer 0 (Train network) via MGC (consist wireless communication system) and a specific defined gateway located in the Layer 2 and based on IEC61375.
- Layer L2: Corresponds to the "white label gateway" (WLG) and the FDFTO Central Instance (FCI). Each consist will be connected to a defined gateway, in a permanent relationship throughout the useful life of the asset, which will transmit the data to/from the landside backends.
    - WLG: The gateway reduces the consists communication connections and ensures that the data are forwarded to/from the contracted and authorized stakeholders. Every gateway is used to establish communication between consist and backend(s).The gateway does not perform permanent storage of data belonging to contracted and authorized stakeholders.
    - FCI: The FCI is connected to all relevant sources and provides the gateway a set of information, called "Transport plan", to route data, files or commands between consist and backend(s) as defined in contractual agreements ensuring privacy. The transport plan, which is provided through the common TAF TSI interface, must be used. This plan contains the following information:
        - Where? (locations of handovers, etc.)
        - When? (dates, schedules, forecasts)
        - Who? (parties involved)
        - What? (asset information)
- Layer L3: corresponds to the "FDFT-Data" Communication from/to the Gateway on Layer 2 to/from the contracted and authorized stakeholders' backend(s) on the backend Layer (Layer 4).
- Layer L4: This corresponds to the backend layer and is where the different stakeholders are located with their respective existing backends. Backends can be data sources, recipients, or both. They provide crucial and relevant information for the operation (e.g. train number, planned compositions, vehicle master data, executable applications releases for download, etc.) and, on the other hand, receive stored and processed information from the consists (e.g. brake test results, geographical location, status reports, etc.).

3.2.5.2 Roles and procedures

SPT4DAC-858 - The following main roles and tasks are identified:

- Operation supervision: Supervision of the FCI Platform itself and its functionalities, in particular reliability, safety and security and service level indicators. This includes resolving conflicts and requests from different users.
- Asset maintenance and management: Updates, maintenance of hardware elements and management throughout the entire life cycle of the assets involved.
- Data management: Handling and supervision of data obtained and forwarded between the various gateways. Possible management of a comprehensive information repository and making it available to authorized requesters. This could also cover software archive - to be decided during implementation.
- Contract management: Contracts between stakeholders as part of the data broker is in the format of "smart contracts" according to the Data Space approach. Contracts related to the FSO organisation and governance is covered by FSO Contractual Management (FCM).

- Reporting: Reports on service reliability indicators, financial and administrative statements.
- Training: Aimed at users of the platform (signatories).

3.2.5.3 Structure and entities

SPT4DAC-861 - FCI Operation/Maintain Guideline Unit:

- Supervising the system, ensuring that service level and reliability indicators are met. Responsible for operating and supervising information exchange. This unit actively participates with the FCI System IT Operation agent.
- Resolution of conflicts and requests received from different users.
- Training for users (signatories).
- Maintaining and managing the assets involved, in direct interaction with the FCM (FSO Contractual Manager).
- Prepare reports and develops and supervises management indicators.

SPT4DAC-854 - FCI Data Broker Agent:

- Resolution of conflicts and requests received from different users.
- (possible) management of a comprehensive information repository.
- Prepare reports and develops and supervises management indicators.

SPT4DAC-853 - FCI System IT Operation Agent:

- Agent responsible for operating the IT system, which is outside the scope of WP4.

3.2.6 FSO Contractual Management

SPT4DAC-845 - The need for contract management stems from the need for a legal link between the various stakeholders and the FDFTO. Taking the GCU as an example, which is a multilateral contract between the parties, the model of a contractual agreement is replicated to establish the rights and duties between the various parties associated with the operation of the FDFTO.

Contracts are not usually static, but rather dynamic, especially if they contain technical documents such as appendices and annexes that regulate certain procedures. This gives rise to a series of requests for proposals and amendments to the documents, as well as proposals for continuous improvement in the various processes.

3.2.6.1 Roles and procedures

SPT4DAC-856 - This chapter is kept open for detailed definition under decisions of the FSO organization.

3.2.6.2 Structure and entities

SPT4DAC-866 - This chapter is kept open for detailed definition under decisions of the FSO organization.

3.3 Financial affairs

SPT4DAC-848 - The content of the following chapter is taken from the current GCU financtial structure as a reference, and it is hereafter reported as base of discussions for the FSO organisation to proper put in place the Financtial organization.

3.3.1 Proposals for a business model of the FSO

SPT4DAC-846 -
The business model is based on full coverage of the costs incurred to financially sustain the FSO. For clarity, the relevant investment and operating costs of the FSO are briefly identified below:

CAPEX

- Capitalization of the initial investment
- Licenses
- Maintenance CAPEX component (if applicable)
- Integration costs

OPEX

- Permanent staff costs (experts and managers)
- Logistical costs (working groups)
- Administrative costs
- Cost of IT operation, support and maintenance
- Rent from office space

Further details of these items will be provided in the next stage.

3.3.2 Financing FSO

SPT4DAC-852 - The main source of income will be membership fees from the various signatories. Other sources of income are not ruled out. Like any public interest body, it shall be subject to annual audits and shall disclose financial indicators in annual or semi-annual reports, as defined.

The rate to be paid by the various signatories must be defined taking into account parameters representative of their size. Mechanisms such as those established in the GCU are taken into consideration as an example:

- RU → according to Tkm (FCI-RU+K according Tkm)
- Keepers → according to number of Wagons and Locomotives

The same could be said for the other stakeholders:

- ECM 4 → according to number of Wagons and Locomotives handled
- Terminals → according to number of Wagons handled
- IM → according total Tkm or Network extension (km)
- Suppliers → according to number of Wagons and Locomotives equipped
- Others → To be discuss

Dimensioning the membership cost based on a factor equivalent to the size of the company (or share) allows the source of income to be balanced and distributed according to the size of the FDFTO's range, in other words, the number of running and the size of the railway networks.

3.3.3 Proposed contractual basis

SPT4DAC-851 -
The form of contract to be considered between the various stakeholders is not necessarily the same, but the rights and obligations must be balanced. Based on the GCU, it is possible to identify a continuous effort to maintain a balance of rights and responsibilities between the Railway Undertaking, Keepers and Suppliers, despite all the modifications that the contract has undergone in recent years.
As a suggestion from the GCU, the contract could have the following characteristics:

1. Private law contract.
2. Multilateral contract: a single contract signed by multiple parties, identified in specific roles defined in the contract.
3. Simple, brief and clear contract.
4. Supplementary appendices, including technical ones.
5. Possible contract structure:
    a. Object, scope of application, termination, further development, discontinuance of being a signatory.
    b. Obligation and rights of:
        i. Keeper
        ii. Suppliers
        iii. Railway Undertaking
        iv. ECM 4
        v. Infrastructure Manager
        vi. Terminals
        vii. Others (?)
    c. Exchange of information
    d. FSO Office
    e. Other provisions
    f. Appendices

4 Setting up the FSO

SPT4DAC-849 - The setting-up of the FSO shall be decided by the stakeholders through the European DAC Delivery Programme (EDDP).