Contract No. H2020 – 826172

SEMANTICS FOR PERFORMANT AND SCALABLE INTEROPERABILITY OF MULTIMODAL TRANSPORT

D2.3 Requirements for an IF architectural design (F-REL)

Due date of deliverable: 30/04/2020

Actual submission date: 17/06/2020

Leader/Responsible of this Deliverable: CEFRIEL

Reviewed: Y

Document status		
Revision	**Date**	**Description**
1	10/06/2020	First complete draft
2	17/06/2020	Final version after TMC approval

Project funded from the European Union's Horizon 2020 research and innovation programme		
Dissemination Level		
PU	Public	X
CO	Confidential, restricted under conditions set out in Model Grant Agreement	
CI	Classified, information as referred to in Commission Decision 2001/844/EC	

Start date of project: 01/12/2018   Duration: 25 months

EXECUTIVE SUMMARY

This deliverable reports about requirements gathering related to two different topics: the integration of SPRINT tools inside the overall architecture being developed by the CONNECTIVE project, and the relationship between the Interoperability Framework and the National Access Points.

The requirements coming from the CONNECTIVE project represent the best of our knowledge at the time of writing and aim at obtaining an F-Rel version of the SPRINT Interoperability Framework which will be better aligned with the work being carried out in parallel in CONNECTIVE.

The National Access Points are catalogues of dataset pertaining to Safe and Secure Truck Parking's (SSTP), Real Time Traffic Information (road) (RTTI), Safety Related Transport Information (road) (SRTI) and Multimodal Travel Information (MMTIS). The implementation of such catalogues has been mandated by the EU Delegated Regulations 2017/1926, 885/2013, 886/2013 and 2015/962. Each member state must implement its own NAP, and all the transport operators are obliged to contribute. Such catalogues will become a key data source in the next years, and their role clearly overlaps to some of the features provided by the Interoperability Framework. We, therefore, decided to analyze different existing NAPs as well as existing initiatives aiming at improving metadata interoperability between NAPs, with the aim of finding requirements pertaining to the different roles of the IF with respect to the NAPs themselves.

Abbreviation	Description
API	Application Programming Interface
DCAT	Data Catalogue vocabulary
DCAT-AP	DCAT Application Profile for data portals in Europe
DMA	Data Market Austria
EU	European Union
GA	Grant Agreement
GTFS	General Transit Feed Specification
H2020	Horizon 2020 framework programme
IdP	Identity Provider
IDSCP	International Data Spaces Connector Protocol
IF	Interoperability Framework
IP	Innovation Programme
IT	Information Technology
ITS	Intelligent Transportation System
JU	Shift2Rail Joint Undertaking
MaaS	Mobility as a Service
NAP	National Access Point
OWL	Web Ontology Language
RDF	Resource Description Framework
RDFS	RDF Schema
S2R	Shift2Rail
TSP	Transport Service Provider
W3C	World Wide Web Consortium

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

1. INTRODUCTION

This report collects the final set of requirements for the F-REL Interoperability Framework architecture design. It includes the outputs from Tasks 2.1-2.3, collecting requirements from the active Shift2Rail IP4 projects and the analysis of the National Access Points.

The document is divided into two main sections. The first section about the requirements analysis related to different aspects to be taken into account while developing the next version of the SPRINT Interoperability Framework. Such requirements have been collected through a series of joint meetings together with the CONNECTIVE project, which is leading the development of the Interoperability Framework.

The last section is dedicated to the analysis of how the Interoperability Framework can relate to the National Access Points. We will document the similarities found in different existing NAP implementations, and we will report about the requirements whose implementation will lead to an IF which will be able to either play the role of a NAP, ease the contributions to existing NAPs by Transport Service Providers, or allow aggregating data coming from multiple NAPs.

2. INTEROPERABILITY FRAMEWORK REQUIREMENTS FROM OTHER SHIFT2RAIL PROJECTS

This section describes the requirements collected by the SPRINT project while interacting with other Shift2Rail projects. Due to the different timelines of the projects, some of the requirements which will be described are generic ideas about how the Shift2Rail IP4 ecosystem and the Interoperability Framework could work in the future, while other describe functionalities which have been fully analyzed and are already planned to be implemented in F-Rel.

2.1 THE REQUIREMENTS COLLECTION PROCESS

The requirements described in this document have been collected through a series of dedicated meetings, each one focusing on a specific aspect of the Interoperability Framework:

- general overview and development plan alignment;
- which information should be required to join the IF ecosystem;
- which asset categories/types should be managed by the Asset Manager;
- definition of user roles;
- introduction of the Identity Provider as a new component for the platform.

The main contributor for the description of the landscape of the Interoperability Framework is the CONNECTIVE project, which is leading the development of such platform and which requested a set of features to be implemented by the SPRINT project. Since the maturity of the IF is still quite low, some of the requirements have been modified during the time, and are likely to change in the future to adapt to the future status of the research efforts. Therefore, the requirements described in this section represent the best of SPRINT knowledge up to this moment. Any change requested by CONNECTIVE will be described and documented in later deliverables.

2.2 COMMON IDENTITY MANAGEMENT

At the time of writing, three components of the IF provide a Web-based user interface: the Operator Portal, the Asset Manager and the CMMP. As each of those components has its authentication and authorization system, it became clear that this can lead to an overall system which could easily become misconfigured. The CONNECTIVE project, therefore, proposed to modify each of the aforementioned components to leverage on the features of an Identity Provider, centralizing authentication and possibly also authorization. Figure 1 reports a common case of how an Identity Provider is used for service authentication. Before accessing the desired service, the consumer must authenticate himself using the Identity Provider (IdP). Once the IdP successfully authenticates him, it sends the consumer a token which can be sent to the desired service. When the service receives the token, it sends it to

the IdP, and if the IdP validates the token then the user is considered as valid also for the service.
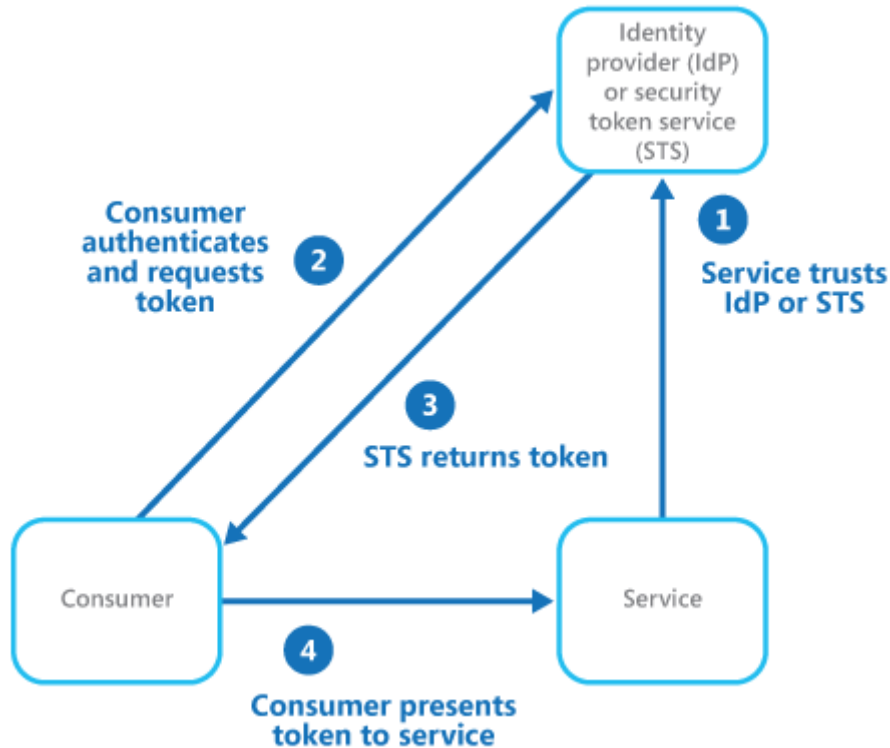
Figure 1: Common usage of an Identity provider

The CONNECTIVE project already selected the specific solution to provide the IdP and will deploy and configure a RedHat Keycloak server on their premises which will be shared among all the IF components. At the time of writing, no further details have been provided about the specific protocol which will be used for authentication and how the authorization information will be conveyed.

R-CONN-1: integrate the authentication and authorization mechanisms of the Asset Manager to leverage on the existing Identity Provider. The IdP will be provisioned and configured by the CONNECTIVE project.

R-CONN-2: Converters SHALL provide the option of using the IdP to authenticate the users and to enforce authorization policies.

R-CONN-3: the Collaborative ontology engineering tool SHALL provide the option of using the IdP to authenticate the users and to enforce authorization policies.
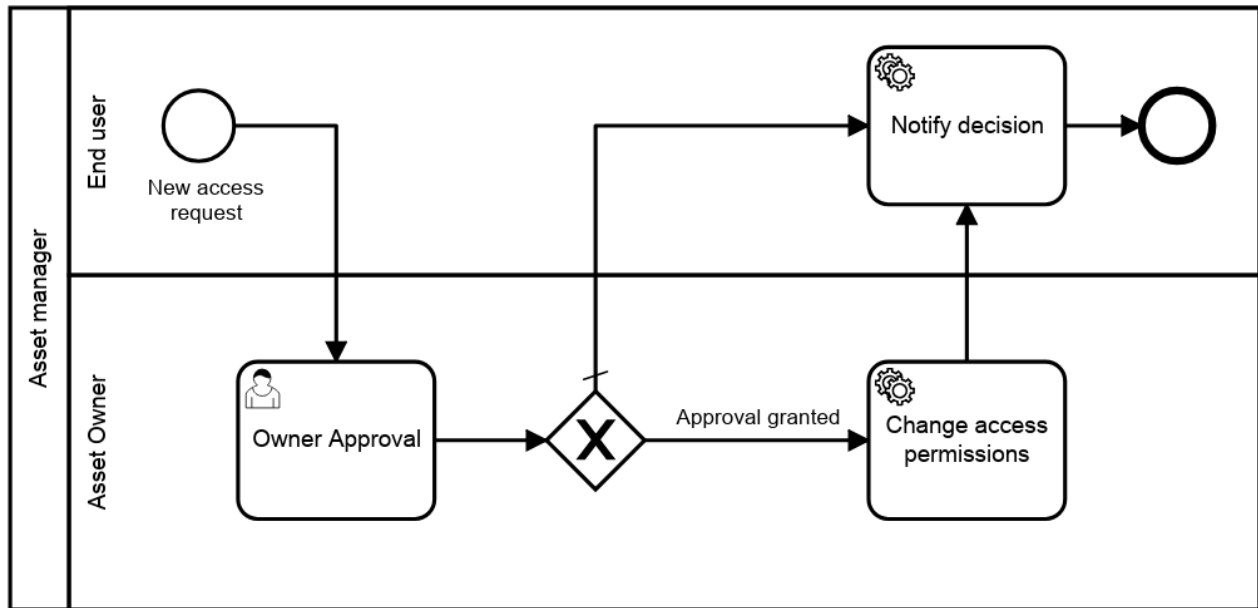
2.3 AUTHENTICATION AND AUTHORIZATION

The two applications provided by the Asset Manager, like also the CMMP and Operator Portal, are meant to be accessed by various classes of users. The joint work between SPRINT and CONNECTIVE identified the following roles to be implemented inside the IF ecosystem:

- **Administrator**: They have administrator's permission. They can access the whole system to test any functionality or control any system's problem
- **Assistants**: they will be in charge to check if anyone is who he says. Moreover, some users can have problems to register or any doubt with any functionality, and they need someone to resolve those doubts.
- **Asset type responsible**: the Asset Manager is able to store many different asset types, and assessing the quality of each description can require specific knowledge of part of the transport and service domain. To this extent, the CONNECTIVE project proposed to create this role, which is in charge of the metadata quality assessment for a specific asset type.
- **Transport Service Providers (TSP)**: users playing this role are officially entitled by their companies to provide service descriptions. They play the role of contributors to the ecosystem, and their aim is to advertise their services through the platform.
- **Maas Operators**: users belonging to this role are mainly interested in obtaining information about the services offered by the various TSPs, with the purpose of accessing them and integrating them with their systems.

All those roles are expected to be implemented inside the Identity Provider so that it will be possible for each of the platform components of the IF to authorize a request coming from a specific user.

Once an asset has been approved for publication by the Asset type responsible person, it becomes visible inside the Asset Manager Store. Since each asset owner may have his policy to disclose the information contained, SPRINT and CONNECTIVE projects agreed on a "request for access" process to be implemented inside the Asset Manager. The expected behaviour of the Store is to let all the users see the DCAT-AP information of all the assets. Those metadata contain basic information, providing a brief textual description of the asset, and stating its version and owner. The complete metadata of the asset will be initially hidden, and the user will be forced to perform an explicit request. Such a request will trigger a process, whose first version is depicted in Figure 2.

Figure 2: BPMN process modelling access requests to assets

To summarize, this is the list of requirements pertaining to "Authentication and Authorization":

R-CONN-4: the lifecycle management processes deployed in the Asset Manager MUST take into consideration the existence of the aforementioned four roles.

R-CONN-5: the authorization policies to be enforced by the Asset Manager MUST take into consideration the existence of the aforementioned four roles.

R-CONN-6: In the Asset Manager Publisher, a TSP MUST be able to access and edit (according to the lifecycle process) all his assets, and MUST NOT see any other "private" asset owned by any other TSP.

R-CONN-7: in the Asset Manager Store, any user (either TSP or MaaS operator) MUST be able to see the "header" of all the published assets. Such header includes basic information and the usage policy.
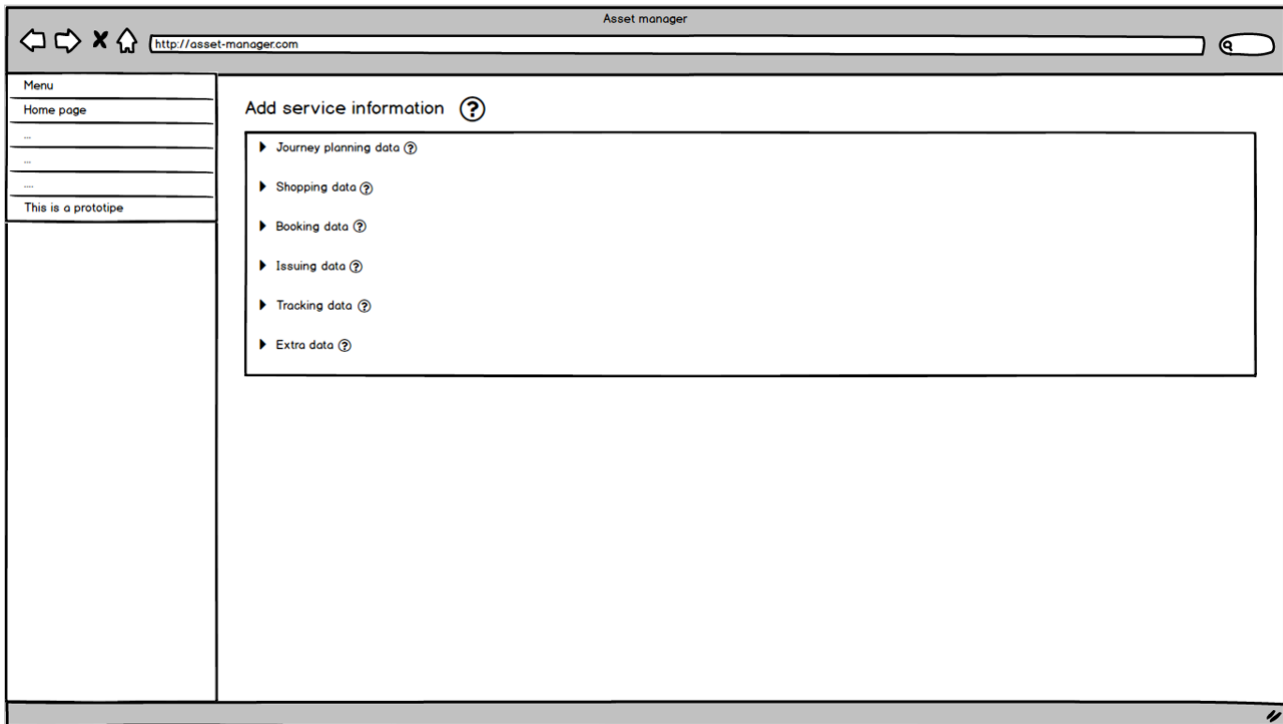
R-CONN-8: in the Asset Manager Store, users MUST activate a request process to gain access to the full content of an asset owned by another party.

2.4 ASSET TYPES

As previously described in past SPRINT deliverables, the role of the Asset Manager in the overall IP4 Ecosystem is to provide a catalogue of pointers to resources which can directly or indirectly ease building an interoperability solution. Such resources can be divided into "types", or "classes", and each type can be described by a different set of metadata. The first task during the collaboration between CONNECTIVE and SPRINT was to identify the first set of asset types to be implemented inside the Asset Manager. This initial set of asset types (also depicted in the mockup shown in Figure 3) allow describing the services offered by a Transport Service Provider:

- Booking

- Issuing
- Journey Planning
- Tracking
- Extra data
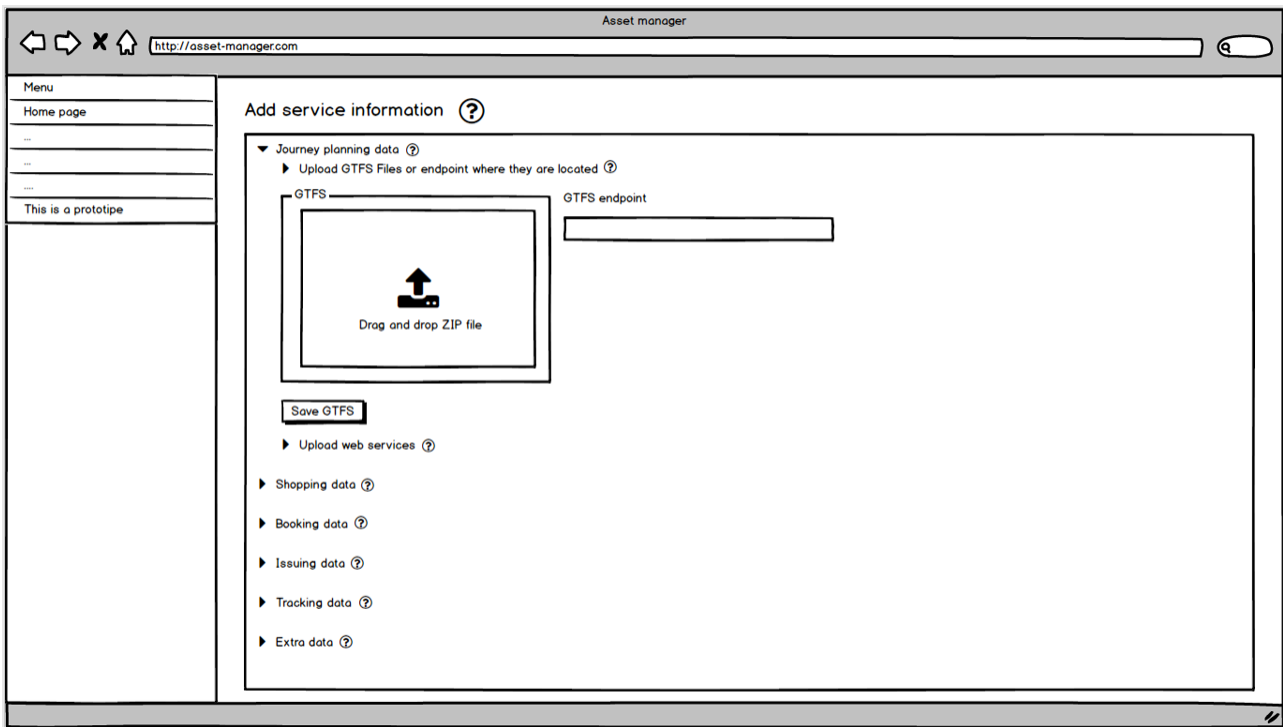
Figure 3: Mockup of the TSP registration form

Such asset types define what a TSP is offering to the IP4 Ecosystem, but they all share an important feature: they all require providing a file or a service descriptor. Such file or service descriptor can be either uploaded directly or can be a remote URL.

So far, the only asset type whose content has been defined by the Connective project is the "Journey planning" type. The Asset Manager contributor is required to either to provide GTFS data (either by uploading the dataset or by stating the URL where the dataset can be retrieved from, as shown in Figure 4) or to provide a service descriptor in a Swagger, WSDL or SoapUI format (as described in Figure 5). The service description is then complemented by a DCAT-AP-like header to capture basic information like the asset version, its description and contact information about who is publishing the asset.
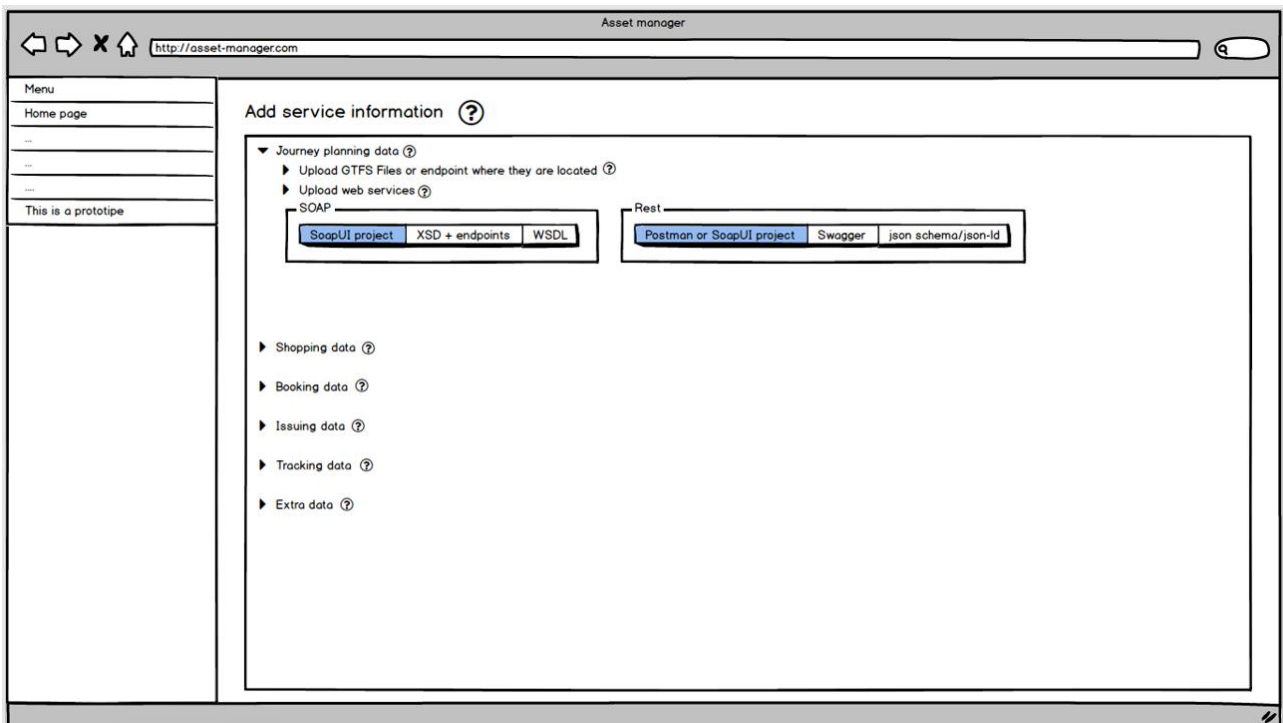
Figure 4: Journey planning GTFS upload

Figure 5: Journey planning service description

To summarize the requirements:

R-CONN-9: the Asset Manager Publisher MUST allow users to contribute Booking, Journey planning, Ticketing, Trip tracking and Extra data asset types. The forms and their specific data and metadata will be defined in conjunction with the CONNECTIVE project, according to their specific needs.

2.5 LIFECYCLE MANAGEMENT

A first proposal of the governance structure and lifecycle process for the Interoperability Framework has already been documented in D5.1 of the GoF4R project. The governance structure is split between "Strategic governance" and "Technical governance" (as shown in Figure 6), where the latter is entitled to check the quality of IF assets and to approve their publication on the Asset Manager.
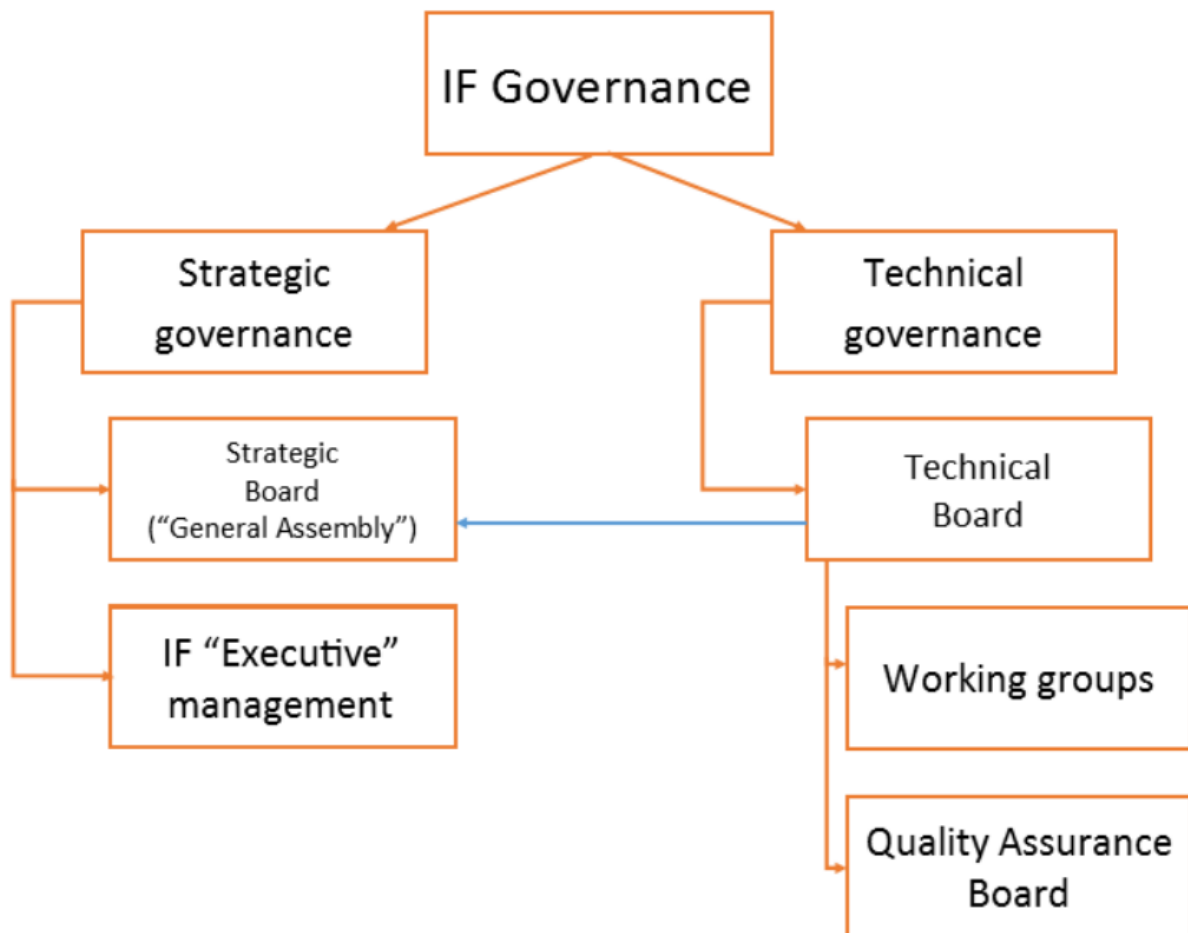
Figure 6: IF governance structure as proposed by GoF4R project

The same GoF4R deliverable also provides the lifecycle management process described by Figure 7, which governs the publication process of a new asset and how it becomes available in the Asset Manager Store. The process defines a quality assurance step and an

overall technical evaluation of the asset, whose responsibilities are assigned to two different groups.
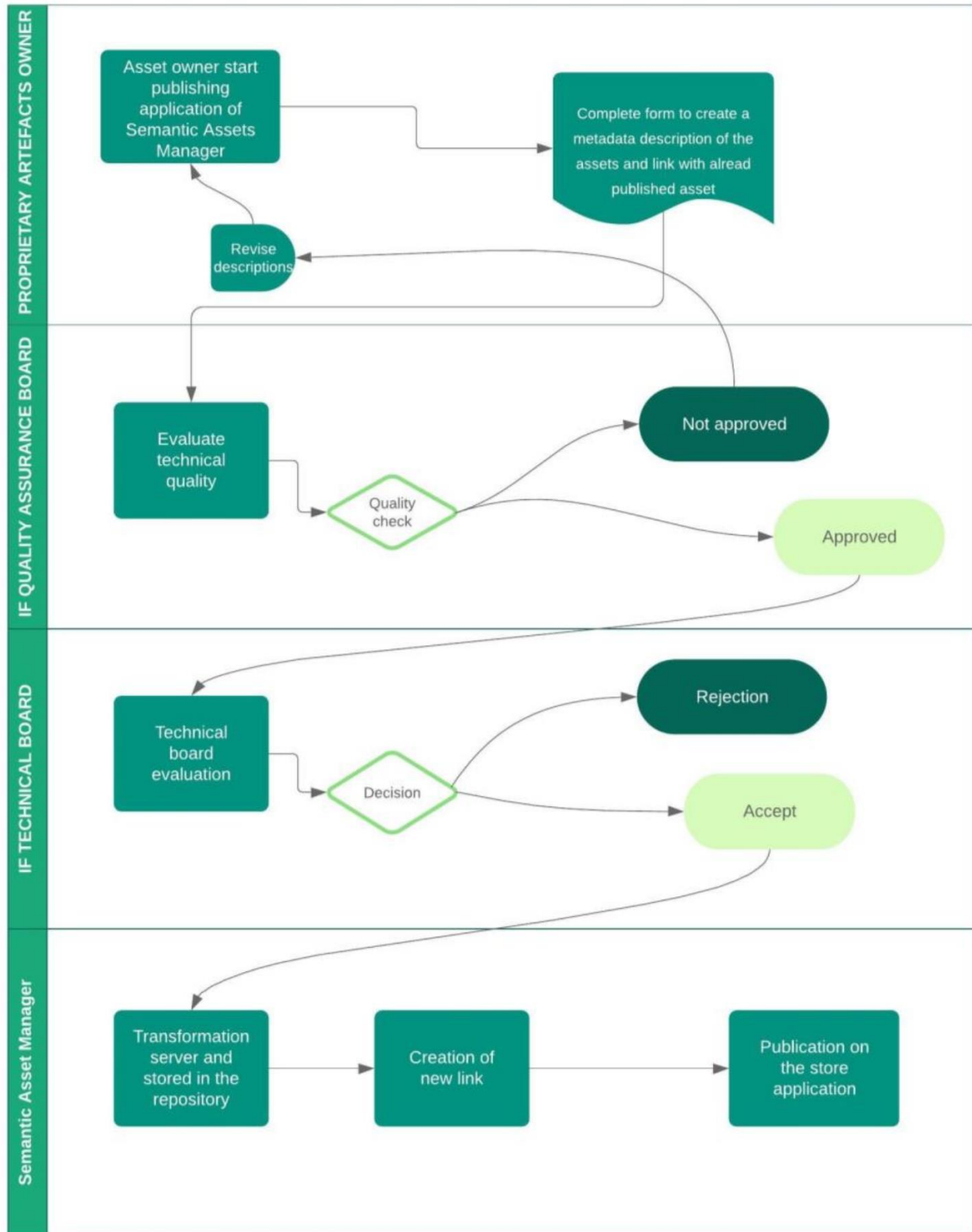
Figure 7: Lifecycle management process proposed by GoF4R

The join analysis made by SPRINT and CONNECTIVE started from such a governance structure and lifecycle management process and agreed on a simplified process to be implemented in the Asset Manager. Such a process, defined using the BPMN notation and reported in Figure 8, defines just two roles, namely the Asset contributor and the Technical management board (TMB). The TMB is entitled to perform quality checks and to decide whether to approve or to reject the asset publication. Once the decision has been made, the asset is "locked" to prevent unauthorized modifications. If the asset publication has been approved, its metadata is converted in RDF and stored in the RDF repository, and all the automation tasks attached to the specific asset type are executed (like converting the asset attachments in another format leveraging on Converters or sending messages to other systems).

Since the TMB could comprise many users, CONNECTIVE requested the possibility to specify TMB sub-groups. Such sub-groups will be entitled to take decisions for assets belonging to just one asset type (so, for example, the "Journey planning TMB" will approve or reject Journey planning assets).
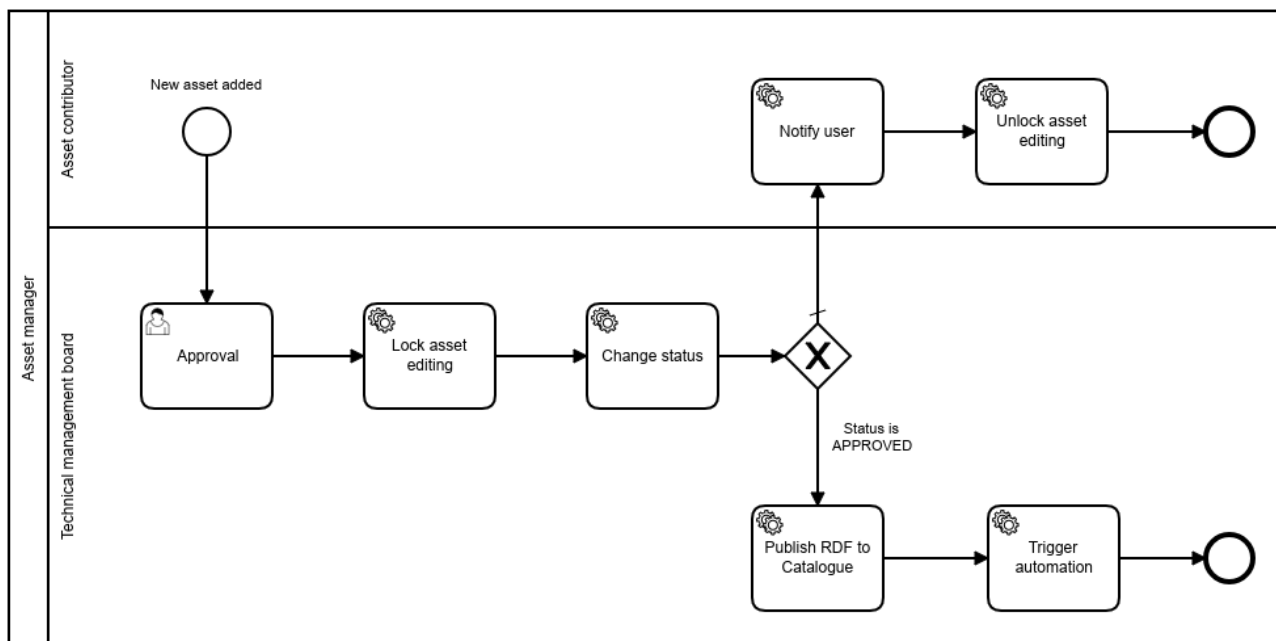
Figure 8: Generic lifecycle management process for newly created assets

To summarize the requirements:

R-CONN-10: the Identity Provider MUST define roles for the TMB and its subgroups.

R-CONN-11: the Asset Manager MUST implement the lifecycle management process shown in Figure 8, together with its required API.

3. INTEROPERABILITY FRAMEWORK AND THE NATIONAL ACCESS POINT REGULATIONS

According to the EU Delegated Regulations 2017/1926, 885/2013, 886/2013 and 2015/962, each EU Member State has to implement a National Access Point (NAP) to make its traffic and the travel data discoverable. A National Access Point (NAP) is an intermediary digital platform that allows accessing to and exchanging of traffic and mobility data.

This section will analyze different existing NAPs, finding common aspects and fueling the final requirements elicitation. The main aim of this section is to understand how the Interoperability Framework and the NAP relate one another, and how the F-Rel version of the IF can either play the role of a NAP or access different NAPs or contribute to them.

3.1 ANALYSIS OF NATIONAL ACCESS POINT FEATURES

National Access Points (NAP) play a crucial role in data exchange in the field of mobility in Europe. A NAP is a web-based portal handling data concerning Safe and Secure Truck Parking's (SSTP), Real Time Traffic Information (road) (RTTI), Safety Related Transport Information (road) (SRTI) and Multimodal Travel Information (MMTIS) (all modes like train, busses, metro, cycling etc.). NAPs vary in services like data search, storage and exchange. National Bodies (NB) are assigned to assess compliance of NAP data and services suppliers.[1]

One of the activities of the EU EIP project (2016 till 2020) is the Monitoring and Harmonisation of National Access Points. The objectives of this activity are:

- to monitor the on-going implementation of NAPs,
- to harmonise technical topics on NAP and National Bodies (NB) services across Europe,
- to support the NAP and NB community to learn from each other

Starting in 2016 the EIP published the status of the NAPs across Europe in the form of annual NAP reports. One of the outputs of the report is a support document [3.1] describing the NAP common features and levels of service. Figure 9 shows the features list and indicates, for each feature, if it's considered required or nice to have.

---

[1] https://eip.its-platform.eu/activities/monitoring-and-harmonisation-national-access-points

NAP Common Feature List

		Required	Nice to have
Access			
1.	The NAP is available over the internet	•	
2.	NAP can be navigated easily and is design compliant with web design standards / accessibility	•	
3.	NAP is provided in the national language and commonly used language(s) of the Member State	•	
4.	NAP follows EU data protection and industry data security standards	•	
5.	NAP requires data publishers to register to add their data / metadata	•	
6.	NAP requires data consumers to register for full access		•
Communication			
7.	NAP provides help for data publishers to register, add data / metadata	•	
8.	NAP provides Terms & Conditions	•	
9.	NAP is promoted	•	
10.	NAP provides means for data consumers to contact NAP operator and / or data provider for assistance	•	
Finding datasets			
11.	NAP provides appropriate discovery services	•	
12.	Datasets can be searched using a metadata catalogue	•	
13.	The NAP provides machine readable metadata		•
14.	The NAP provides a map-based search		•
Update and maintenance			
15.	The NAP service is maintained	•	
16.	The NAP content and metadata is maintained and makes best effort is made to keep content up-to-date	•	
17.	NAP monitoring and evaluation is undertaken		•
Dataset information			
18.	NAP provides clear descriptions of each dataset	•	
19.	NAP provides dataset documentation (or links) where required	•	
20.	NAP datasets classified according to standard / controlled vocabularies		•

Figure 9: NAP common feature list.

Below, some additional descriptions/considerations are given for some of the features.

Feature 4: EU General Data Protection Regulation (GDPR) is applicable as of May 2018. NAP providers need to document their Data Protection or Privacy policy on the NAP. Physical security, network security and security of computer systems and files all need to be considered to ensure the security of data and prevent unauthorized access and changes to data. Data security may be needed to protect intellectual property rights, commercial interests, or to keep personal or sensitive information safe.

Feature 5: this allows NAP providers to improve security and to control and monitor data publisher activity, by means of creation of user accounts and related roles/permissions.

Feature 6: this allows NAP operators to improve security and to control and monitor data consumers activity, i.e., their access to resources.

Feature 8: data consumers and publishers need to be aware, understand, (and in some cases agree) to the terms and conditions. These can include access information, highlighting specific licensing issues, site traffic limits and what happens to any information NAP users submit. It should be noted that this feature is referring to the terms & condition of the data and not of the NAP unless the NAP is (also) the repository from where data is consumed.

Feature 11: discovery services are typically search tools, a search box like an internet search engine where data consumers type a keyword.

Feature 12: data will not be discoverable or reusable by anyone other than the data publisher if insufficient metadata is provided. Data publishers are encouraged to provide human-readable information in multiple languages. Metadata for both human data consumers and computer applications provide even greater benefit. It is worth noting that a specific effort of EU EIP WG NAP is the harmonization in the field of Metadata of European NAPs. A first agreement was found in the form of the "Coordinated Metadata Catalogue". It allows the description and discovery of the most relevant features of NAP datasets.

Feature 15: it should be noted that the IT (systems, software and hardware) underlying the NAP need to be maintained also to ensure that data consumers and data publishers have confidence in the service. The NAP service needs to be secure, functional, have sufficient speed, and be resilient.

Feature 20: it is worth noting that the "Coordinated Metadata Catalogue" already contains a mapping with standard vocabularies as EUEIP, DCAT-AP and INSPIRE.

This features list will be converted in a set of requirements for the F-Rel version of the IF, and the requirements will be summarized in 3.4.1.

3.2 COORDINATED METADATA CATALOGUE

The main focus of the NAP regulations is to promote the usage of a specific set of standards, based on Transmodel, across all Europe to improve transport data interoperability. Even though the role of the NAP as a dataset catalogue is clear, each member state is then free to implement it according to its design. Such principle led to the appearance of different metadata vocabularies, and the need for interoperability between different metadata sets offered by different NAPs.

A working group composed of representatives from the Netherlands, Germany, Austria and Sweden started to work on common Metadata definitions to be applied at the various NAPs in Europe. They called it the "Coordinated Metadata Catalogue". They focused on aspects of the minimum metadata set and their idea is to support easy data exchange and to avoid errors in data exchange between databases. For example, if an international user accesses the NAPs of several EU Member States, there should be no difference in wording and meaning between the metadata provided, even in different languages.

According to Coordinated Metadata Catalogue, *Metadata* describes both datasets and services. A dataset contains the traffic or travel data, and specific services for multi-modal travel are listed by EU Regulation 2017/1926 lists. An example of a specific service is "location search" on a data set describing address identifiers.

A *Publication* is the combination of a dataset and the way in which the data are published and made accessible. A *Publisher* is the one who publishes a dataset. A *Contact Point* is the one who registers the dataset at the NAP. A *Data Owner* is the one who owns or produces data.

A Metadata set is the collection of all metadata elements which are listed by category in Table 1-Table 10. The metadata information in Table 1 includes the last date and time when the metadata set was created or last modified, the language in which the metadata is described, and responsible for creation and maintenance of the metadata.

Metadata information		
Element Name	Domain	Mandatory
metadata_date	DateTime YYYY-MM-DD 'T'hh:mm:ssTZD	Y
md_ language	A 3-letter code extracted from http://www.loc.gov/standards/iso639-2/	Y
Contact point	vCard-Textfields including name and organization name as mandatory fields, and optionally address, e-mail, website and telephone number.	Partially*

Table 1: Metadata information

The content information in Table 2 has information about a dataset such as its name, brief description, type of resource (dataset or service), dataset type category according to logical clustering or EC Delegated Regulations, service type category listed in EU Delegated Regulation 2017/1926, language, and the georeferencing method applied within the payload.

Content Information		
Proposed DB field (Element Name)	Type	Mandatory
cont_name (Name of a dataset)	Free text	Y
cont_description (Description of dataset)	Free text	Y
cont_res (Resource type)	Dataset or Service	N
cont_agr_type (Dataset type category)	two-hierarchy category description is used: "Dataset type category" and optionally "Dataset detailed description". Dataset type category may be assigned to the datasets with or without reference to the EC Delegated Regulations. Dataset detailed description can be found in [2].	Y
cont_det_type (Dataset detailed type)	Possible categories are listed in [2].	N
cont_serv_type (Service type category)	possible services listed in EU Delegated Regulation 2017/1926, e.g. location search, information service	Conditionally*
(cont_lang) Dataset language	A 3-letter code for 24 EU languages	Y

---

[2] https://www.its-platform.eu/sites/default/files/EU%20EIP_Coord.%20Metadata%20Catalogue_Annex%20I_v2.0_191115.xlsx

(cont_georef) Georeferencing Method	ALERT-C (LCL), Geocoordinates WGS84, Geocoordinates ETRS89, ISO 19148, OpenLR, other.	N

Table 2: Content information

Some of the possible values for the dataset type category and dataset detailed type according to a logical clustering are listed in Table 3. This kind of values is of interest to represent the IF catalogue.

Variant A (logical clustering)		
Options for Metadata element "Dataset type category"	Options for Metadata element "Dataset detailed type"	Coded reference to data category of EC Del. Reg. *
Public transport: location information	Access nodes/stop facilities: Location and features	A-1.1.c.i, A-1.1.d.vii, A-1.1.d.x, B-1 l
	Access nodes/stop facilities: Geometry/map layout structure	A-1.1.c.ii
	Access nodes/stop facilities: Status of features	A-2.1.iii
	Access nodes/stop facilities: Accessibility and paths within the facility	A-1.1.d.ix
Public transport: operational information	Operational Calendar	A-1.1.b
	Connection links	A-1.1.d.i
	Network topology and routes/lines	A-1.1.d.ii
	Transport operators	A-1.1.d.iii
	Timetables (static)	A-1.1.d.iv, A-1.3.d
	Timetables (real-time), estimated departure and arrival times of services	A-2.2.a.i
	Planned interchanges between guaranteed scheduled services	A-1.1.d.v
	Hours of operation	A-1.1.d.vi
	Vehicle details	A-1.1.d.viii, A-1.2.c.ii
	Disruptions, delays, cancellations	A-2.1.i, A-2.1.ii
Public transport: fare and purchase information	Basic common standard fares	A-1.2.c.i
	Passenger classes	A-1.3.a.i
	Common fare products	A-1.3.a.ii
	Special Fare Products	A-1.3.a.iii
	Basic commercial conditions	A-1.3.a.iv
	Purchase information	A-1.2.b

Table 3: Some values for categories may be assigned to one or more of the

EC Delegated Regulations

The temporal information described in Table 4 presents the period of time in which the publication of data does not expire.

Temporal Information		
Proposed DB field (Element Name)	Type	Mandatory
temp_valid_from (Valid From)	DateTime YYYY-MM-DD'T'hh:mm:ssTZD	Y
temp_valid_to (Valid To)	DateTime YYYY-MM-DD'T'hh:mm:ssTZD	N

Table 4: Temporal information

The geographic area covered by a data set can be detailed by means of Geographical coverage. Regions in which a dataset is valid and details on the transport network are elements in Table 5.

Geographical coverage		
Proposed DB field (Element Name)	Type	Mandatory
geo_area (Area covered by publication)	Possible values can be found in [3]	Y
geo_network (Network coverage)	Motorways, Arterial road network, Regional roads, Urban and local roads, Rail, Metro or light-rail network, Other public transport networks, Waterways, Air network, other	Y
geo_description (Network coverage description)	Free text	N

Table 5: Geographical coverage

---

[3]   http://ec.europa.eu/eurostat/ramon/nomenclatures/index.cfm?TargetUrl=LST_NOM_DTL& StrNom=NUTS_22&StrLanguageCode=DE&IntPcKey=&StrLayoutCode=HIERARCHIC&Int CurrentPage=1

Transportation modes in which a dataset is valid are defined in Table 6.

Transportation system		
Proposed DB field (Element Name)	Type	Mandatory
trans_mode (Transportation modes covered)	Scheduled (Air, rail, conventional rail, light rail, etc), Demand-responsive (Shuttle bus, shuttle ferry, tax, etc), Individual (car, truck, motorcycle, etc)	Y

Table 6: Transportation system

Table 7 contains who publishes and owns the datasets.

Responsibilities		
Element Name	Type	Mandatory
Publisher	vCard-Textfields	Partially*
Data Owner	vCard-Textfields	Partially*

Table 7: Responsibilities

Table 8 includes the condition of use for a dataset. If it is "License" or "Contract", then the condition of use has to be clarified in Conditions for use.

Conditions for use		
Proposed DB field (Element Name)	Type	Mandatory
con_lic (Contract or license)	No license – No contract, License and Free of charge, License and Fee, Contract and Free of charge, Contract and Fee, Not relevant	Y
con_description (Conditions for use)	URL	Conditionally*

Table 8: Conditions for use

The access information in Table 9 includes four layers: Encoding, Syntax, Grammar and Data Model. As part of the minimum Metadata set, the working group suggests introducing

these four layers as explicit Metadata elements. This way, a data user will be able to learn about how to read and interpret a data set, when he discovers it on the NAP.

Access information		
Proposed DB field (Element Name)	Type	Mandatory
acc_enc (Data format – Encoding)	ASCII, UTF-8, UTF-16, ISO-8859-1, ISO-8859-15, other	N
acc_syn (Data format – Syntax)	XML, JSON, CSV, ASN.1 encoding rules, Protocol buffers, Other	Y
acc_gra (Data format – Grammar)	XSD, JSON Schema, ASN.1, Protocol buffers, other	N
acc_mod (Data format – Data Model)	DATEX II, OCIT-C, DATEX II Light, NeTEx (CEN/TS 16614), SIRI (CEN/TS 15531), GTFS	Y
acc_description (Data format description)	Free text	Conditionally*
acc_int (Access interface)	OTS2, HTTP/HTTPS, HTTP/HTTPS-SOAP, FTP, RSS, AMQP, MQTT, gRPC, other	Y
acc_con (Communication method)	Push, Push periodic, Pull	Conditionally*
acc_url (Access URL)	URL	Conditionally*

Table 9: Access information

Lastly, the quality information for a dataset is introduced in Table 10. The update rate and quality criteria of the data set, and the history and status of procedures to assess the compliance of the Delegated Regulations regarding the provisioning of data via a NAP are elements in the Quality Information.

Quality Information		
Proposed DB field (Element Name)	Type	Mandatory
qual_freq (Update frequency)	On the occurrence, Up to 1min, Up to 5min, Up to 10 min, Up to 15 min, etc.	Y
qual_ass (Quality description)	Free text	Y
qual_natbod (National body assessment)	Date	N

Table 10: Quality information

Competency Questions (CQs) play an important role in the ontology development lifecycle, as they represent the ontology requirements. CQs consist on a set of questions stated and replied (the replies are often neglected during ontology specification) in natural language so that the data represented using the ontology structure must be able to answer them correctly. They play an important role in the ontology development life cycle, as they represent the ontology requirements. Based on the minimum metadata elements described in Table 1-Table 10, we applied the same technique to the Coordinated Metadata Catalogue specifications. Below we provide some examples of competency questions that are specific to the metadata harmonised by NAP:

- Which are the publishers (transport data providers) of the datasets including information on different means of public transport?
- Which is the list of owners of the datasets containing information of the different means of public transport?
- Which are the datasets containing operational information such as vehicle details (i.e. A-1.1.d.viii and A-1.2.c.ii as codes according to EC Delegated Regulation)?
- Which are the datasets containing Special Fare Products (i.e. A-1.3.a.iii as the code according to EC Delegated Regulation)?
- Which are the names of the datasets published by the Consorcio Regional de Transportes de Madrid (CRTM)?
- What are the datasets related to the region of Madrid that also deal with buses?
- Which is the list of publishers of the datasets ordered by the publishers' websites?
- What is the metadata data and National body assessment status of a specific dataset?

- What are the starting time and the ending time from which a specific dataset is valid?
- What is the transportation mode covered by a given dataset?
- What is the license agreed on to use a given dataset?
- In which data format can a particular dataset be accessed?

Such competency questions could become the basis of an extended set of API provided by the Asset Manager through the mechanism of the Exploration API.

3.3 ANALYSIS OF CURRENTLY AVAILABLE NATIONAL ACCESS POINTS

In this section we report an analysis of the existing National Access Points, focusing on aspects which are common to the Interoperability Framework and asset management. The analysis focuses on:

- the features which are already implemented,
- on the required metadata and data formats for the assets,
- the publication process and its related approval checks.

3.3.1 German NAP

The Mobility Data Marketplace (MDM)[4] - as the National Access Point in Germany[5]- allows offering, searching and subscribing to traffic relevant online data, as well as the distribution of online data between data suppliers and data. It is important to highlight that MDM is working mainly as a data broker where data supplier can advertise their data by specifying several attributes, data client can search and subscribe to data and then upon such subscription, the actual data would be transmitted to the data requester. The data transmission, however, is always done through MDM, and there are the following possible approaches:

Pull based: If Delivery mode is chosen as pull, it means that data client system actively retrieves the data from the MDM system.

Push based: If Delivery mode is chosen as pull it means that MDM system sends this data to the respective data client system as soon as a new data packet of the subscribed publication is available.

Download: Data client can access data packets, provided they have a validated subscription to the publication. They can obtain and analyse data packets before putting your systems into operation.

Metadata

The MDM system supports the delivery and distribution of data in two different XML formats:
1. European standard **DATEX II**
2. Proprietary **CONTAINER** format.

---

[4] https://www.mdm-portal.de/about-mdm/?lang=en

[5] Accessible from https://www.cestrin.ro/web2014/nap_eueip/

Where the former is a way of wrapping any custom XML data with a unified and MDM compliant headers which make distribution of data possible. Accordingly, the meta-data required to publish data packets are mainly based on the DATEX II. It includes name, description, contact information of data publisher, the validity duration of the data packet, data type, type of protocol for data transmission, geographical area of specific mobility data. However, the essential parameters are limited to

- o Name
- o Description
- o Contact

The data supplier can determine which attributes of data will be visible (at the searching time) to various user groups, i.e. anonymous and registered users as represented in Fig. A registered user then can subscribers to a publication and if such subscription being approved by the data supplier then the user can always view all attributes of a publication.

Figure 10: Visibility Configuration of a data packets in MDM, taken from MDM User Manual

Registration process

The registration is open, and it is designed for "organizations" and not individuals as represented in Figure 11. Within the registration process, an organization will be uniquely recorded at the MDM. Hence an employee of a registered organization should ask a responsible colleague to create a user account. After successful registration of an organization, more user accounts can be created for another employee of the organization using an already existent user account within your organization on the MDM portal.

Register your organisation

Organisation

Organisation*:

Homepage*:   http://

Contact Person

Your organisation must designate at least one person as contact.
Other contacts can be registered later in the portal.

General alerts of the operator are sent to all contacts automatically. If your organisation acts as a data supplier, your contact information will be displayed in the portal. Please indicate the exact function of the contact person (for example, technical support, sales). This way, you help other users to immediately contact the right person.

Name*:

Function/Dept. *:

Street*:

ZIP* / City*:

Country:

Phone*:

Mobile number: +49

E-mail*:

Homepage:

User Account

Full access to the MDM platform requires a user account, for which each user must apply individually.
The first user can apply for other user accounts in the portal later on.
Please enter an account name and personal email address of the person who administrates your organisation on the MDM portal.

Name*:

E-mail*:

Figure 11: Registration form in MDM, taken from MDM User Manual

In registration, a profile is created for an organization and a first user account is set up. The user then receives an email link so that s/he can confirm the account. After this, a user certificate is generated and sent to the user by email while the necessary password is sent

by fax. After importing the user certificate and logging into the MDM, one can create and manage other user accounts and contacts for his/her organization.

After successful registration, one can log in by clicking the Login button. Login into the system establishes a secure and authenticated connection of the user browser to the MDM platform. After login one has access to a full range of services.

Publication process

Data suppliers can administrate their publications and the associated data supplies (i.e., a client which has been subscribed to specific data) by using the features *Publications* and *My Supplies*. The data must fall into one of the data type categories identified in MDM such as parking or traffic data. Furthermore, the MDM system supports the delivery and distribution of traffic data in two different XML formats: the European standard DATEX II and a proprietary CONTAINER format[6]. The latter makes it possible to publish any XML based data model upon publication of the XSD schema of such data model.

When a new publication is to be created, it is possible to upload certain files to the MDM. For example, a file can be uploaded to determine the geographical area of a publication; the same applies to reference files or data licenses.

MDM states that their operator endeavours to ensure that the content of the website (information about the MDM, usage aids for MDM users, etc.) is correct and up to date. However, no guarantee can be assured for the reliability, accuracy or completeness of the information about the data offers (metadata) provided by the data providers.

Datasets are not expected to be uploaded in any Transmodel-based standard, and MDM does not provide automatic data conversion.

All functions except the searching are only available to registered users. Accordingly, only registered users (with the logical role of data suppliers) can proceed with the publication of their data.

Access to datasets

The main part of this information is publicly available on the MDM. Any user, even without registration, can browse through the list of available datasets. Then, if the user is interested, he can contact the data supplier, e.g. for additional information, initiation of contract negotiations or request for data provision.

When a data client finds his desired dataset, he must apply for subscription to obtain access to data. Then, an email will be similarly prepared, and the message will be provided with the required information. During the subscription process data client also select his desired delivery options (pull vs push). Then data supplier must approve and activate the subscription and after that user can receive data.

---

[6] MDM container Specification

Furthermore, there is a *Demand for data* functions, through which registered users can either announce desired data that have been missed so far or view existing requests.

The system does not provide a payment system but is able to generate the billing data, that contains information about data supplied to and from the MDM platform can be downloaded for ab organization.

3.3.2 Finnish NAP

In the Finnish conditions, the open NAP is the NAP service catalogue to which transport service providers are obliged to submit essential information on their services via digital machine-readable interfaces. NAP is a service catalogue meant for service developers, where developers can find transport service information and interfaces. Registration is not required to utilize NAP information. NAP enables development of more comprehensive journey planners and new transport services.

In general, the definition of essential information is set up the Government Decree 643/2017 and operating areas, routes, timetables, prices, service times and accessibility information, including information about tickets, booking and sales channels and accepted payment methods can be considered as examples of this essential information. It is valid that not all essential information is valid for each service. The NAP also includes information on how to publish information about the transport service providers' services. [4]

Registration process

As it is described within the publication process below, registration is not required to utilize NAP information. Registration is needed only for those companies who store data in the NAP service. Service developers can browse mobility services from the Transport service catalogue page without registration.

Publication process

Publication instructions consist of the following steps [7] [5]:

1. Check out the information obligations, terms of service and manuals before signing up to the NAP service
    a. Which kind of essential information needs to submit to the NAP service by law.
    b. If the obligation to provide access to ticket and payment systems applies to the particular company.
2. Go to www.finap.fi and register to the service
    a. Registration is needed only for those companies who store data in the NAP service.
    b. Service developers can browse mobility services without registration.
3. Create a new transport operator in the NAP service
    a. In the first phase, the basic information about the company is provided.

---

[7] At the moment, user guide for the NAP service exists only in Finnish and Swedish.

b. In the second phase, more detailed information on the transport services is provided.
4. Add a new transport service or services to the NAP service
   a. By adding a new transport service, it is possible to share all the essential information on the transport service in the NAP service. Then:
      i. A: If the data of the transport service can be found via machine-readable interfaces, it is necessary to fill into the NAP form only the information that is mandatory and cannot be accessed via the interfaces.
      ii. B: If the transport service information is not found from machine-readable interfaces, the External machine-readable interfaces part is left empty and all the other parts in the NAP form are filled.
   b. In general, it is mandatory to submit route and timetable information for regularly scheduled transport as a machine-readable interface. If necessary, it is possible to digitize the routes with Traficom's digitization tools, the external RAE route and timetable editor.
5. To finish, click Save and Publish or Save a draft
   a. After publishing the service, the service information can be found in the section Transport service catalogue. The service can be edited later on the page Own transport services by clicking on the name of the service or the pencil icon at the end of the row.
6. Remember to keep the information updated
   a. The transport operator has a responsibility that all the service information in the NAP service is correct and up to date.
   b. Traficom sends newsletter in a couple of times in a year via email to registered users with current information about the development of the NAP service and tips for updating the information.

Transport operator must sign a Declaration of Compliance [6] in relation to the Commission Delegated Regulation (EU) No. 886/2013 of 15 May 2013 supplementing Directive 2010/40/EU (ITS Directive) and the articles published therein, that the transport operator is providing or will provide safety-related traffic information according to the events or conditions defined in the Declaration of Compliance, as well as it will make this information available based on its role as Data Supplier or Information Service Provider etc.

The following documents are attached to the Declaration of Compliance:
- Mandatory
  o Information about the entity's access point to the road safety-related traffic data and the conditions for its use and its format.
  o Information about the entity's means of disseminating the road safety-related traffic data to end-users.
- Optional

- o Overview of the road network for which data or service provision is made available as a supplement to paragraph 2 of this Declaration.
- o Quality manual or procedure description with respect to data collection/information provision in the context of road safety-related traffic information.
- o Key Performance Indicators in relation to data collection/information provision in the context of road safety-related traffic information.
- o Description of quality level for the service provision in the context of road safety-related traffic information.
- o Other…

Access to datasets

Export from GTFS to NeTEx (NeTEx interface generated by NAP) is possible using Chouette[8]. [9]

3.3.3 Norwegian NAP

The National Access Point (NAP) for transport data in Norway is transportportal.no. The portal is established to secure access to all open data on road infrastructure, road traffic, public transport and mobility services through one single point[10]. The portal includes descriptions (metadata) and links to data on road infrastructure, road status, incidents, travel times, public transport stops, routes and schedules, traffic information, warnings and mobility services like city bikes and new micro-mobility. The providers of these data may be road administrations, transport service suppliers and operators of mobility and traffic information services. These data may be re-used to make new services and combine different sets of data to make new and innovative information and mobility for all types of transport users. The data is available in machine-readable and standardized formats in compliance with the ITS directive and the delegated regulations. [7]

Metadata

The National Access Point does not contain the data itself or the services that are made available for re-use, but only the metadata describing them. The data sources are with the individual data owner. As part of the metadata, it is possible to find links to the underlying services and the sets of data that can be accessed. For some (mostly commercial) sets data it may be rules for use, re-use and payment.

---

[8] Chouette is an open source software. Its main purpose is to capture and exchange data, describing the planned public transport timetables and network topology. The supported exchange formats are NeTEx, the French NEPTUNE Standard, GTFS and CSV.

[9] https://finap.fi/#/service/11/3648

[10] Implementation: https://github.com/nvdb-vegdata/nvdbtransportportal

The National Data Catalogue uses the metadata standard DCAT-AP-NO, which is compatible with the European standard DCAT-AP so the descriptions of data may be understood and can be collected also from international data catalogues.

Licenses

In the metadata, a license that will inform the data users under which terms they may use the data has to be provided.

The most commonly used licenses are:
- Norsk lisens for offentlige data (NLOD) (the current recommendation from Difi - the Agency for Public Management and eGovernment - and most commonly used in Norway)
- Creative Commons Navngivelse 4.0 International (it is better known internationally)
- Creative Commons Universal Free status declaration (if the organization wants to renounce all rights to the data) [8]

Registration process

The registration process consists of the following steps[11] [8]:
1. Manager of the company must give access to the "Registration in data directory" service in Altinn, and possibly assign the role "Access management".
2. Contact the person who can delegate access to Altinn in the company.
3. After gaining access, the company's data directory will be available after login.
4. Log in to the registration solution.

Publication process

Metadata can be published in two ways:
- By automatic harvest from a data portal in your organization
  - This way is suitable for organizations already having a data portal where they publish their open data and services. Some integration work by Digitaliseringsdirektoratet (Digdir) and possibly on own side of the organization must be expected. The NPRA data service on dataut.vegvesen.no is an example of an internal data portal with this type of integration.
- By direct input via a web form
  - In this case, the registration service from Digdir is used. To be able to do this, it is necessary to have a «role» in Altinn which gives the permissions to publish metadata on behalf of the organization. This must be set up by someone in the organization having the role «Tilgangsstyring» in Altinn.

Data and service providers must follow the requirements of the delegated regulations related to the Declaration of Compliance. For delegated regulation 886/2013 on provision of safety-related information, the data and service provider shall submit a self-declaration of

---

[11] Registration is only possible in Norwegian.

compliance to The Road Supervisory Authority. For the regulations 962/2015 on provision of real-time traffic data and 1926/2017, the practical procedures will be decided. [8]

Access to datasets

Usage of data shall preferably be free of charge, but the Delegated Regulations allow the owner of the data to impose financial compensation for use. Any financial compensation shall be reasonable and proportionate to the legitimate costs incurred of providing and disseminating the relevant travel and traffic data. [7]

3.3.4 Austrian NAP

In Austria, AustriaTech is responsible for implementing the NAP for multimodal travel information. AustriaTech provided the Mobilitaetsdaten.gv.at platform that acts as a national access point for Austria. Information on mobility data from private and public data holders is presented there in order to provide a data overview and to make data access much easier for transport service providers.

AustriaTech aims to ensure providing Multimodal Travel Information Services (MMTIS) data in time with the established Austrian NAP. By now, AustriaTech implemented architecture as data directory: www.mobilitaetsdaten.gv.at / www.mobilitydata.gv.at. At the moment, there are 7 data providers and 23 data sets.

The main challenge for the Austrian NAP is creating a common approach in creating and implementing minimum profiles (NeTEx including other service levels, SIRI) on the EU level.

Metadata

Austrian NAP has a standardized format for the description of data, data provider, contracts, etc. According to SPA – Coordinated Metadata Catalogue, a document developed in cooperation with Germany and the Netherlands, there is the following list of minimum mandatory metadata elements:

- Metadata information
  - Metadata date
  - Metadata language
  - Organization name
  - Email
- Content information
  - Name of dataset
  - Description of dataset
  - Dataset type category
  - Dataset detailed type (for self-declaration)
  - Dataset language
- Temporal information:
  - Star date of publication
- Geographical coverage

- o Area covered by publication
  - o Network coverage
- Responsibilities/ contact information
  - o Publisher
    - ▪ Organization name
    - ▪ Email
  - o Data owner
    - ▪ Organization name
    - ▪ Email
- Condition for use
  - o Contract or license
  - o Condition for use if contract or license is used
- Access information
  - o Structure of publication
  - o Publication structure description if contract or license is used
  - o Access interface
  - o Communication method
  - o Access URL
- Quality information
  - o Update frequency
  - o Quality indicator

Example of the data set description on the NAP platform:

Intermediate Traffic Service

We developed TomTom Intermediate Traffic to deliver detailed, real-time traffic content to business customers who integrate it into their own applications. Target customers for TomTom Intermediate Traffic include automotive OEMs, web and application developers and governments. We deliver bulk traffic flow information that provides a comprehensive view of the entire road network. Our real-time traffic products are created by merging multiple data sources, including anonymized measurement data from over 550 million GPS- enabled devices. TomTom Intermediate Traffic Events provides information on the current observed congestion and incidents on roads in all countries where we offer this service. Traffic 'incidents' in this context includes information like closed roads, lane closures, construction zones and accidents and current observed speed on roads in all countries where TomTom live traffic information services are available.

Contact ✉   **Data access**

Information details

Organisation

Published on: 30/07/2019
Publisher: TomTom ✉
Registered by: TomTom
Data owner (1): Service supported by multiple data providers
License model: Contract and Fee
Partner portal: no external usage
Validity: 30/07/2019 to 30/07/2020

Validity

Area covered:
Austria

Network coverage:
Roadnetwork, Motorways, Regional roads, Urban and local roads

Transportation modes:
Personal, car, truck, motorcycle, cycle, pedestrian

Technical description

Type: Dataset
Content language: English
Publication structure: DATEX II Profile
Data format – Syntax: XML
Access interface: HTTP/HTTPS
Update frequency: Up to 1min
Communication method: pull

Quality description:

Our real-time traffic products are created by merging multiple data sources, including anonymized measurement data from over 550 million GPS-enabled devices. TomTom has quality mechanisms in place via our Fusion Engine to validate information.

Categories

According to delegated regulation:
Traffic data, Real-time traffic data, Traffic volume, Speed, locations of queues, Travel times, Waiting time at border crossings to non-EU Member States, Estimated travel times, Expected delays, traffic restrictions, Safety-related traffic information, Temporary slippery road, Animal, people, obstacle, debris on the road, Unprotected accident area, Reduced visibility, Short term road works, Wrong-way driver, Unmanaged blockage of a road, Exceptional weather conditions, Traffic regulations and identifying dangers, Tunnel access conditions, Bridge access conditions, Speed limits, Permanent access restrictions, Other traffic regulations, Traffic circulation plans, Traffic management plans, Dynamic access information, Road closures, Lane closures, Bridge closures, Dynamic overtaking bans on heavy goods vehicles, Dynamic Speed limits, Direction of travel on reversible lanes, Dynamic access conditions for bridges, Dynamic access conditions for tunnels, temporary traffic management measures or plans, Road status, Road Works, Poor road conditions, Weather conditions affecting road surface and visibility, Accidents and incidents

Figure 12: Data set description on the Austrian NAP platform

Registration process

NAP in Austria has an easy registration process and there are no complicated details about internal processes needed on the NAP. Austrian NAP has direct contact with a data provider because there are just a few data authorities in Austria.

The registration and first publication of metadata or data sets consist of three steps:

1) Step 1: Register a master user and an organization

A master user is required per organization who carries out the other users' authorizations from the organization, as well as the administration and coordination and data sets for the organization. The master user is responsible for checking the correct information of the organization and the information of other users from the organization. Invited by the master user sub-users can also publish data descriptions.

After registration of the master user, he has to provide information about the organization: Name, Address, Website, and Logo. Each organization can be created only once and checked by NAP administrators.

Anmelden | Neues Benutzerkonto erstellen | Neues Passwort anfordern

Sign in with
in X

Personendaten

Alle Pflichtfelder sind **farblich hervorgehoben** und mit einem ● Punkt gekennzeichnet.

Titel

● **Vorname**

Inhalt auf 50 Zeichen beschränkt, bleiben noch: **50**

● **Nachname**

Inhalt auf 50 Zeichen beschränkt, bleiben noch: **50**

● **Geschlecht** ○ Weiblich ○ Männlich

Telefon

Inhalt auf 50 Zeichen beschränkt, bleiben noch: **50**
Bitte geben Sie hier Ihre Telefonnummer ohne Leerzeichen und Klammern im internationalen Format (0043 oder +43) ein.

Zugangsdaten

● **Benutzername**

Leerzeichen sind erlaubt. Satzzeichen sind mit Ausnahme von Punkten, Bindestrichen, Apostrophen und Unterstrichen nicht erlaubt.

● **E-Mail-Adresse**

Eine gültige E-Mail-Adresse. Alle E-Mails der Website werden an diese Adresse geschickt. Die Adresse wird nicht veröffentlicht und wird nur verwendet, wenn Sie ein neues Passwort anfordern oder wenn Sie einstellen, bestimmte Informationen oder Benachrichtigungen per E-Mail zu erhalten.

Figure 13: Registration of a master user on the Austrian NAP platform

2) Step 2: Approval of the organization's registration by the NAP administrator

Figure 14: Registration of an organization on the Austrian NAP platform

After checking the registered on the NAP portal organization, the NAP administrator provides access for the organization to the services. Thus, data set descriptions can be uploaded and published.

3) Step 3: Publish a data set description

By filling out the form "Create metadata set", an entry is created on the NAP platform and is published for one year from the date of creation. After a year, the users of the organization has to confirm that data is still valid (for another year) or update the data description.
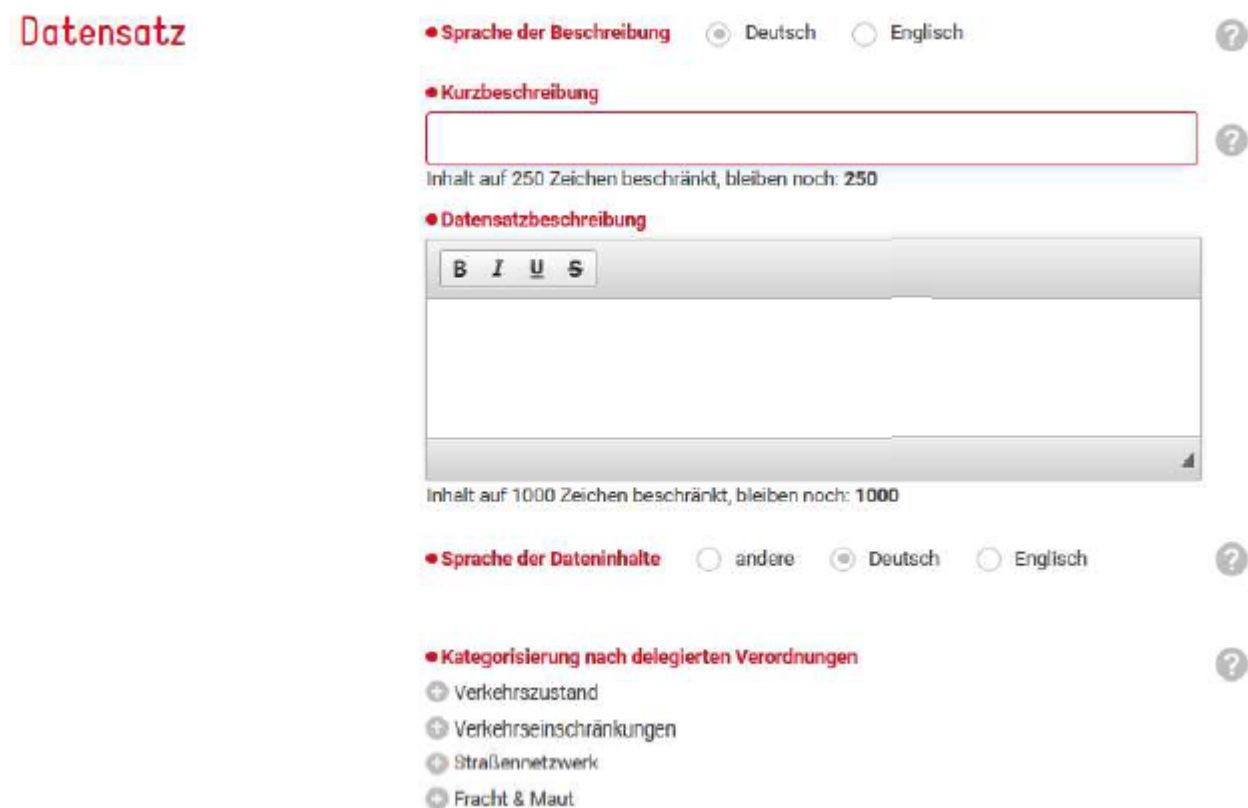
Publication process

There were defined 15 dataset types to be stored in the NAP: static road network, traffic regulations and identifying dangers, toll information, parking information, filling and charging

stations, freight logistics, location of public transport stops and interchange points, dynamic access information, temporary traffic regulation, road work information, unexpected events and conditions, traffic management measures, real-time traffic data, safety-related traffic information, truck parking information. Regarding MMIS, the type of data is already collected through the NAP:

- Time-tables
- access nodes
- operation calendar
- network topology
- routes/lines

The creation of a data set description is carried out in the data centre under the menu item "Data records" initialized by pressing the "New data record" button.

Figure 15: Creation of the dataset description on the Austrian NAP platform

The data form is divided into several areas. The description is structured as follows:

- Record
- Validity

- Publisher
- Data owner
- Technical information
- Rights

Datasets can be valid for more than one region, for that reason a multiple-choice selection should be applied. A dataset without an area is not valid, therefore this field is mandatory. Description of network coverage is also mandatory and since it should be searchable and compatible with other Single Points of Access, the categorisation has to be harmonized. But for now, no commonly agreed European definition is existing.

The Austrian NAP highlights the publisher and the data owner. The "publisher" describes an entity (company and person) that publishes datasets of a publication. He is responsible for the given information and concludes a contract if applicable. The Data Owner defines the company that owns the dataset of a publication and is responsible for the content and quality of the dataset.

Data providers link their data platforms with the NAP. However, support of the data providers concerning the required standards is needed (NeTEx, SIRI). Based on the delegated legal acts and in order to achieve a high level of compatibility, all data offered must comply with the DATEX II standard or NeTEx or at least be compatible with these standards. Standards used to feed the NAP:

- MMITS: NeTEx, GTFS, GeoJSON, Shape, xlsx, JSON.

Austrian NAP doesn't use any software tools to import/convert date models to feed the NAP because Austrian providers use conversion tools to export data in the required format (Mentz export tool, Chouette: GTFS to NeTEx).

Access to datasets

Access to the data depends on the information provided to the meta-data field "Contract or license". The field "Contract or license" indicates the condition of use: whether a free and unrestricted use is possible, a contract has to be concluded or a license has to be agreed on to use a dataset. Therefore there are predefined tags where only one can be selected:
- No license – No contract
- License and Free of charge
- License and Fee
- Contract and Free of charge
- Contract and Fee

A sample contract or the terms of use need shall be provided as part of the metadata set, in order to allow potential data consumers to check and prove terms and conditions before getting in touch with the publisher. This meta-data field contains an URL to a PDF document,

which contains all important information. The operator of SPA can decide to store that document on the SPA server to ensure that the document is accessible.

Data descriptions which correspond to the Open data standard for public data can be found in one step on the data portal http://data.gv.at . For such data descriptions, the general terms and conditions of data.gv.at are also applied. Data that does not correspond to public data but is available free of charge can use the opportunity of cooperation with the Open data portal http://opendataportal.at to promote the data. The general terms and conditions of the Opendata portal are applied.

The publication of a data description means that the data set description begins to be immediately listed in the data search and can be found.

The publisher has to provide an access interface – application layer protocol in the metadata. The access interface describes the IT protocol of the data interface that will be used to transfer data. For error minimizing, there are predefined tags:
- SOAP
- OTS2
- HTTP/HTTPS
- FTP
- RSS
- Other

There are two communication methods for data transmitting from a data provider to data receiver: push and pull. For pull modes, the publisher can provide a link for access to the current dataset of a publication. Furthermore, an access URL can be unique for every single relationship between a data owner and data receiver. In this case, the access URL is no metadata for a publication but linked to a subscription that enables access to the publication.

The user and/or non-user of the NAP platform can search for data sets descriptions. In order to get access to the data, the user and/or non-user can send an inquiry to the data publisher. For this, the following fields have to be filled out: Subject (mandatory), First name (optional), Last name (optional), Phone number (optional), Email address (mandatory), Text of inquiry (mandatory).

Request

Figure 16: Request form for a dataset on the Austrian NAP platform

Or the data access button can lead to the portal of data descriptions publisher (see example):

Figure 17: Dataset publisher portal

3.4 RELATING THE INTEROPERABILITY FRAMEWORK TO THE NATIONAL ACCESS POINTS

3.4.1 The Interoperability Framework acting as a National Access Point

The Interoperability Framework is a consistent collection of independent tools all based on semantic web standards designed to support a wide range of architectural compositions and deployment options. It is designed for flexibility to match the fundamental business need in the mobility domain of creating interoperable, distributed computing applications without enforcing a synchronized roadmap of simultaneous migration to a single integrated system.

Because of its flexibility, it lends itself to be used in the implementation of National Access Points in their different architectural 'styles' documented in the previous chapter: from fully centralized and homogeneous to fully distributed and federated heterogeneous systems. In addition, it supports publishing and consuming complete data sets in batch mode (upload/download), or operating in a service oriented, online mode, across any data format

representation of common concepts expressed in a formal machine-readable ontology. Finally, it supports the linking of data across multiple NAPs allowing consumer applications to query and retrieve data from everywhere through their unique (national) access point. These capabilities are of paramount importance to Mobility Operators, who are much more concerned with *getting* the data to a single point, where they need it, than in the data *being* in a single point; and much more interested in *getting* data in a single format *they understand* than in providing data in a single format they do not use locally.

The table below summarizes how the Interoperability Framework meets the National Access Point requirements.

NAP requirement	Interoperability Framework support
Registration (Administrator, Contact Point, Publisher, Consumer)	Asset Manager component provides out-of-the-box functionality to create and administer system, business and technical roles with different privileges, and to register and manage user accounts associating them to the appropriate roles. Also provides user activity tracking and auditing functionality natively
Publishing datasets	Asset Manager components provide out-of-the-box configurable automated workflow process management to enforce dataset management, including publishing. Workflow is configured with steps assigned to roles and individual user accounts, e.g. Data Owners or Contact Points, and its execution is enforced by Asset Manager business process management. Process execution generates a notification of to-do lists and process events, as well as tracking and audit trails
Consuming datasets	Asset Manager components provide out-of-the-box configurable automated workflow process management to enforce dataset management, including consuming. Consumer workflow can be configured to allow for subscription to one or more assets, including data sets. Availability, e.g. through publication by a Contact Point or Data Owner, of a subscribed data set can trigger a notification send to the Consumer, and/or send the dataset to the Consumer automatically through a process associated to the asset in the asset descriptor, e.g. a publish-subscribe queue. Out-of-the-box functionality can be used by Consumers to lookup the Asset Descriptor Registry and obtain manually the requested dataset. Asset Manager Registry and Asset Store can also be accessed online by machines through specialized

	Interoperability Framework resolver services, e.g Location Resolver, through REST web services and a SPARQL REST endpoint
Machine-readable metadata management	Asset Manager component provides out-of-the-box management of configurable asset descriptors in the Asset Descriptor Registry. Asset descriptors are machine-readable metadata associated with a wide range of assets managed by the Asset Manager, including data sets. The Asset Descriptors Registry in the Asset Manager is used for automated or manual discovery of the assets, whether stored in the Asset Manager itself or remotely distributed and is used by the Interoperability Framework to obtain and execute semantic conversion automatically, described below, as necessary
Mandatory and/or compatible data format specifications	The Interoperability Framework provides automatic semantic conversion across multiple data formats by design. Specialized converters to/from any format to/from the formats made mandatory by the EU Delegated Regulation are automatically packaged into deployable units or microservices based on a common ontology. Converters are themselves assets managed by the Asset Manager with their Asset Descriptors: they can, therefore, be discovered and deployed: • at the Producer, to generate and publish local formats in the EU Regulation specification to the NAP • at the Consumer, to convert EU Regulation specification from the NAP to the local format • at the NAP, to accept or produce either format, local or EU Regulation Data are always automatically 'lifted' to a Resource Definition Framework (RDF) graph internally by the Interoperability Framework according to the common ontology, making all formats 'compatible' by virtue of their common semantics. Additionally, at the time of dataset publication the Asset Manager internally "lifts" contents creating semantic RDF graphs that are stored in its internal Graph (or "Triples") store. These graphs can be linked across NAPs over the

		world wide web, thus creating a distributed linked data 'web of transport' data. While datasets in a specific format can always be generated and consumed through a manual or REST endpoint, or through a publish and subscribe channel, the linked graph can also be queried using the Asset Manager's SPARQL endpoint. SPARQL endpoints supporting federated queries, this enables a consumer to query and generate datasets from multiple NAPs simultaneously, provided proper privileges to the user are granted by them. The overall linked RDF graph can also be populated through by streaming, rather than uploading, data from the Producer.	

NAP Requirements

| Code	Level	Short Description	Extended Description
NAP-01	REQUIRED	NAP MUST implement user registration	NAP MUST implement user registration and authentication to enable controlling and monitoring access to resources.
NAP-02	REQUIRED	NAP MUST implement user roles	NAP MUST implement user roles to enable different privileges on resources. At least three roles need to be implemented: • Admin • Publisher • Consumer Each role has different privileges about which metadata of a resource can see and about what can do on the resource
NAP-02.1	RECOMMENDED	NAP SHALL implement an Admin role which has all privileges over resources and is able to approve the publication and the utilization of a resource	

NAP-02.2	RECOMMENDED	NAP SHALL implement a Publisher role which is able to request the publication of a resource and to approve the utilization of a resource	
NAP-02.3	RECOMMENDED	NAP SHALL implement a Consumer role which can request the utilization of a resource	
NAP-03	REQUIRED	NAP MUST implement search functionalities over resources	NAP MUST implement the following search functionalities: • search box, • browsing by categories/filters
NAP-03.1	RECOMMENDED	NAP SHALL expose search functionalities also to not authenticated users	
NAP-04	REQUIRED	NAP MUST implement a metadata catalogue	NAP MUST implement a metadata catalogue, i.e. information about a resource MUST be collected in a structured way.
NAP-04.1	RECOMMENDED	NAP SHALL implement the Coordinated Metadata Catalogue	
NAP-04.1.1	OPTIONAL	NAP MAY convert metadata from	

		Coordinated Metadata Catalogue to DCAT-AP	
NAP-05	RECOMMENDED	NAP SHALL implement serialization of metadata in a machine-readable format	NAP SHALL implement serialization of metadata in a machine-readable format such as Turtle and JSON
NAP-06	RECOMMENDED	NAP SHALL implement evaluation functionalities	NAP SHALL implement functionalities to evaluate the extent of use of the resources
NAP-07	RECOMMENDED	NAP SHALL implement monitoring functionalities	NAP SHALL implement functionalities to monitor the state and performance of the system
NAP-08	OPTIONAL	NAP MAY implement tools for converting data into standards which EU Delegated Regulations refer to	NAP MAY implement conversion tools from common or proprietary transport formats to standard formats required by EU Delegated Regulations, such as: • DATEX II • NeTEx • SIRI

3.4.2 The Interoperability Framework contributing data to a National Access Point

Compliance with the EU Regulation requires that Data Owners make their datasets available to the NAPs in a specified format or a format 'compatible' with it. Using Interoperability Framework microservices this can be accomplished by linking them to create specific 'routes' or processing chains. The following diagram shows one of many possible such routes[12]:

---

[12] Icons in this and the following diagrams are the standard industry Enterprise Integration Patterns. Cfr: https://www.enterpriseintegrationpatterns.com/patterns/messaging/toc.html
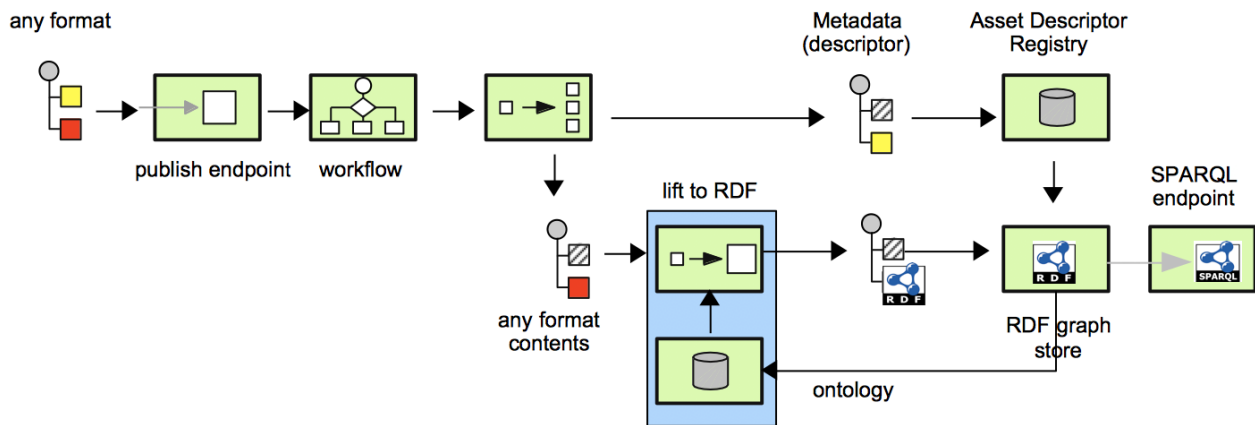
Figure 18: High-level publishing process

The essential feature of the process is the fact that datasets can be published in any format and are stored internally in the Asset Manager's RDF graph store as an RDF graph. At the heart of the process is the "lifter" block, shown in light blue, which uses a common ontology, also stored in the graph store, to convert the incoming dataset contents into RDF. Metadata is stored as the asset description of the specific graph contents. An automated workflow process is executed to enforce publishing rules which can be defined by NAP administrators prior to being committed to the graph store.

Since RDF graphs in the graph store can always be "lowered" to one or more of the EU Regulation format specification at the time of consumption, as explained in the next chapter, the process makes, in effect, all incoming formats 'compatible' with those specifications.

3.4.3 The Interoperability Framework accessing data from a National Access Point

As in the case of Publishing, Interoperability Framework microservices can also be chained in process links to create 'consuming' processing routes, as in the following diagram:
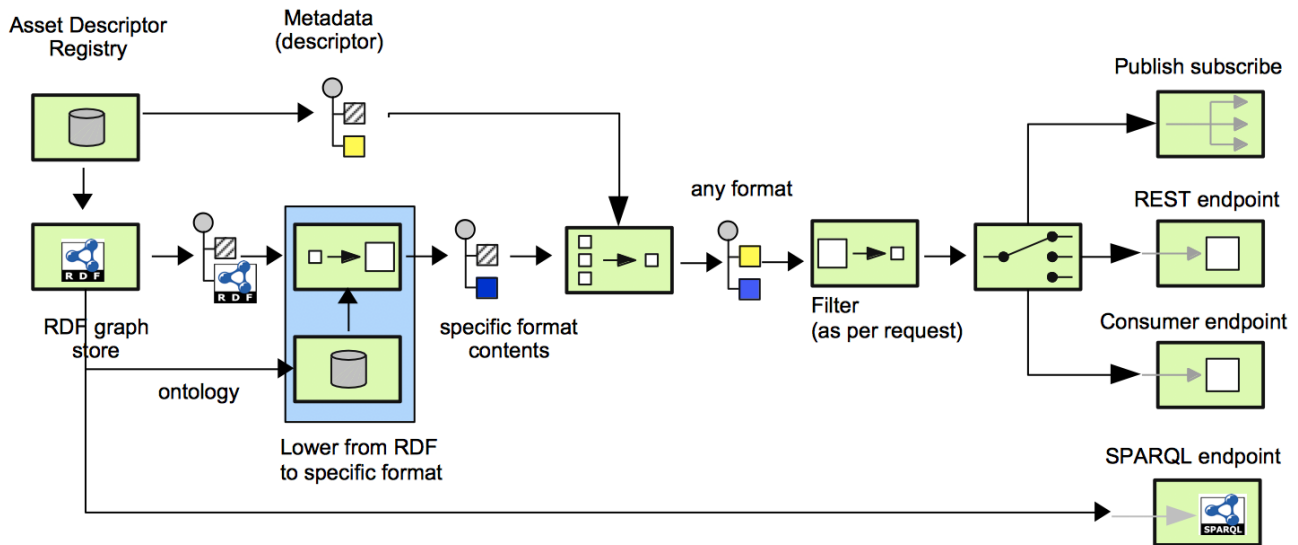
Figure 19: High-level consuming process

In this case, the data contents stored in the RDF graph store is 'lowered' to the specific requested data format, it may go through a filtering step if only a portion of the dataset is required, and it can be routed to one or more of several endpoints depending on the consumer's requirement, e.g. to a publish and subscribe channel, to a REST web service or a manual endpoint such as the NAP's web portal interface. Consumers can also access the SPARQL endpoint provided by the Access Manager to perform semantic queries which, since the RDF data contained in graph stores in multiple NAPs can be linked, can span the entire 'web of transport data'.

In this deliverable we analyzed how to improve the integration of the components being developed in the context of this project with the components being developed in the CONNECTIVE project, and we laid out a path for a better Interoperability Framework. The requirements coming from CONNECTIVE will allow SPRINT to provide a better set of tooling with better support for the IP4 scenario.

The analysis of the National Access Point landscape showed that SPRINT tools are already able to efficiently relate to existing NAPs. F-Rel will take into account the requirements extracted from the analysis, and will deliver a better Asset Manager which will support contributing to a NAP, and aggregating metadata coming from different NAPs, and will demonstrate that the Interoperability Framework can be an effective "partner" of the National Access Point.

[1] European Commission, Directorate-General for Informatics, "New European interoperability framework : promoting seamless services and data flows for European public administrations," Publications Office of the European Union, Luxembourg, 2017.

[2] M. Glinz, "On non-functional requirements," in *n 15th IEEE International Requirements Engineering Conference (RE 2007)*, 2007.

[3] Semantic Web Group, "W3C SEMANTIC WEB ACTIVITY," 11 December 2011. [Online]. Available: https://www.w3.org/2001/sw/. [Accessed 14 August 2019].

[3.1] NAP Common Features and Level of Services Support Document v 2.0. [Online]. Available: https://portal.its-platform.eu/filedepot_download/2229/6586

[4] NAP: Finnish national open transport service catalog. [Online]. Available: https://finap.fi/#

[5] TRAFICOM: Finnish Transport and Communications Agency, "How to submit your transport service information to the NAP service catalog". [Online]. Available: https://www.traficom.fi/en/services/how-submit-your-transport-service-information-nap-service-catalog

[6] Declaration of Compliance, ITS Action C – Road Safety-Related Traffic Information. Available: https://www.its-platform.eu/filedepot_download/1980/5870

[7] TRANSPORTPORTAL.NO: Nasjonalt tilgangspunkt for veg- og transportdata, "Information about the portal". [online]. Available: https://transportportal.atlas.vegvesen.no/en/gen/about/

[8] TRANSPORTPORTAL.NO: Nasjonalt tilgangspunkt for veg- og transportdata, „Add data". [online]. Available: https://transportportal.atlas.vegvesen.no/en/write/add-data/

[9] AUSTRIATECH Mobilitätsdaten Österreich [online]. Available: https://mobilitydata.gv.at/en/about-mobilitydatagvat