FENIX D3.3

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1. INTRODUCTION

1.1 Purpose of the document

This document shall give the reader an insight into the resources of data and services available within the FENIX federation. Each member of the FENIX federation can contact and request any resource provider of the Federation to receive access to the resource.

This document provides insight into the exposed resources in a structured way, allowing use case and service architects to familiarize with the resources available within Fenix 1.0.

1.2 Contractual references

FENIX stands for "A European **FE**derated **N**etwork of **I**nformation e**X**change in Logistics". FENIX is an action 2018-EU-TM-0077-S under the Grant Agreement number INEA/CEF/TRAN/M2018/1793401 and the project duration is 36 months, effective from 01 April 2019 until 31 March 2022. It is a contract with the Innovation and Networks Executive Agency (INEA) under the powers delegated by the European Commission.

Communication details of the Agency:

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2. EXECUTIVE SUMMARY

This document identifies the exposed FENIX resources that can be used by the Federation members to build application services in the frame of "services and applications for creating corridor management solutions". All listed resources are to be exposed via the facilitating platform Fenix Connector(s) of the pilot sites. The collection of the resources follows a bottom-up approach. The existing operational resources were identified individually by each individual FENIX pilot site. The involved FENIX Pilot Sites to this deliverable are:

- *Austria*, on Fürnitz Pilot Site (south Austria) the Baltic-Adriatic corridor;
- *Belgium*, Aircargo Pilot Site;
- *Belgium*, multimodal inland hub-Procter & Gamble-Mechelen-Willebroek Pilot Site;
- *France*, French Mediterranean – North Sea Pilot Site;
- *Germany*, Rhine-Alpine corridor;
- *Greece*, Greece Balkan-TEN-T network, Adriatic-Ionian corridor-Cyprus multimodal Pilot Site;
- *Italy*, Trieste Pilot Site: Mediterranean and Baltic-Adriatic and the Motorway of the Sea of South-East;
- *Italy*, Milan/Genova: the Italian Rhine Alpine Pilot Site – Dynamic Synchromodal Logistic Modules;
- *Netherlands* (Dutch pilot site, Smart Multimodal Operations Platform (SMIP));
- *Slovakia*, all TEN-T corridors and multimodal Pilot Site;
- *Spain*, the Spanish-Atlantic Corridor Pilot.

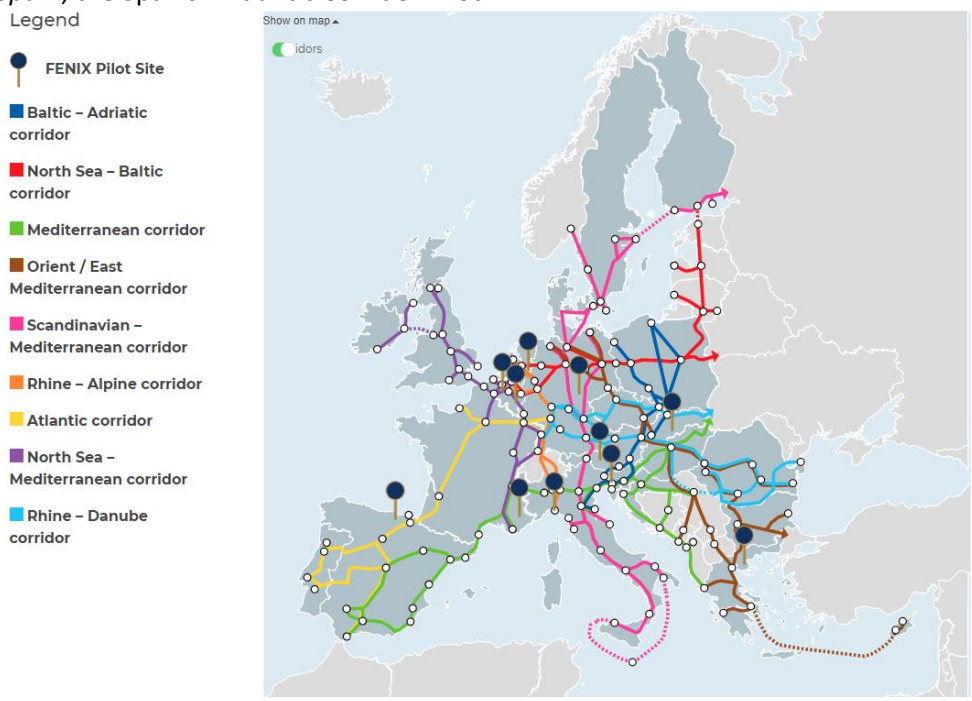

Figure 1: FENIX Pilot Sites geographical coverage

This deliverable explains the process of identification, collection, and mapping of these services. Main intention of this deliverable is to provide a catalogue of collected exposed resources clustered into 3 pillars:

- Transport and logistics planning services suite as service
- Transport and logistics planning and Execution Management as service
- KPI driven orchestration tools for corridor management solutions

Since the Covid-19 pandemic had and still has impact on the individual pilot site implementation plans, some resources will be exposed to the FENIX federation at a later point in time.

3. Methodology

This chapter presents the underlying methodology for the collection and the clustering of the exposed FENIX resources by the pilots, i.e., services, applications, and data sets which can be used to create corridor management solutions.

Working steps for resource collection:

We perform four steps to scope, collect and finally cluster the exposed resources in course of this deliverable:

Step 1: Create common understanding of high-level DTFL goals and FENIX contribution

- Analyse working documents and meeting protocols of DTLF SG 2 towards Technology Independent Services (BB2).
- Perform dialog with DTFL consortium members and Fenix A3 technology core group to scope understand and contribution of FENIX to DTLF BB2.

Step 2: Desk research

- Perform desk research on existing FENIX deliverables towards identification of "services and applications for creating corridor management solutions".
- Analyze documents D2.1.1, D2.1.2, D2.2.1, D2.2.2; D3.1, D3.2, D4.1.1. The result is a comprehensive list of all resources applied to the Fenix pilots.

The identified resources are to be clustered to 3 categories:

- Transport and logistics planning services suite as service
- Transport and logistics planning and Execution Management as service
- KPI driven orchestration tools for corridor management solutions

Outcome of this step is a comprehensive listing, which services and functionalities are available in each pilot site per cluster.

Step 3: Setup and application of a clustering methodology for the resources catalogue

- Analysis of existing clustering and classification approaches.
- Adaptation and definition of a classification scheme for resource classification for digital logistics services.
- Application of the defined scheme towards the collected resources of the desk research step.

Step 4: Contacting FENIX Pilot Sites to create short list of exposed resources

- Contact different pilot site leaders to receive insight into the available and planned resources.
- Conduct individual workshops to identify potential resources to be exposed to the FENIX federation and to explain the classification approach.

4. DTLF Technology Independent Services in Fenix

This chapter links the work scheme of DTLF subgroup 2 as central foundation for Fenix.

At the moment the data sharing is not yet a commodity for logistics, independent of barriers and drivers of enterprises to implement data sharing. Thus, the DTLF I SG2 requirements are to create such a commodity, based on the following design principles:

- Plug and play – each user should register and connect to a platform of choice and select its required services of the platform.
- Technology independent infrastructure services – the services of the platform should be specified technology independent, thus enabling different providers to offer a solution that best fits their end-users and to support different technologies for realising the services.
- Federation – the commodity consists of platforms of different service providers, whereas these platforms can operate in an enterprise domain, thus creating so-called peer-to-peer solutions.
- Trusted, safe and secure – the commodity and its (integration with) end-users should be trusted, data sharing should be safe and secure, etc., based on minimal central governance.

The following figures shows these design principles as DTLF SG2 requirements.

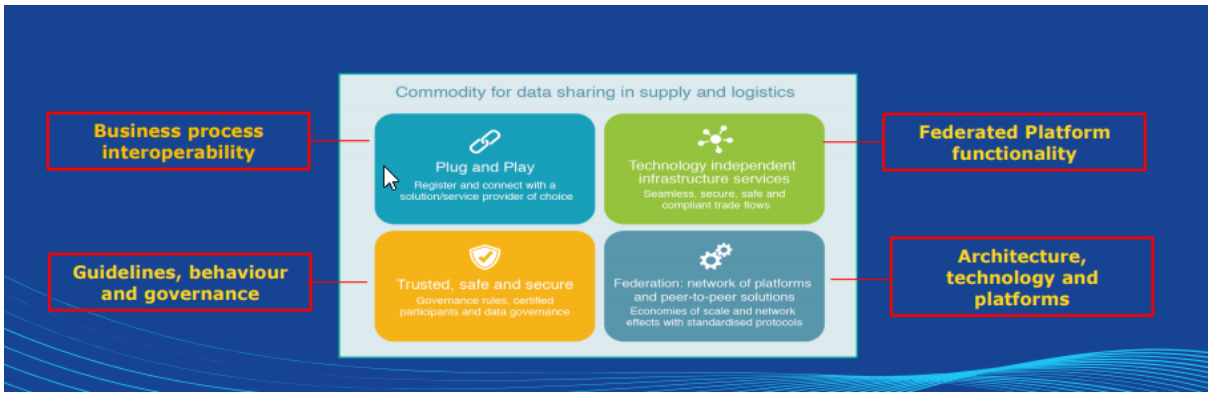

Figure 2: DTLF Sub-Group 2 building blocks

Further to the definition of building blocks, the DTLF identified basic principles for digital interoperability between actors. These are:

- Business and authority interoperability principles - basic design principles and concepts
- Business scenario's – examples of use cases that have to be supported
- Business transaction choreography – specification of sequencing of data sharing and data requirements for interactions between any two enterprises
- Semantic model – semantics of all data that can be shared in supply and logistics, utilising knowledge gained by existing standardization bodies
- Platform Services – transforming the choreography into Platform Services for end-users
- Standards – support/inclusion of standards by semantic model

FENIX envisages the creation of a Federation that will involve legacy and new platforms operated both by private and public authorities. All platforms will retain governance and technical independence for any services provided outside the FENIX Federation as long as they comply to the safety and security rules set by the governance model of the FENIX Federation, compare Fenix D2.5.

The FENIX Federation is based upon two components, the FENIX Connector and the FENIX Broker. The FENIX Connector is built once for every platform wishing to join the FENIX Federation and allows the discovery of available services using the FENIX Broker, the use of available services of FENIX Platforms

and the development of new services that will be available to the FENIX Federation. These two components allow any platform to Plug and Play with any other that is part of the FENIX Federation.

Technology independent infrastructure services – the services of the platform should be designed technology independent, thus enabling different providers to offer a solution that best fits their end-users and to support different technologies for realising the services.

The contribution of Fenix Activity 3 to the DTLF building blocks is on all DTLF building blocks, special focus is on federated platform and architecture.

The technical approach of Fenix, described in D3.2, supports the high-level DTLF goals with underlying technology in order to facilitate the envisaged use cases of DTLF.

Overall, the connector specification of Fenix described in Fenix D3.2 is contributing with the description of the sub-components:

- IDM
- Data Exchange
- Broker of the connector
- Logging concept

In the context of "Technology Independent Services", the Fenix connector and federation concept the main contribution. FENIX defined a distributed catalogue of services and resources using a harmonized meta description model. Each pilot site running a Fenix connector owns and maintains an own catalogue of services and resources connected and exposed via the specific connector.

Identification of services and resources of a specific connector by federation member takes place by machine-to-machine interaction, querying the meta description of the catalogue for the resources and services of the connector.

Each service and resource of the catalogue is described in a specific meta structure. The services and resources as such are provided in the described format of the meta description. Depending on the software service or the resource, different messages and resource formats, e.g. industry standards, can be used, depending of the offering. This enables the provider as well as the user to provide or consume the service or resource in the preferred structure, i.e. the message / data object structure and format is independent of the data communication via the Fenix connector.

Semantic interoperability services can be applied once they become available through a Fenix connector. Any service of that kind will be listed and documented by the service provider following the meta description format of the Fenix connector broker catalogue. By that approach different semantic models can be supported, the Fenix connector technology is agnostic to any underlying service or data model.

Interoperability is also focussed by the Fenix project. This topic is discussed at large as part of Fenix Activity 6.5 (D6.5).

5. Clustering and categorization approach for PS resources

This chapter reviews and clustering and classification of resources of the Fenix pilot sites.

Main cluster scheme for the resources are the 3 main pillars:

- Transport and logistics planning services suite as service
- Transport and logistics planning and Execution Management as service
- KPI driven orchestration tools for corridor management solutions

While the above-mentioned pillars give a basic structure of the application area for the resource(s), the individual resources still content wise variate largely. To structure and classify the resources at a more detailed level, Fenix D5.1 has set up a classification scheme. Sub-chapter 5.1 discusses the set of identified category classes while sub-chapter 5.2 introduces and elaborates on the nomenclature for coding the resources.

5.1 Service definition and clustering structure

The Fenix project runs several pilots across Europe within the TEN-T network to demonstrate multiple Fenix use cases. Each pilot site has its own focus on use case specific resources, i.e. which services, data sets and functions are used in the specific pilot to run the defined pilot use case.

To be unambiguous about the resource terminology on what to understand as a “service” and what as a “technology”, Fenix deliverable D5.2, has set 2 unique definitions on these two terms within the project FENIX:

- Service: Within FENIX, the resource class “service” is a functionality that is offered by the pilot sites’ platforms:
    - to satisfy business needs and transactions,
    - to add value to existing T&L operations (e.g. ETA),
    - and (3) to support system requirements and the federation to the federated eco-system.
- Technology: The way of implementation, the required data and its acquisition and sharing (e.g. Block-chain, restful APIs, geospatial data, web applications, mobile applications, client-server, etc).

Fenix deliverable D5.1 - Evaluation Framework introduced a service classification. This classification is used throughout the project to classify certain services to meaningful categories. Fenix activity A3.3 adapts this approach:

#	Category	Description
1	Cargo Monitoring	Monitoring the conditions of cargo.
2	Catalogues & KPIs	Digital services inventories, repositories of knowledge & statistics dashboards.
3	Customs services optimization	B2A and A2B customs operations.
4	Dangerous goods management	Management of the transport and handling of materials or items with hazardous properties.
5	Emissions reduction	Monitoring CO2 and NOx emissions.
6	Gate management	Managing node/terminal gate operations.
7	Parking services	Managing parking operation.
8	Slot management	Slot reservation and booking.

9	Track & trace	Tracking & tracing transport of modes, estimated time of arrival (ETA), status, etc
10	Traffic management	Traffic event statutes, forecasting and statistics.
11	Transport & cargo e-doc	E-documentation services (e.g. e-CMR
12	Trip & Capacity planning	Services for cargo transport optimization (e.g. matching) and trip scheduling

Table 1: Service classification scheme

5.2 FENIX Logistics Service Classification (FLSC)

In course of the collection and review process of the Fenix resources, the importance of a structured identification of the resources became obvious. The structured identification contributes to the Fenix connector broker. By including the identification code of a resource to its description within the broker catalogue list, automated and individual search and exploration of resources using the broker resource catalogue is significantly improved. The topic of working towards this structured identifier has been jointly carried out by Fenix activity A6.5 and activity A3.3. The related work results are described within the FENIX Deliverable 6.5.1.

Main work pattern for this action is to develop the FENIX Logistics Service Classification (FLSC) for resources in order to assure a unique identification and mapping of the different FENIX services. This will ultimately help establishing the classification's validity across FENIX and will improve the FENIX Broker functionality.

Of course, a classification of the service and functional interoperability is necessary in the background, so that, for example, if a service consumer searches for an ETA service and opens the list of services provided by the broker at his request, he will find it regardless of the name of the service.

Real example from the project: PTV offers the "drive and arrive" service. Without knowing that it is an ETA service, the Broker would not identify it as an ETA service unless it is classified as such.

In a series of meetings in 2021 and a final physical classification workshop, the methodology concept was developed and finalized.

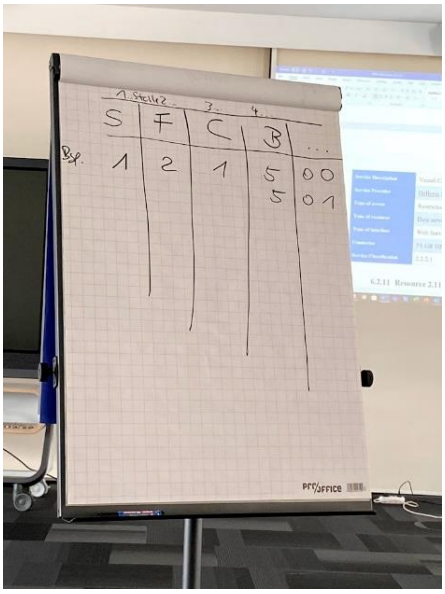

Figure 3: Classification workshop (GS1, Cologne, Germany, 31/08/ 2021

The base of the idea to create a FENIX Logistic Service Classification is to use the Global Product

Classification (GPC)[1] logic and transfer it to classify services within the Broker.

This kind of hierarchical structure is also known as a taxonomy.
The first idea was to develop an almost similar classification scheme (taxonomy) for the information services offered over the FENIX network.

Methodology:

Structure:	Segment-Level	Physical Service	1.0.0.000
(Examples)		Digital Service	
	Family-Level	Data Service	2.1.0.000
		Software Service	2.2.0.000
	Class-Level	Planning Service	2.1.1.000
		Excecution Service	2.1.2.000
		Evaluation Service	2.1.3.000
	Brick-Level	Track & Trace & Event handling Service	2.1.1.001
		Cargo Monitoring Service	2.1.1.002
		Traffic Management Service	2.1.1.003
		...	

Figure 4 FENIX Logistics Services Classification methodology

The methodology of FENIX Logistics Service Classification (FLSC) consists of a 4-level classification. Each level is indicated by a digit (see Figure 4). At least all elements of the FLSC are identified with a 6-digit number.

The first three levels (segment, family and class) are used to categorize different services and to lead to the exact name of the service (brick).

The FENIX logistic services that the pilot sites (and their use cases) use most frequently are grouped firstly into **Physical** services and **Digital** services, which is described as the overall Segment-Level (see Figure 5). In the next step, the Family-Level differentiate between **Data** and **Software** services. The third digit of the logistic service classification describes the Class-Level. This consist of **Planning**, **Execution** and **Evaluation** services. In addition, a distinction can then be made between "real" logistics service name, like ETA. This class is called the Brick-Level. There you can choose between thirteen services. That is why the Brick-Level can be indicated with three specific numbers.

[1] https://www.gs1.org/standards/gpc

FLSC Methodology (Draft)				
Base:	6-digit number			
	2.	2.	1.	501
	Digit 1	Digit 2	Digit 3	Digit 4-6
FLSC	Segment	Family	Class	Brick

Figure 5 FENIX Logistics Services Classification methodology code structure

For all the levels of the hierarchy, a speaking numeric is used.

The FLSC can be used to search for various services via the FENIX Broker.

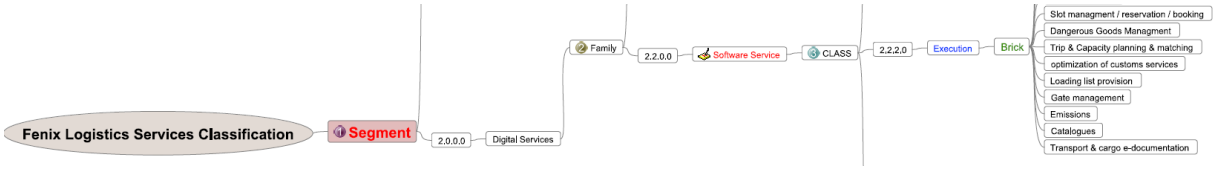

Figure 6 FENIX Logistics Services Classification application

An implementation of the service request can be filtered by different classifications, which allows a very granular search. A typical service classification request can be mapped out in the following way:

- *"Search for all Track & Trace & Event handling Services! Look at Digit 4-6 with "001""*

- *"Search for all Digital Services & Track & Trace & Event handling Services! Look at Digit 1 with "2" and Digit 4-6 with "001""*

- *"Search for all Digital Services & Software Services & Track & Trace & Event handling Services! Look at Digit 1 with "2" and Digit 2 with "2" and Digit 4-6 with "001"".*

Exact Search (fictive example):

- *Search for all Digital Services & Software Services & Planning Services & Track & Trace & Event handling Services!*
- *Look at Digit 1 with "2" and Digit 2 with "2" and Digit 3 with "1"and Digit 4-6 with "001" --> 2.2.1.001*

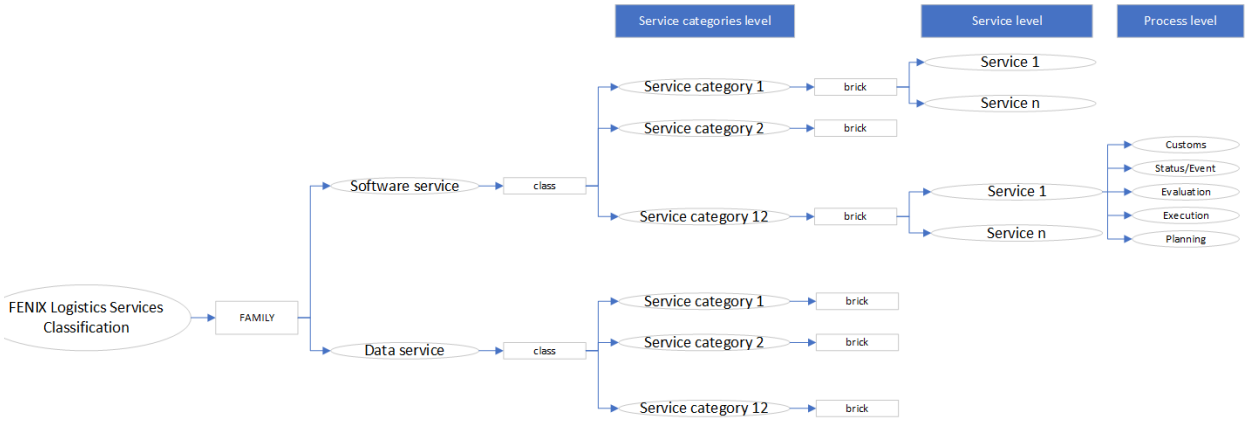

Figure 7 FENIX Logistics Services Classification –Logic Structure example 1

Basic example (fictive example):

All data services that provide status information regarding temperature can be found in the Broker because all of them would have the same Information Service code associated with them in the broker (regardless of the commercial name each of them may use).

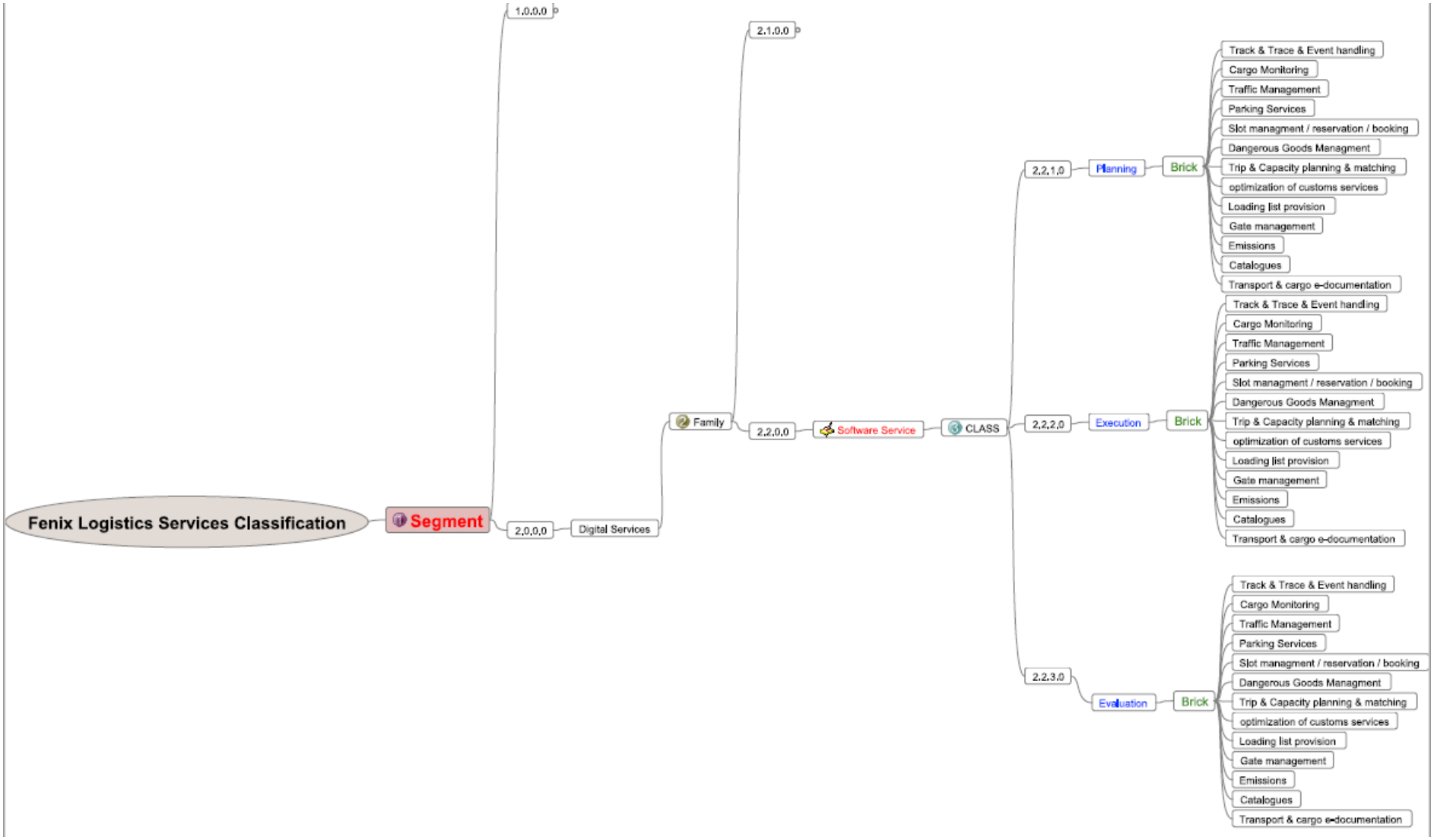

Figure 8 FENIX Logistics Services Classification –Logic Structure

5.3 Pilot site engagement for A3.3

Regarding the implementation of the Fenix Federation members, the pilot sites are the main actors. The pilot sites deploy the Fenix connector(s) and facilitate resources (data and services) to demonstrate site-specific use cases as well as support cross-pilot use case tests. In course of this implementation action, pilot sites apply and include their resources (data and services) to the Fenix setup. Mainly these pilot site resources are of interest for creating corridor solutions.

As part of the pilot site engagement for Fenix A3.3, all pilots have been contacted by Fenix A3.3 members. Since the implementation of the Fenix connector(s) and the applied resources by the different pilots still variates significantly due to the Covid 19 pandemic delay, all sites have been contacted individually to cover the individual situation. The pilot site specific workshops took place between July and October 2021. Three main topics have been addressed per pilot workshop. They are:

- Explain the purpose of the resource collection and the underlying methodology
- Check per pilot site which resources (data and services) exist as such
- Check per pilot site which resources can be exposed to the Federation (short list)

Feedback and participation by each pilot sites are as follows:

Pilot Site	Country	Relevant services	Expose services	Attended workshop	Number of exposed resources
PS IT 1		Yes	Yes	Yes	
PS IT 2		Yes	Yes	Yes	13
PS SLO		Yes	Yes	Yes	2
PS DE		Yes	Yes	Yes	5
PS NL		TBD	TBD	Yes	TBD
PS BE 1		Yes	Yes	Yes	1
PS BE 2		Yes	No	Yes	0
PS AT		Yes	Yes	Yes	1
PS FR		Yes	Yes	Yes	2
PS GR		Yes	Yes	Yes	9
PS ES		Yes	Yes	Yes	5

Table 2: Fenix Pilot workshop feedbac

6. Services and Applications for Creating Corridor Management Solutions.

This section captures resources of data services, e.g. data bases, and software services, e.g. APIs from the different project pilot sites. The resources are clustered in 3 thematic scopes: 1) Transport and logistic planning services suite as a service 2) Transport and logistics planning and Execution Management as service 3) KPI driven orchestration tools for corridor management solutions.

6.1 Transport and logistics planning services suite as service

This sub-section's list exposed Fenix resources in the category "planning services suite" as a service. A software or application suite is a collection of computer programs (application software, or programming software) of related functionality, sharing a similar user interface and the ability to easily exchange data with each other. This mainly reflects the complexity covered within the application suite.

6.1.1 Resource 1.1 PTV intermodal service

Resource name:	PTV intermodal service
Resource description	This service provides intermodal routing and planning functionality. It integrates timetable networks, capacities, intermodal network information (terminal, ...) to the routing functionality. The service can be used for strategic, tactical and operation use cases
Resource provider	PTV AG
Access	restricted
Type of resource:	Data service
Type of interface:	API
Facilitating Connector:	PSDE DIH
FLSC	2.2.1.007; 2.2.1.011; 2.2.2.007; 2.2.2.011; 2.2.3.007; 2.2.3.011

Table 3: Resource 1.1 PTV intermodal service

6.1.2 Resource 1.2 Noscifel

Resource name:	Noscifel
Resource description	Noscifel is an innovative multimodal interoperable platform for the transport of goods. It provides services for: Appointment management for transporters –shippers – receivers; CO2 and GHG (greenhouse effect) calculation platform; Traceability of goods; Management of a bundling and unbundling of goods platform; Electronic archiving by a digital electronic safe service
Resource provider	NeoGLS
Access	restricted
Type of resource:	Data service
Type of interface:	API

Facilitating Connector:	PS FR
FLSC	2.2.1.1; 2.2.1.2; 2.2.1.5;2.2.1.6; 2.2.1.7; 2.2.1.11; 2.2.2.1; 2.2.2.2; 2.2.2.2 ; 2.2.2.5; 2.2.2.6; 2.2.2.7; 2.2.2.11; 2.2.3.1; 2.2.3.2; 2.2.3.5; 2.2.3.5;2.2.3.6; 2.2.3.7; 2.2.3.11

Table 4: Resource 1.2 Nosifel

6.1.3 Transport and logistics planning and Execution Management as service

6.1.4 Resource 2.1: Vessel loading list

Resource name:	Vessel loading list
Resource description	Provides the list of containers expected to be loaded on a specific vessel. Note: only for IoT shipments (UC6), only for intermodal/rail connections (UC7) PSIT2
Resource provider	Circle
Access	Restricted (only to authorized customers)
Type of resource:	Data service
Type of interface:	RESTful API
Facilitating Connector:	FENIX connector (Milos Federative Services)
FLSC	2.2.1.009

Table 5: Resource 2.1 Mondelēz Event Service

6.1.5 Resource 2.2: Mondelēz Event Service

Resource name:	Mondelēz Event Service
Resource description	MDLZ event service in which status of the Carrier carrying MDLZ goods are updated. Potentially Carrier partner can update data fields of MDLZ load details with truck and/or trailer number plates, driver name, driver contact details
Resource provider	Mondelēz SK ERP
Access	Restricted
Type of resource:	Data service
Type of interface:	API
Facilitating Connector:	PS SK ERP
FLSC	2.2.2.002

Table 6: Resource 2.2 Mondelēz Event Service

6.1.6 Resource 2.3: Mondelēz Load Service

Resource name:	Mondelēz Load Service
Resource description	MDLZ load message [which is our Shipment] can be shared with all the contracted partners for transport execution
Resource provider	Mondelēz SK TMS
Access	Restricted
Type of resource	Data service
Type of interface	API
Facilitating Connector	PS SK TMS
FLSC	2.2.2.013

Table 7: Resource 2.3 Mondelēz Load Service

6.1.7 Resource 2.4: LISAS GPS Tracking

Resource name:	LISAS GPS Tracking
Resource description	Provision of data structure and GPS data from rail traffic
Resource provider	LCAS
Access	Restricted
Type of resource	Data base / data structure
Type of interface	DIH
Facilitating Connector	PS DE DIH
FLSC	2.2.3.001

Table 8: Resource 2.4 LISAS GPS Tracking

6.1.8 Resource 2.5: Entry and exit of containers at the terminal

Resource name:	Entry and exit of containers at the terminal.
Resource description	Gate In and Gate Out of the containers recording the truck which done the service and ATA or ATD, sending CODECO IN/OUT (EDIFACT Message), dangerous good acceptance validation for gate in.
Resource provider	Terminal of Bilbao
Access	
Type of resource	Data Source
Type of interface	
Facilitating Connector	epuertobilbao
FLSC	2.2.2.001

Table 9: Resource 2.5 Entry and exit of containers at the terminal

6.1.9 Resource 2.6: Bilbao port - data from an outgoing train

Resource name:	Entry and exit of containers at the terminal.
Resource description	Gate In and Gate Out of the containers recording the truck which done the service and ATA or ATD, sending CODECO IN/OUT (EDIFACT Message), dangerous good acceptance validation for gate in.
Resource provider	Terminal of Bilbao
Access	
Type of resource	Data Source
Type of interface	
Facilitating Connector	epuertobilbao
FLSC	2.2.2.001

Table 10: Resource 2.6 Entry and exit of containers at the terminal

6.1.10Resource 2.7: Bilbao port - entry and exit of containers at the terminal

Resource name:	Entry and exit of containers at the terminal.
Resource description	Gate In and Gate Out of the containers recording the truck which done the service and ATA or ATD, sending CODECO IN/OUT (EDIFACT Message).
Resource provider	Terminal of Júndiz.
Access	
Type of resource	Data Source
Type of interface	EDIFACT Message
Facilitating Connector	CARGO2RAIL
FLSC	2.2.2.001

Table 11: Resource 2.7 Entry and exit of containers at the terminal

6.1.11Resource 2.8: Terminal of Júndiz. Data from an outgoing train

Resource name:	Terminal of Júndiz.– data from an outgoing train
Resource description	Train composition, Loaded/Unloaded Cargo list and ATA of a train witch exit the terminal.
Resource provider	Terminal of Júndiz.
Access	
Type of resource	Data Source
Type of interface	
Facilitating Connector	CARGO2RAIL
FLSC	2.2.1.007

Table 12: Resource 2.8: Terminal of Júndiz. Data from an outgoing train

6.1.12Resource 2.9 PTV ETA service

Resource name:	PTV ETA service
Resource description	This service offers calculation, notification, and information regarding road trips. For the calculation other data sources like traffic state and prediction.
Resource provider	PTV AG
Access	Restricted
Type of resource	Data Source
Type of interface	AOI
Facilitating Connector	PSDE DIH
FLSC	2.2.2.001

Table 13: Resource 2.9 PTV ETA service

6.1.13 Resource 2.10: Piraeus Vessel Schedule

Resource name:	Piraeus Vessel Schedule
Resource description	Vessel Calls for the container terminal of Piraeus
Resource provider	Hellenic Port Community System
Access	HPCS registration required
Type of resource	Data service
Type of interface	Web Service (JSON calls)
Facilitating Connector	PS GR HPCS
FLSC	2.2.1.007

Table 14: Resource 2.10 Piraeus Vessel Schedule

6.1.14 Resource 2.11: Piraeus Rail Schedule

Resource name:	Piraeus Rail Schedule
Resource description	Rail Schedule for the container terminal of Piraeus
Resource provider	Hellenic Port Community System
Access	HPCS registration required
Type of resource	Data service
Type of interface	Web Service (JSON calls)
Facilitating Connector	PS GR HPCS
FLSC	2.2.1.007

Table 15: Resource 2.11: Piraeus Rail Schedule

6.1.15 Resource 2.12: Piraeus Vessel Progress

Resource name:	Piraeus Vessel Progress
Resource description	Percentage of completion of loading/unloading of vessels at the container terminal of Piraeus
Resource provider	Hellenic Port Community System
Access	HPCS registration required
Type of resource	Data service
Type of interface	Web Service (JSON calls)
Facilitating Connector	PS GR HPCS
FLSC	2.2.2.002

Table 16: Resource 2.12: Piraeus Vessel Progress

6.1.16 Resource 2.13: Piraeus Gate Traffic

Resource name:	Piraeus Gate Traffic
Resource description	Number of trucks arriving and exiting the container terminal of Piraeus with real time timestamps
Resource provider	Hellenic Port Community System
Access	HPCS registration required
Type of resource	Data service
Type of interface	Web Service (JSON calls)
Facilitating Connector	PS GR HPCS
FLSC	2.2.3.001

Table 17: Resource 2.13: Piraeus Gate Traffic

6.1.17 Resource 2.14: GLN as a Service geocoding

Resource name:	GLN as a Service geocoding
Resource description	Geocoding based on coordinates or Global Location Reference Number (GLN).
Resource provider	GS1 & PTV
Access	Restricted
Type of resource	Data service
Type of interface	API
Facilitating Connector	PS DE
FLSC	2.2.1.007

Table 18: Resource 2.14: GLN as a Service geocoding

6.1.18 Resource 2.15: Rail Transport Availability

Resource name:	Rail Transport Availability
Resource description	A service providing details on available rail transport services (number of available wagons/TEUs, origin, destination, Estimated Time of Departure, Estimated Time of Arrival) as provided to Cargo Bundling Marketplace from rail operators
Resource provider	TREDIT S.A
Access	restricted
Type of resource	Data service
Type of interface	Data source
Facilitating Connector	Aeolix FENIX Connector
FLSC	2.2.1.007

Table 19: Resource 2.15: Rail Transport Availability

6.1.19 Resource 2.16: Traffic information

Resource name:	Traffic information
Resource description	The service provides real time and forecasted traffic information at the Road Network close to the container terminal and ferry boat Ports of Piraeus. The traffic information includes: speeds, travel times at selected road links and traffic flows at the Roads leading to the container terminal Gates.
Resource provider	CERTH/HIT
Access	Restricted
Type of resource	Data service
Type of interface	API
Facilitating Connector	PS GR Yellow Pages
FLSC	2.2.1.003

Table 20: Resource 2.16: Traffic information

6.1.20 Resource 2.17: T&L Companies Catalogue

Resource name:	T&L Companies Catalogue
Resource description	Catalogue of T&L Companies across Greece. The user, through smart search options, can search for T&L Companies in specific geographical and operational areas using classification tools and keyword search functionalities.
Resource provider	Yellow Pages (Greek T&L Observatory)
Access	registration required
Type of resource	Data service

Type of interface	REST API (JSON payload)
Facilitating Connector	PS GR Yellow Pages
FLSC	2.2.1.012

Table 21: Resource 2.17: Yellow Pages (Greek T&L Observatory)

6.1.21 Resource 2.18: Digital Services Inventory

Resource name:	Digital Services Inventory
Resource description	Inventory of digital T&L services in Greece and abroad. The user can get access to third party digital services to optimize their T&L operations and routines.
Resource provider	Yellow Pages (Greek T&L Observatory)
Access	registration required
Type of resource	Data service
Type of interface	REST API (JSON payload)
Facilitating Connector	PS GR Yellow Pages
FLSC	2.2.1.012

Table 22: Resource 2.18: Digital Services Inventory

6.1.22 Resource 2.19: CO2 Calculation

Resource name:	CO2 Calculation
Resource description	CO2 calculation
Resource provider	NeoGLS
Access	Not restricted
Type of resource	Data service
Type of interface	Web Service API
Facilitating Connector	PS FR
FLSC	2.2.1.011

Table 23: Resource 2.19: CO2 Calculation

6.1.23 Resource 2.20: Vessel manifest and Customs data

Resource name:	Vessel manifest and Customs data
Resource description	Provides the list of loaded goods on a vessel with Customs authorization data. Note: only for IoT shipments
Resource provider	Circle
Access	Restricted (only to authorized customers)
Type of resource	Data service

Type of interface	RESTful API
Facilitating Connector	FENIX connector (Milos Federative Services)
FLSC	2.2.1.008

Table 24: Resource 2.20: Vessel manifest and Customs data

6.1.24Resource 2.21: Vessel unloading list

Resource name:	Vessel loading list
Resource description	Provides the list of containers expected to be unloaded on a specific vessel. Note: only for IoT shipments (UC6), only for intermodal/rail connections (UC7) PSIT2
Resource provider	Circle
Access	Restricted (only to authorized customers)
Type of resource	Data service
Type of interface	RESTful API
Facilitating Connector	FENIX connector (Milos Federative Services)
FLSC	2.2.1.013

Table 25: Resource 2.21 Vessel loading list

6.1.25 Resource 2.22: Submit cargo booking request

Resource name:	Submit cargo booking request
Resource description	Enables the customers of the MTO to submit transport (railway or intermodal) booking requests through a fully-automated M2M interface. The booking request shall contain all information needed to do the transport planning, including e.g. customer booking reference, service type (door-to-door, door-to-terminal, etc.), booking type (import, export), UTI type, UTI status (empty, full), UTI code, cargo weight, etc. A single booking may contain more transport requests. The service makes a formal check on input data and returns a status code indicating if the message is valid or not; the return status also includes an internal unique booking code for further queries (see below).
Resource provider	Circle
Access	Restricted (only to authorized customers)
Type of resource	Data service
Type of interface	
Facilitating Connector	
FLSC	2.2.1.007

Table 26: Resource 2.22 Submit cargo booking request

6.1.26Resource 2.23: Get cargo booking status

Resource name:	Get cargo booking status
Resource description	Enables the customers of the MTO to get up-to-date information about the processing status of a previously-submitted transport booking request. The info request shall contain the internal unique booking code returned at submission time (see above). Returned information contains the customer booking reference and the current booking status (e.g. open, accepted, refused, cancelled, closed, planned, loaded, etc.)
Resource provider	Circle
Access	Restricted (only to authorized customers)
Type of resource	Data service
Type of interface	RESTful API
Facilitating Connector	FENIX connector (Milos Federative Services)
FLSC	2.2.1.013, 2.2.2.013

Table 27: Resource 2.2 Mondelēz Event Service

6.1.27 Resource 2.24: Train composition wagons

Resource name:	Train composition
Resource description	Provides the list of wagons of a train with the loaded containers. Note: only for Hupac trains (through Crosstec connector). Potentially applicable to Fast Corridor
Resource provider	Circle
Access	Restricted (only to authorized customers)
Type of resource	Data service
Type of interface	RESTful API
Facilitating Connector	FENIX connector (Milos Federative Services)
FLSC	2.2.1.009

Table 28: Resource 2.24 Train composition wagons

6.1.28Resource 2.25: Train composition units

Resource name:	Train composition
Resource description	Provides the list of loading units present on the train arriving at the terminal with destination port. The information available on the composition of the train are: Train number, Arrival date, Arrival Terminal, Vehicle wagon combination, Type of load, Weight and length, Content, Presence of ADR goods
Resource provider	Crosstec
Access	Restricted (only to authorized customers)

Type of resource	Data service
Type of interface	RESTful API
Facilitating Connector	FENIX connector (Wolf4EU)
FLSC	2.2.1.009

Table 29: Resource 2.25 Train composition units

6.1.29 Resource 2.26: Train arrival time

Resource name:	Train arrival time
Resource description	This service informs the port of destination about the actual train arrival date/time. Through this information, the port can determine if the loading schedules remain valid, or need to be changed because the announced delay (ETA) has become a non-arrival
Resource provider	Crosstec
Access	Restricted (only to authorized customers)
Type of resource	Data service
Type of interface	RESTful API
Facilitating Connector	FENIX connector (Wolf4EU)
FLSC	2.2.2.001

Table 30: Resource 2.26 Train arrival time

6.1.30 Resource 2.27: Port terminal gate in (only road)

Resource name:	Port terminal gate in (only road)
Resource description	Provides the list of containers accessing the port terminal by road
Resource provider	Circle
Access	Restricted (only to authorized customers)
Type of resource	Data service
Type of interface	RESTful API
Facilitating Connector	FENIX connector (Milos Federative Services)
FLSC	2.2.2.010

Table 31: Resource 2.27 Port terminal gate in (only road)

6.1.31 Resource 2.28: Port terminal gate out (only road)

Resource name:	Port terminal gate out (only road)
Resource description	Provides the list of containers exiting the port terminal by road
Resource provider	Circle
Access	Restricted (only to authorized customers)

Type of resource	Data service
Type of interface	RESTful API
Facilitating Connector	FENIX connector (Milos Federative Services)
FLSC	2.2.2.010

Table 32: Resource 2.28 Port terminal gate out (only road)

6.1.32Resource 2.29: Train ETA

Resource name:	Train ETA
Resource description	Provides the ETA (Estimated Time of Arrival) for trains bound to the port terminal. Note: only for Hupac trains (through Crosstec connector)
Resource provider	Circle
Access	Restricted (only to authorized customers)
Type of resource	Data service
Type of interface	RESTful API
Facilitating Connector	FENIX connector (Milos Federative Services)
FLSC	2.2.2.001

Table 33: Resource 2.29 Train ETA

6.1.33 Resource 2.30: Port terminal gate out (only road)

Resource name:	Port terminal gate out (only road)
Resource description	Provides the list of containers exiting the port terminal by road
Resource provider	Circle
Access	Restricted (only to authorized customers)
Type of resource	Data service
Type of interface	RESTful API
Facilitating Connector	FENIX connector (Milos Federative Services)
FLSC	2.2.2.010

Table 34: Resource 2.30: Port terminal gate out (only road)

6.1.34 Resource 2.31: Inland Terminal Gate in (only rail)

Resource name:	Inland Terminal Gate in (only rail)
Resource description	Provides the list of containers accessing the inland terminal by railway
Resource provider	Circle
Access	Restricted (only to authorized customers)

Type of resource	Data service
Type of interface	RESTful API
Facilitating Connector	FENIX connector (Milos Federative Services)
FLSC	2.2.2.010

Table 35: Resource 2.31: Inland Terminal Gate in (only rail)

6.1.35 Resource 2.32: Inland Terminal Gate in (only road)

Resource name:	Inland Terminal Gate in (only road)
Resource description	This service provides the exact date and time of delivery of cargo from ports to the terminal (road to rail), which is useful for planning the loading of trains to Northern Europe via the Rhine-Alpine corridor
Resource provider	Crosstec
Access	Restricted (only to authorized customers)
Type of resource	Data service
Type of interface	RESTful API
Facilitating Connector	FENIX connector (Wolf4EU)
FLSC	2.2.2.010

Table 36: Resource 2.32: Inland Terminal Gate in (only road)

6.1.36 Resource 2.33: Train ETA

Resource name:	Train ETA
Resource description	This service concerns the section of the Rhine-Alpine corridor for traffic coming from Northern EU terminals towards the node of Novara. The data include the forecast train arrival at Novara terminal, which are useful to organize operations and provide information to the port of destination for the arrival of goods
Resource provider	Circle
Access	Restricted (only to authorized customers)
Type of resource	Data service
Type of interface	RESTful API
Facilitating Connector	FENIX connector (Wolf4EU)
FLSC	2.2.2.001

Table 37: Resource 2.33: Train ETA

6.1.37 Resource 2.34: Inland Terminal Gate out (only rail)

Resource name:	Train ETA
Resource description	This service concerns the section of the Rhine-Alpine corridor for

	traffic coming from Northern EU terminals towards the node of Novara. The data include the forecast train arrival at Novara terminal, which are useful to organize operations and provide information to the port of destination for the arrival of goods
Resource provider	Circle
Access	Restricted (only to authorized customers)
Type of resource	Data service
Type of interface	RESTful API
Facilitating Connector	FENIX connector (Wolf4EU)
FLSC	2.2.2.009

Table 38: Resource 2.34: Train ETA

6.1.38 Resource 2.35: Inland Terminal Gate out (only road)

Resource name:	Train ETA
Resource description	This service concerns the section of the Rhine-Alpine corridor for traffic coming from Northern EU terminals towards the node of Novara. The data include the forecast train arrival at Novara terminal, which are useful to organize operations and provide information to the port of destination for the arrival of goods
Resource provider	Circle
Access	Restricted (only to authorized customers)
Type of resource	Data service
Type of interface	RESTful API
Facilitating Connector	FENIX connector (Wolf4EU)
FLSC	2.2.2.009

Table 39: Resource 2.35: Train ETA

6.1.39 Resource 2.36: E-seal status

Resource name:	E-seal status
Resource description	Provides the status of the e-seal of a given container
Resource provider	Circle
Access	Restricted (only to authorized customers)
Type of resource	Data service
Type of interface	RESTful API
Facilitating Connector	FENIX connector (Milos Federative Services)
FLSC	2.2.2.002

Table 40: Resource 2.36: Train ETA

6.1.40 Resource 2.37: BRU ground handler gate capacity

Resource name:	BRU ground handler gate capacity
Resource description	Visibility for trucking companies coming from MPX to BRU on the available gate capacity at a BRU handling agent
Resource provider	BRU ground handler via BRUcloud platform
Access	restricted
Type of resource	Data service
Type of interface	Web Service (JSON calls)
Facilitating Connector	PS IT or PS BE connector
FLSC	2.2.1.10

6.2 KPI driven orchestration tools for corridor management solutions

6.2.1 Resource 3.1 T&L Dashboard (KPIs and Statistics)

Resource name:	T&L Dashboard (KPIs and Statistics)
Resource description	T&L sector statistics and values. The user can access visualizations of transport datasets from acknowledged sources, compare key values across modes and get measurements of key performance indicators for selected operations.
Resource provider	Yellow Pages (Greek T&L Observatory)
Access	registration required
Type of resource	Data service
Type of interface	REST API (JSON payload) / Dashboard UI?
Facilitating Connector	PS GR Yellow Pages
FLSC	2.2.2.002; 2.2.3.002

Table 41: Resource 3.1: T&L Dashboard (KPIs and Statistics)

6.2.2 Resource 3.2: CARGO2RAIL– Terminal Dashboards

Resource name:	Terminal Dashboards
Resource description	BI applied to optimize management operations at the terminal.
Resource provider	Terminal of Júndiz
Access	registration required
Type of resource	Data service
Type of interface	Dashboard UI

Facilitating Connector	CARGO2RAIL
FLSC	2.2.1.007; 2.2.2.007

Table 42: Resource 3.2: CARGO2RAIL– Terminal Dashboards

6.2.3 Resource 3.3 Noscifel

Resource name:	Noscifel
Resource description	Noscifel is an innovative multimodal interoperable platform for the transport of goods. It provides services for: Appointment management for transporters –shippers – receivers, CO2 and GHG (greenhouse effect) calculation platform, Traceability of goods, Management of a bundling and unbundling of goods platform, Electronic archiving by a digital electronic safe service
Resource provider	NeoGLS
Access	restricted
Type of resource:	Data service
Type of interface:	API
Facilitating Connector:	PS FR
FLSC	2.2.2.1, 2.2.2.2, 2.2.2.5, 2.2.2.5,2.2.2.6, 2.2.2.7, 2.2.2.11, 2.2.3.1, 2.2.3.2, 2.2.3.5, 2.2.3.5, 2.2.3.6, 2.2.3.7, 2.2.3.11

Table 43: Resource 3.3 Nosifel

7. Integration examples of corridor service resources

This section presents 2 integration examples to illustrate the interplay and data valorisation in cooperative scenarios of different Fenix Federation resources.

7.1 Integration example 1: Intermodal routing and planning

This example illustrates the application of the resources:

- Intermodal planning service
- Train schedule data TX
- Train schedule data Hupac
- Train capacity data TX
- GLN as a service

Integration setup

The integration is geared towards intermodal routing and planning functionality. It builds upon a cross pilot interplay of resources facilitated in the pilot site Rhine-Alpine. Train schedule data exposed by 2 pilot site connectors is used to enrich the intermodal routing and planning service. The intermodal planning service interacts through the pilot site connector with the train capacity data as well as with the GLN, as a service geocoding.

Enabled use cases:

- Calculation of relevant transport chain alternatives along the corridor taking different transport modes into account
- Estimation of KPIs lead time, monetary and environmental cost transport for alternatives
- Optimized assignment of transport orders to intermodal transport services available considering time restrictions, costs and capacities
- Integration of GLN codes to geocoding

7.1.1 Use Case Calculation of transport alternatives and KPIs

This functionality is to search for intermodal transport chains between locations for a certain start or end time, respecting given chain composition restrictions (e.g. mode, operator). Results are based on Intermodal data such as digital map data and intermodal schedules.

The routing request returns a set of composed transport chains between these two locations (addresses or geo-locations like GLN), which match the applied routing restrictions for a certain starting time.

A transport chain can consist of a single or multiple transport leg elements. The transport chain can include only a single or multiple transport modes.

Transport modes supported are:

- Road
- Rail
- Inland water ways (Barge)
- Air
- Deep sea
- Short sea

Routing restrictions supported are:

- Excluded transport modes
- Excluded transport service operators
- Excluded terminals
- Accompanied transport
- Unaccompanied transport
- Maximum costs allowed
- Maximum distance for alternative terminals

A routing result can either be based on a road routing or a timetable-based transport service or a combination of both. Depending on the intermodal schedules available, the intermodal routing result set consists of a single or multiple transport chain results.

Transport chain results consider the given start time of the request and deliver different chain alternatives accordingly. Each alternative presented in the results consists of a unique service composition (with respect to chain composition and operator).

Each transport chain proposal results in itinerary and Key Performance Indicator (KPI) (km, travel-time and costs - € and CO_2. Both based on given data sets or data models.

Input

- Origin address (with coordinates)
- Destination address (with coordinates)
- Starting time
- Restrictions (optional)

Output

- List of routes (= transport alternative), each of them consisting of a sequence of leg descriptions containing
    - Station (Origin address, Terminal or destination address)
    - Results concerning the inbound leg to the actual station such as
        - Mode
        - Regular service
        - Times (Arrival time, handling time, departure time, …)
        - costs
        - KPIs (distance, duration, emission, …)

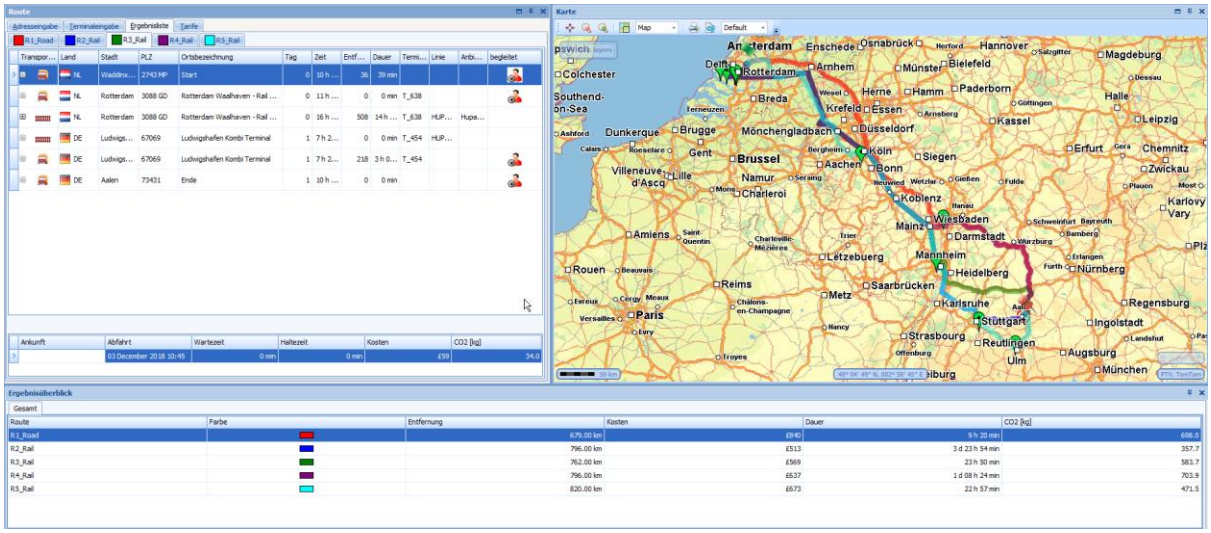

Figure 9: Determination of transport alternatives including KPIs

7.1.2 Use Case Optimised planning of transport orders based on available capacity

The planning functionality allocates given transport orders to transport services in an optimized way respecting given capacity limitations.

Required input are transport orders including calculated transport chain alternatives. Transport chain alternatives can originate from the previously described use case or some other source of the same content format. For the proposed transport services within the calculated transport chains alternatives, costs and maximum available capacity per voyage have to be given.

The server request triggers a solver process consisting of model creation and model solving. The model creation step spans a network of transport services and costs described by the transport chain alternatives and the given available capacities. In the second process step, the model is being solved.

The solver solution provides an optimized allocation of orders to transport services by minimizing costs under the constraints of not exceeding the given capacity limitations of the transport services.

Input

- List of transport orders, each consisting of
  - Order ID
  - No of transport units (to be checked against capacity of voyage)
  - Pickup-Location with coordinate
  - Delivery Location with coordinate
  - Earliest and latest pickup date and time
  - Earliest and latest delivery date and time
  - Order specific restrictions (optional)

Output

For each transport order, a

- List of valid transport alternatives, each of them consisting of a sequence of leg descriptions containing
  - ID of regular transport service (empty, if mode of transport = road leg)
  - Terminal from
  - Terminal to
  - Mode of transport

- Departure date and time at Terminal from
- Road leg costs (if mode of transport = “road leg”, not used if timetable-based road transports are modelled)

List of voyages, used in transport alternatives above, each of them containing

- ID of regular transport service (empty, if mode of transport = road leg)
- Terminal from
- Terminal to
- Mode of transport
- Departure date and time at Terminal from
- Available capacity
- Costs

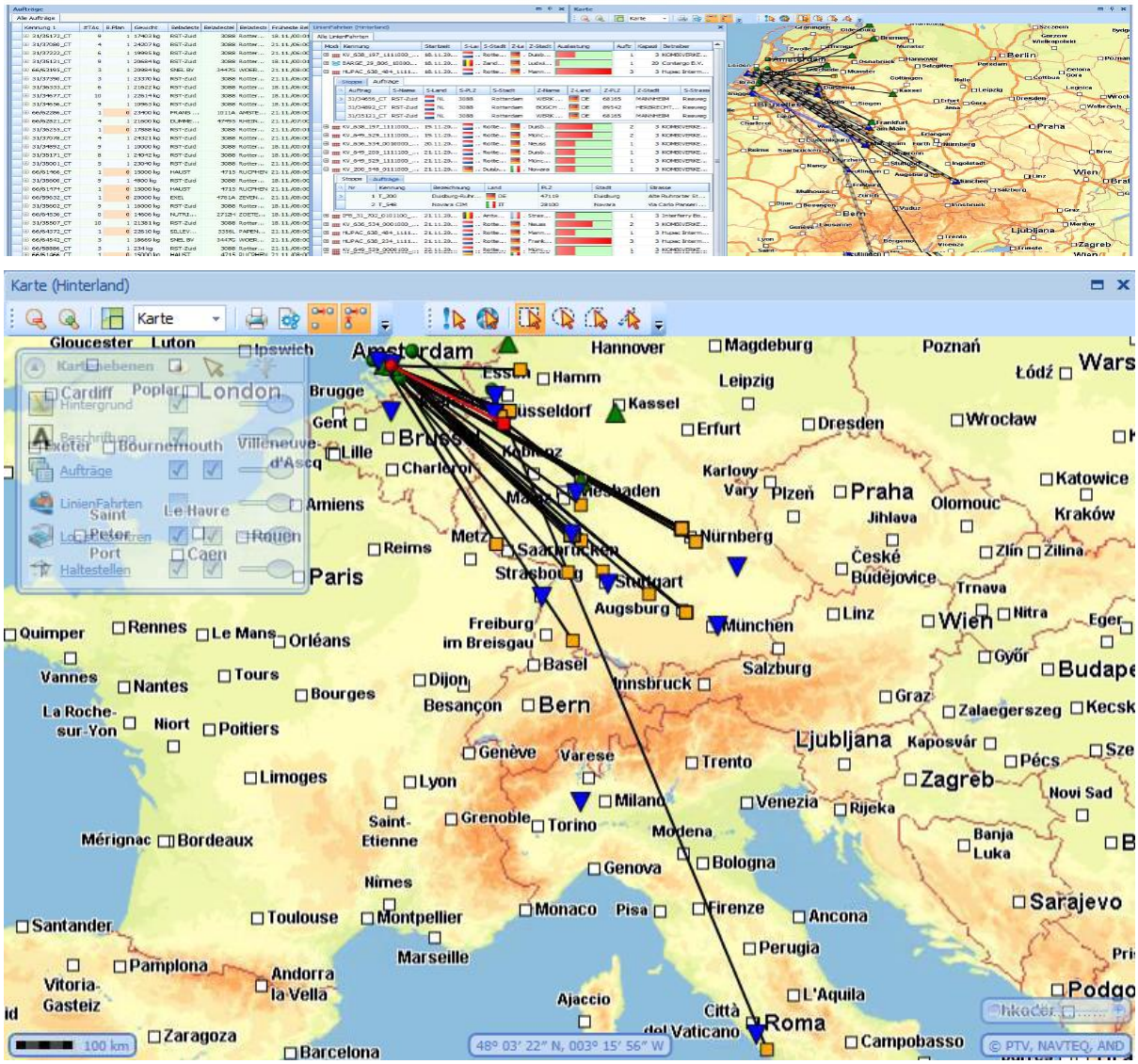

Figure 10: Optimised transport order planning to intermodal schedules

7.2 Integration example 2: NOSCIFEL

NOSCIFEL is an innovative multimodal interoperable platform for the transport of goods. It provides an innovative and modular platform for the management of the transport of goods. Services offered via NOSCIFEL such as:

- Slot reservation: for example, for a refinery, this service allows the carrier to reserve time slots to fill their tankers. The refinery provides the list of time slots available per dock and the carrier can visualize this information.
- CO2 calculation: this service is a AEOLIX toolkit service. It takes in input information on the transport for which the customer wants to perform a CO2 calculation and in output, this service provides the result of the CO2 calculation.
- Transport orders management: allows the carrier to manage the transport orders, to follow the progress (loading, delivery, position of barges or truck) and to inform the consignee about the arrival time of the barge or truck.

7.2.1 Use Case CO2 and GHG

The CO2 and GHG calculation platform allows a carrier to calculate the cost of CO2 in stages or all the way to delivery and by product transported.

This calculation can be done in deferred time using the CO2 calculator, indicating the information related to transportation. It can also be done automatically in the appointment as imaging module with a distance calculation that based on fleet monitoring data.For this service, the CO2 calculation service of the NOSCIFEL platform awaits information to calculate the CO2 balance sheet and provide the result.

The tool manages the following:

- List of transport types
- Standard vehicle referential for each type of transport
- CO2 calculation rules: French rules and European standard NE16258

In order to generate a result, the CO2 tool must receive the following data:

- List of goods (Id, weight or volume)
- List of the steps of the transport with
    - Type of transport (road, sky, maritime, inland, rail)
    - Type of vehicle (standard, company or real consumption)
    - Place of departure / arrival or distance of transport
    - OPTIONAL: Total weight or volume of goods transported

After the CO2 calculation, NOSCIFEL can provide the following information:

- CO2 Index value
- NE 16258 Index
    - GHG upstream + use
    - GHG use
    - Energy upstream + use
    - Energy use
- GHG emissions
    - Value

- % linked to the fuel
- % linked to the storage
- % linked to the vehicle
- % linked to the infrastructures

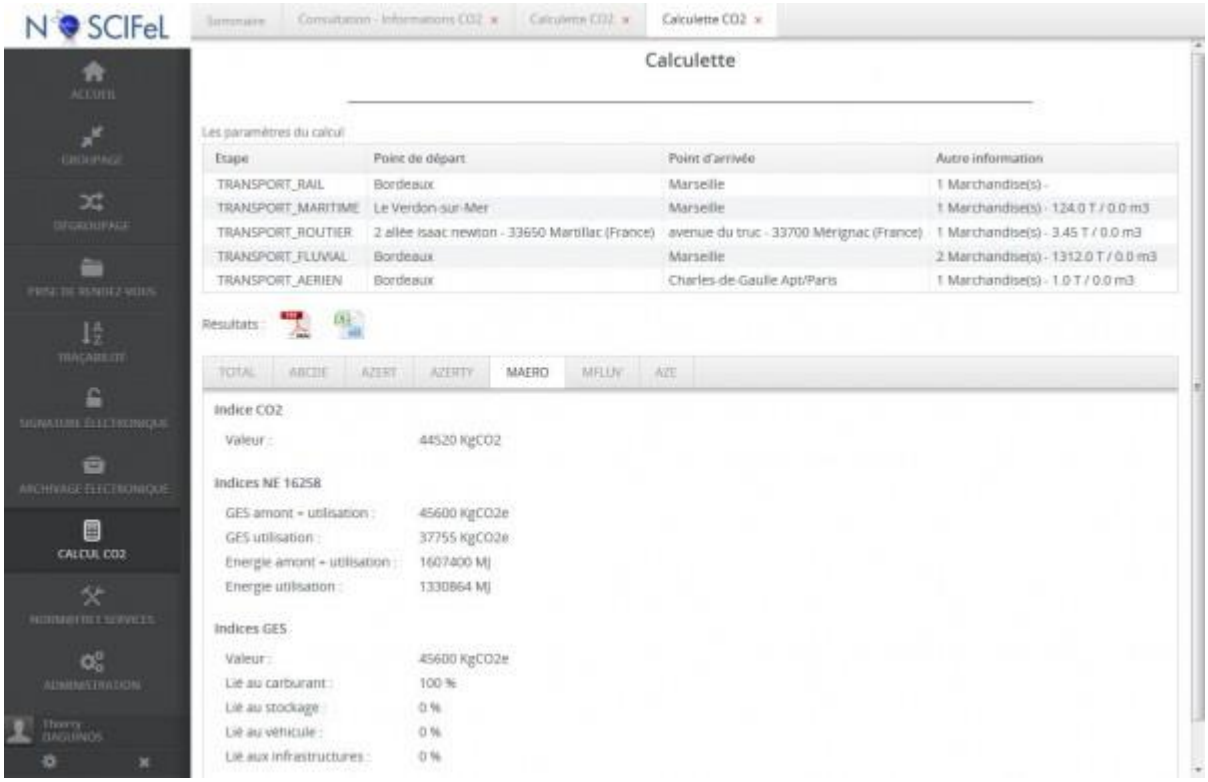

Figure 11: NOSCIFEL CO2 and GHG calculation

7.2.2 Use Case Slot management

Dynamic status slot verification: Optimization of cargo transport to Terminals by improving predictability of dock availability in time. Often truck drivers have to wait for upon their arrival at the Terminal. This service is meant to optimize the planning for (un)loading trucks at Terminals.

Optimization of cargo transport to Terminals by slot reservation. The implemented UC proposes the slot reservation at a given terminal (including date and time) to achieve this optimisation.

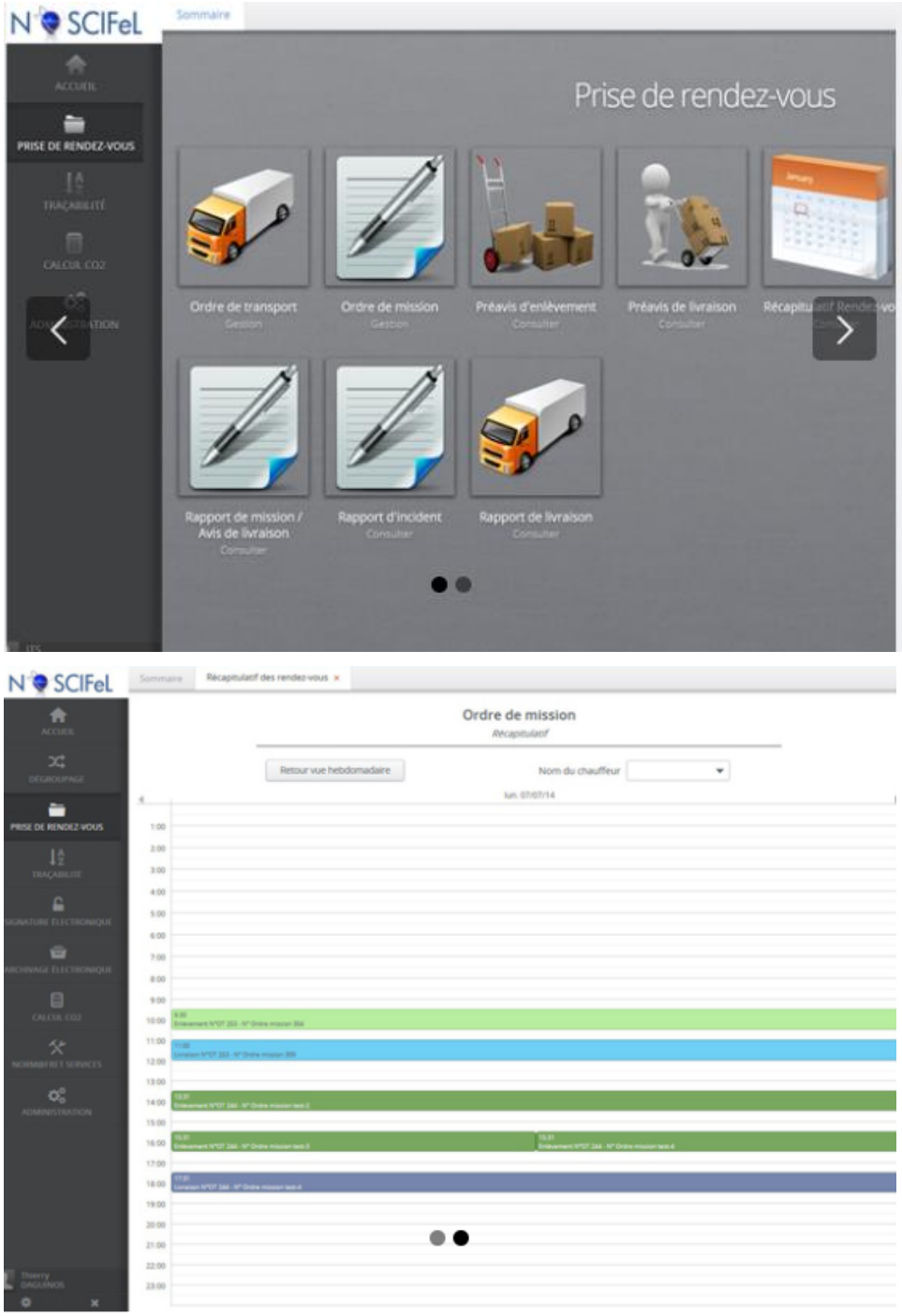

Figure 12: NOSCIFEL slot management

8. CONCLUSIONS

This deliverable provides insight into the structurization of FENIX services for corridor management. Services are clustered into 3 categories:

- Transport and logistics planning services suite as a service,
- Transport and logistics planning and execution management, and
- KPI driven orchestration tools for corridor management solutions.

Following a bottom-up approach, FENIX A3.3 reached out to the FENIX pilot sites in order to collect exposed resources by the pilot sites (exposed = exposed to the FENIX Federation).

As previously stated, the pilot sites had to face during the progression of the project the COVID – 19 pandemic, therefore, not all pilot sites are by end of 2021 fully deployed yet.

For the currently applied services and database resources of the pilot sites, a total number of 42 exposed resources could be collected by December 2021. In the near future, more pilot sites will roll out additional data and service resources that will be added to the current list.

An overview of the exposed resources is presented in the figure 13.

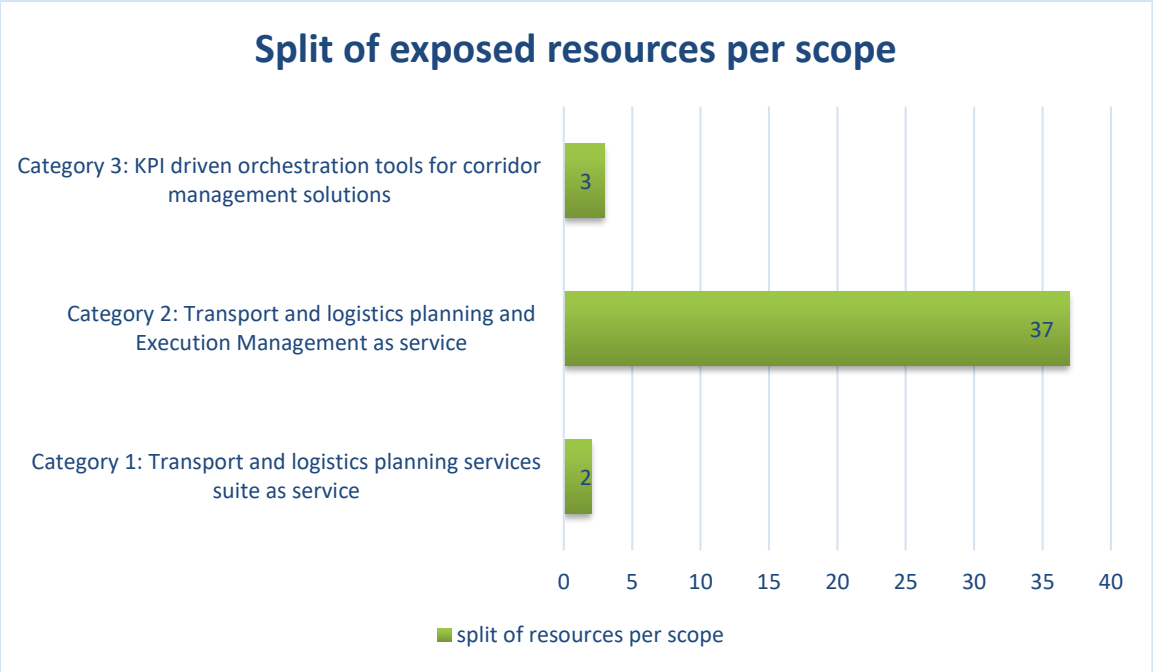

Figure 13: Split of exposed resources per scope

Main analytical interpretation of the figure 13 is that both categories "Transport and logistics planning services suite as a service" (2) and "KPI driven orchestration tools for corridor management solutions" (3) are significantly outnumbered by "Transport and logistics planning and execution management" (37). This is on the one hand due to the fact that, for the categories KPI driven orchestration tools for corridor management solutions and Transport and logistics planning services suite as a service a significantly higher level of complexity can be assumed. For instance, a planning suite encapsulates several functionality aspects

The more focussed single services of "Transport and logistics planning and execution management" focus on specific data and functionality and are therefore more likely to be shared and exposed.

This observation is underlined by the split structure of resource categories exposed. The following figure visualizes the split of exposed FENIX resources per category:

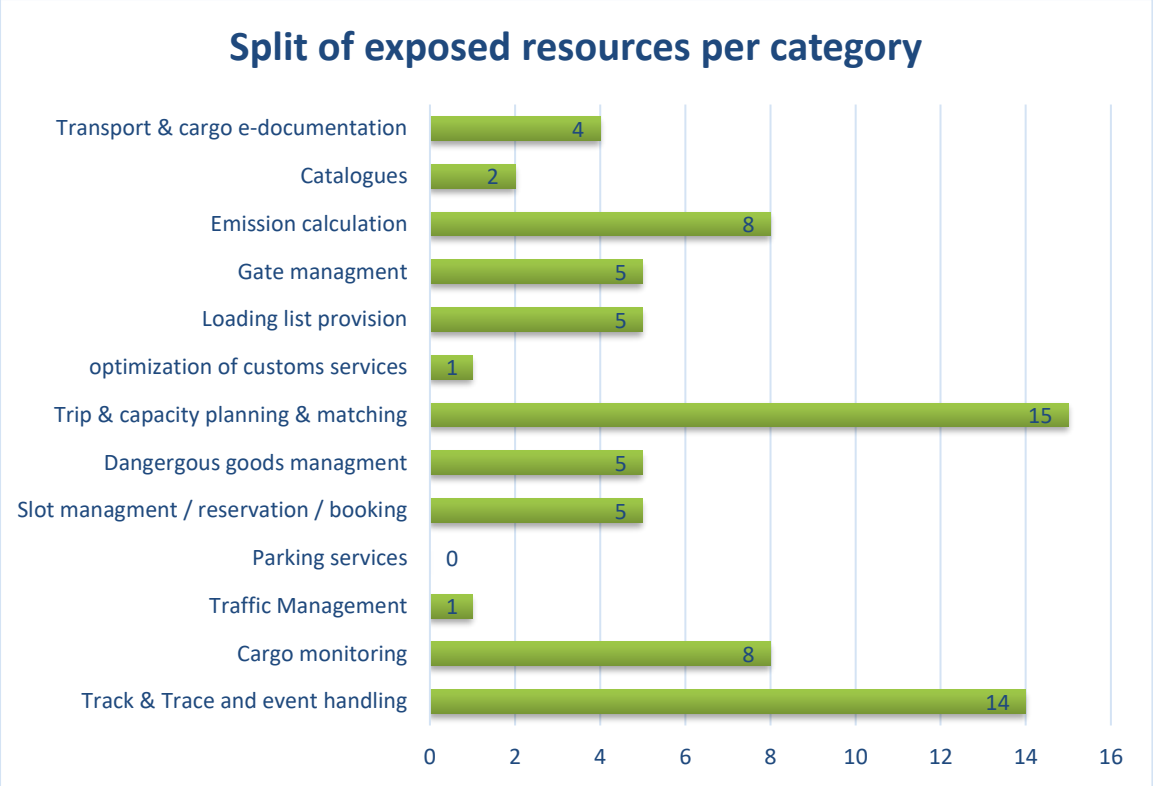

Figure 14: Split of exposed resources per category

Services and dataset resources in the field of event, trip, cargo monitoring and emission calculation represent the top-4 counted categories. One can assume, that these categories include data and services, which are typically useful to be exchanged along with other stakeholders in the information chain.

A second observation is the fact that, except for parking services for all categories, exposed services are offered by the pilot sites.

Overall, a wide set of exposed services and data set could be collected for the different pilot sites. These resources can be used to create new or to enrich existing offering along the corridors. As more resources will become available over time, exposed data and services will valorize even more, promoting collaboration and digitalization

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- FENIX Deliverable D4.1.1
- FENIX Deliverable D5.1
- FENIX Deliverable D6.5.1