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Triona AB

Lars Wikström, Peo Svensk

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[INSPIRE ALIGNMENT]

A study on how to align ROSATTE with INSPIRE on a technical point of view

Abstract

Already during the ROSATTE-project which was the predecessor to eMaPS, an alignment with INSPIRE was the goal. Some technical solutions from INSPIRE was adopted as is in ROSATTE. Also the RappTrans report suggests that a combination of INSPIRE and ROSATTE could be the best solution to make public data available for digital maps in the next decade.

The goal of this report is to answer the question how to, from a technical perspective, make the existing ROSATTE specifications an extension to, or align it with the framework of INSPIRE including the Transport Network spec, service discovery method and methods for monitoring and management of content quality.

The INSPIRE Network Service Architecture **Feil! Fant ikke referansekilden.**, provides an architectural framework within which the INSPIRE network services will be implemented. The various types of services described in the architecture, e.g. for discovery, view, download and transformations are the same for all data themes within INSPIRE. INSPIRE provides data specifications for a large set of data themes, where the data specification for transport networks (DS TN) [11] is the one closest to the ROSATTE scope.

Since it is reasonable to assume that many road authorities in EU member states are providers of both INSPIRE and ROSATTE data, a good solution would be to fit the ROSATTE framework into the INSPIRE Network Services Architecture. If this can be achieved, both the authorities and the data consumers will benefit.

The road authorities' benefit since one single technical platform may be used for publishing all data which results in lower costs for development and maintenance which in turn possibly leads to better overall quality.

Besides from benefitting from increased quality of data and service, the data consumers benefit since common portals with common services/interfaces and data formats can be used to access public authority data.

This report compares the various technical components of INSPIRE and ROSATTE and describes the actions needed to achieve the cleanest possible full harmonization. To achieve a full harmonization, we believe that some modifications are necessary also in INSPIRE DS TN [11]. However, we also believe that it is unrealistic to propose any changes to the current INSPIRE framework in the short run. Therefore, we propose a "good enough" solution which means that any alignment work occurs on the ROSATTE side and that the INSPIRE is untouched. In the short run, we propose the following actions to occur on the ROSATTE side:

- **Produce an INSPIRE compliant data specification for ROSATTE (DS ITS)**
    - This is fundamental to any INSPIRE theme and specifies the data, metadata, quality and presentation requirements according to a template which is common to all INSPIRE themes. This activity presents ITS (ROSATTE) as a new data theme that fits into the INSPIRE Network Services Architecture. Even though things like map agnostic location referencing methods could be useful also within DS TN they are kept local to DS ITS at the moment. Also some partly overlapping definitions between DS ITS end DS TN will exist for the time being. This activity would include both development and review. To make DS ITS compliant with INSPIRE D2.5 [3], some changes are needed in the DS ITS specification compared with the ROSATTE application schema. We assume that the main generic structure of the ROSATTE schema may be kept as is. This structure models different types of safety features and safety feature attributes using code lists which may be managed separately. This means that, at least structurally, most extensibility issues should be possible to handle without affecting the structure of the application schema.
- **Modify the ROSATTE gml schemas according to changes in the data specification and review the schemas against INSPIRE encoding rules**
    - The ROSATTE xsd files already use most of the INSPIRE (GML) encoding rules but the schemas needs some minor changes and also inspection by experts

- **Make ROSATTE download services INSPIRE compliant**
    - At the time, no guidelines regarding services were available from INSPIRE which lead to ROSATTE specifying a simple RESTFul interface for download services. This activity aims to make ROSATTE (DS ITS) data available through the same channels and interfaces as the other INSPIRE data themes.

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Glossary and Abbreviations

Table 1 – Glossary and Abbreviations

Term	Definition
INSPIRE	Infrastructure for Spatial information in the European Community [http://inspire.jrc.ec.europa.eu/]
DG MOVE	Directorate-General for Mobility and Transport (European Commission)
eMaPS	The eMaPS project contributes to the establishment of an independent implementation platform promoting and extending the scope of the validated ROSATTE framework as an enabler for the implementation of priority action 1.2 and 1.3 of the ITS directive. [http://www.ertico.com/emaps]

1 Introduction

1.1 Prerequisites and background

Already during the ROSATTE-project which was the predecessor to eMaPS, an alignment with INSPIRE was the goal. Some technical solutions from INSPIRE was adopted as is in ROSATTE. Also the RappTrans report suggests that a combination of INSPIRE and ROSATTE could be the best solution to make public data available for digital maps in the next decade.

The above leads to the need to specify best possible way to use the ROSATTE-specification in the context of INSPIRE.

1.2 Objectives of this study

The goal is to answer the following question:

- How to make the existing ROSATTE specifications an extension to, or align it with the framework of INSPIRE including the Transport Network spec, service discovery method and methods for monitoring and management of content quality.

- How to develop unambiguous specifications of necessary attributes for the full range of ITS applications.

And also to prepare a set (the 10 original ROSATTE) of specifications as examples

By answering the above questions it should be possible to take an informed decision on how to align the ROSATTE specification with INSPIRE when establishing the ROSATTE Implementation Platform.

During further testing of ROSATTE exchange between Trafikverket and TomTom, there sometimes has been a need for the supplier (Trafikverket) to provide information about the road network geometry in addition to the ROSATTE safety features. This need may arise when location referencing fails when road elements exist at the supplier and not the consumer side. The ROSATTE data format does not cover the exchange of road network geometry at all. This need could perhaps be covered by INSPIRE since it is possible there to exchange road element geometry and the authorities are already obliged (since INSPIRE is European law) to be able to provide such information.

1.3 Scope and delimitations

The report describes the technical framework of INSPIRE and a recommendation how ROSATTE can align with it on a technical point of view. No organizational investigation is carried out.

2 Overview of INSPIRE

2.1 Introduction

The following introduction to INSPIRE is cited from INSPIRE Network Services Architecture **Feil! Fant ikke referansekilden.**:

INSPIRE is a directive proposed by the European Commission in July 2004 setting the legal framework for the establishment and operation of an infrastructure for spatial information in Europe.

The guiding principles of INSPIRE are:

- That the infrastructures for spatial information in the member states should be designed to ensure that spatial data are stored, made available and maintained at the most appropriate level;

- that it is possible to combine spatial data from different sources across the Community in a consistent way and share them between several users and applications;
- that it is possible for spatial data collected at one level of public authority to be shared between all the different levels of public authorities;
- that spatial data are made available under conditions that do not unduly restrict their extensive use;
- that it is easy to discover available spatial data, to evaluate their fitness for purpose and to know the conditions applicable to their use.

INSPIRE specifications are categorized according to the figure below:

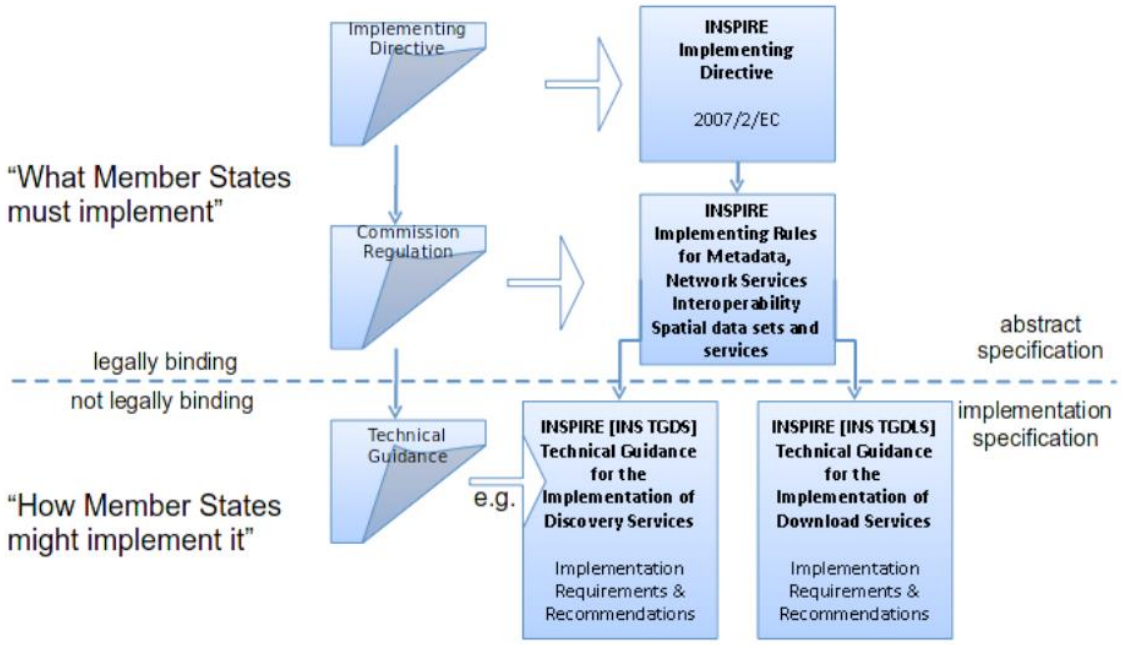

Figure 1 - Relationship between INSPIRE Implementing Rules and Technical Guidance

2.2 INSPIRE Network Services Architecture

The document INSPIRE Network Services Architecture **Feil! Fant ikke referansekilden.** is an informative document which provides an architecture within which the INSPIRE Network Services will be implemented.

The figure below shows an overview of the components in the INSPIRE Network Services Architecture.

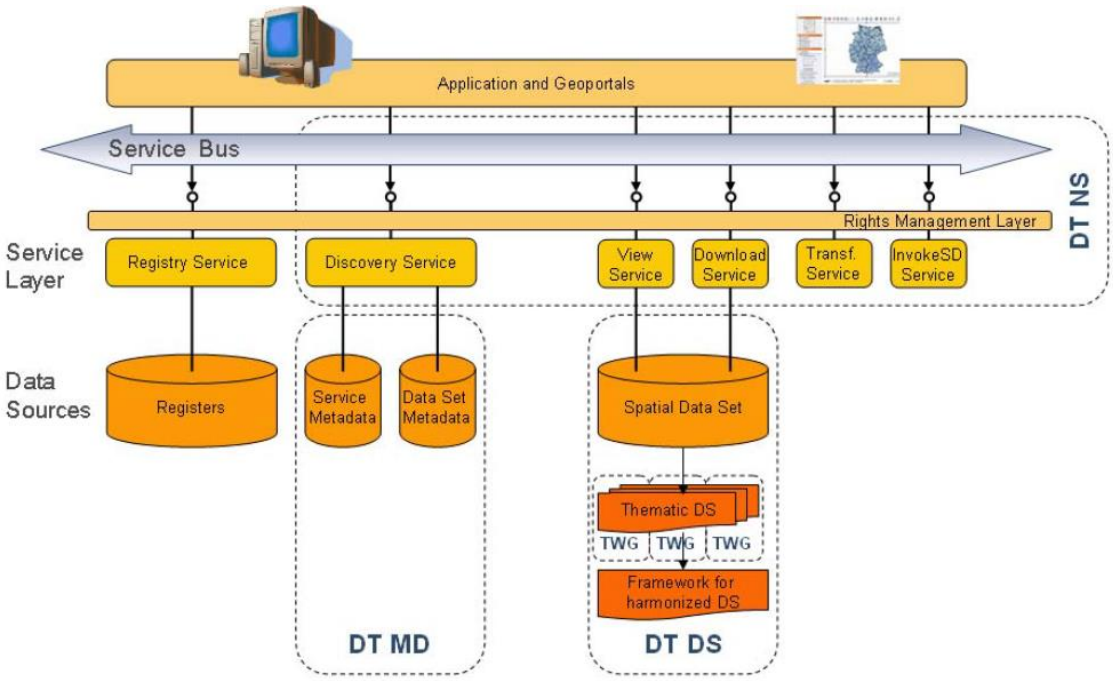

Figure 2 - INSPIRE Network Services Architecture Overview

The overall goal of the architecture is to provide a framework which enables users to discover (find and evaluate), view and download spatial data in a uniform manner, regardless of who is providing the data. Below, the different components in the architecture are briefly explained.

2.2.1 Discovery Services

The goal of discovery services is to support discovery of data, evaluation and use of spatial data and services through their metadata properties. Metadata is the information and documentation which makes these resources understandable and sharable for users over time.

In other words, the purpose of discovery services is to make users aware that data exist and also provide information which enables users to evaluate the usability of the data for their particular use.

2.2.2 View Services

The goal of view services is to support viewing of spatial data making it possible to, as a minimum, to display, navigate, zoom in/out, pan or overlay viewable spatial data sets and to display legend information and any relevant content of metadata. Some of the aspects considered by the implementing rules for view services:

- Nature of the Metadata
- Common coordinate reference system
- Temporal data dimension
- View geometry selection
- Multiple datasets view output format
- Styling
- Rights Management
- Legend availability and handling
- Correspondence between layers and INSPIRE themes
- Multilingualism
- relationship with client applications

2.2.3 Download Services

A download service supports

- Download of a complete dataset or datasets, or
- a part of a dataset or datasets, and¨
- where, practicable, provides direct access to complete datasets or parts of datasets.
- Gazetteer like services are also covered by a type of download service

In the context of INSPIRE and the scope of the implementing rules, datasets are restricted to the categories defined by the annexes I-III.

Ideally, the data that is available for download should be made available according to the various theme specific data specifications (e.g. Transport Networks, Administrative Units etc).

It is worth to note that the conceptual or application schema of the local or national spatial data set may and will often differ from the INSPIRE harmonised specification of the spatial object types in the data specification. In this case a download service may transform between the application schema of the spatial dataset and the harmonised schema on-the-fly, if possible, or a transformation service may be invoked. Alternatively, a member state may provide a download service based on derived datasets converted in advance of receiving the query. Search criteria need to support a variety of criteria, including spatial and temporal extents, metadata elements, and feature properties.

2.2.4 Transformation Services

The INSPIRE Directive requires, in Article 11(1)(d), Member States to “establish and operate a network of … transformation services, enabling spatial data sets to be transformed with a view to achieving interoperability”.

Transformation Service is a special case among the recognized INSPIRE service types, as its function is to help other services in achieving compliance with the relevant INSPIRE specifications. It cannot thus be required at the MS level, if all the existing services already comply with the INSPIRE rules. In many cases the functionality envisaged for a Transformation Service is recommendable to be embedded inside another service type. This can be justified both for performance and service robustness reasons and might be realised, for instance, in the form of a transforming View service or a transforming Download service. When regarded as an individual service instance, the Transformation Service is currently interpreted as a real-time Coordinate Transformation Service, chained with a Download Service for input data. This kind of Transformation Service is seen as a spatial data processing service, capable of transforming the input dataset from a Coordinate Reference System (CRT) into another.

2.2.5 Invoke Spatial Data Services

The INSPIRE Directive asks Member States in article 11(1) (e) to establish and operate a network of “services allowing spatial data services to be invoked”. In addition, where public authorities levy charges for invoke spatial data services, Member States shall ensure that e-commerce services (including rights management services) are available (arcticle 14(4)).

The “Invoke Spatial Data Service” service allows defining both the data inputs and data outputs expected by the spatial service and define a workflow or service chain combining multiple services. It also allows the definition of a web service interface managing and accessing (executing) workflows or service chains.

The “Invoke Spatial Data Services” service supports invoking individual (spatial) services as well as combinations of individual (spatial) services both synchronous and asynchronous, in service chains through a (web) service orchestration engine a.k.a. “workflow engine”. The service chains are expressed in a standard (e.g. XML-based) notation that can be consumed by commercial as well as open-source orchestration engines from multiple sources.

For spatial data services available on the Internet, the “Invoke Spatial Data Service” service will enable a user or client application to run them without requiring the availability of a GIS. This requires that a client application can discover the service, bind to it and invoke it. The orchestration/combination of Spatial Data Service with other services will require to precisely define the interactions between the

services. Therefore, the interaction between the (spatial) services to be invoked is defined as a workflow or composite service in a standard notation (e.g. XML-based).

2.2.6 Thematic Data Specifications

For each of the themes defined in annex I-III a data specification has been/shall be developed. The data specifications are technical guidelines that serve as basis for the corresponding implementing rules. The data specifications specify the structure and possible content of the spatial datasets that may be viewed and/or downloaded via the view/download services. The table below shows the various available themes (copied from **Feil! Fant ikke referansekilden.**).

Annex I:

Theme	Description
Coordinate reference systems	(INSPIRE, 2007) Systems for uniquely referencing spatial information in space as a set of coordinates (x,y,z) and/or latitude and longitude and height, based on a geodetic horizontal and vertical datum.
Geographical grid systems	(INSPIRE, 2007) Harmonised multi-resolution grid with a common point of origin and standardised location and size of grid cells.
Geographical names	(INSPIRE, 2007) Names of areas, regions, localities, cities, suburbs, towns or settlements, or any geographical or topographical feature of public or historical interest.
Administrative units	(INSPIRE, 2007) Units of administration, dividing areas where Member States have and/or exercise jurisdictional rights, for local, regional and national governance, separated by administrative boundaries.
Addresses	(INSPIRE, 2007) Location of properties based on address identifiers, usually by road name, house number, postal code.
Cadastral parcels	(INSPIRE, 2007) Areas defined by cadastral registers or equivalent
Transport networks	(INSPIRE, 2007) Road, rail, air and water transport networks and related infrastructure. Includes links between different networks. Also includes the trans-European transport network as defined in Decision 1692/96/EC of the European Parliament and of the Council of 23 July 1996 on Community guidelines for the development of the trans-European transport network * and future revisions of that decision. * OJ L 228,9.9.1996, p.1. Decision as last amended by Decision No. 884/2004/EC (OJ L 167,30.4.2004, p.1. Corrigendum published in OJ L 201,7.6.2004,p.1).
Hydrography	(INSPIRE, 2007) Hydrographic elements, including marine areas and all other water bodies and items related to them, including river basins and sub-basins. Where appropriate, according to the definitions set out in Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy *, and in the form of networks. * OJ L 327,22.12.2000, p.1. Directive as amended by Decision No. 2455/2001/EC (OJ L 331, 15.12.2001, p.1.).
Protected sites	(INSPIRE, 2007) Area designated or managed within a framework of international, Community and Member States' legislation to achieve specific conservation objectives.

Annex II:

Theme	Description
Elevation	(INSPIRE, 2007) Digital elevation models for land, ice and ocean surfaces. Includes terrestrial elevation, bathymetry and shoreline.
Land cover	(INSPIRE, 2007) Physical and biological cover of the earth's surface including artificial surfaces, agricultural areas, forests, (semi-)natural areas, wetlands, water bodies.
Orthoimagery	(INSPIRE, 2007) Geo-referenced image data of the Earth's surface, from either satellite or airborne sensors.
Geology	(INSPIRE, 2007) Geology characterised according to composition and structure. Includes bedrock, aquifers and geomorphology.

Annex III:

Theme	Description
Statistical units	(INSPIRE, 2007) Units for dissemination or use of statistical information.
Buildings	(INSPIRE, 2007) Geographical location of buildings.
Soil	(INSPIRE, 2007) Soils and subsoil characterised according to depth, texture, structure and content of particles and organic material, stoniness, erosion, where appropriate mean slope and anticipated water storage capacity.
Land use	(INSPIRE, 2007) Territory characterised according to its current and future planned functional dimension or socio–economic purpose (e.g. residential, industrial, commercial, agricultural, forestry, recreational).
Human health and safety	(INSPIRE, 2007) Geographical distribution of dominance of pathologies (allergies, cancers, respiratory diseases, etc.), information indicating the effect on health (biomarkers, decline of fertility, epidemics) or well-being of humans (fatigue, stress, etc.) linked directly (air pollution, chemicals, depletion of the ozone layer, noise, etc.) or indirectly (food, genetically modified organisms, etc.) to the quality of the environment.
Utility and government services	(INSPIRE, 2007) Includes utility facilities such as sewage, waste management, energy supply and water supply, administrative and social governmental services such as public administrations, civil protection sites, schools and hospitals.
Environmental monitoring facilities	(INSPIRE, 2007) Location and operation of environmental monitoring facilities includes observation and measurement of emissions, of the state of environmental media and of other ecosystem parameters (biodiversity, ecological conditions of vegetation, etc.) by or on behalf of public authorities.
Production and industrial facilities	(INSPIRE, 2007) Industrial production sites, including installations covered by Directive 96/61/EC of 24 September 1996 concerning integrated pollution prevention and control * and water abstraction facilities, mining, storage sites. * OJ L 257, 10.10.1996, p.26 Directive as last amended by Regulation (EC) No 1882/2003
Agricultural and aquaculture facilities	(INSPIRE, 2007) Farming equipment and production facilities (including irrigation systems, greenhouses and stables).
Population distribution –	(INSPIRE, 2007) Geographical distribution of people, including population characteristics and activity levels, aggregated by grid,

demography	region, administrative unit or other analytical unit.
Area management / restriction / regulation zones & reporting units	(INSPIRE, 2007) Areas managed, regulated or used for reporting at international, European, national, regional and local levels. Includes dumping sites, restricted areas around drinking water sources, nitratevulnerable zones, regulated fairways at sea or large inland waters, areas for the dumping of waste, noise restriction zones, prospecting and mining permit areas, river basin districts, relevant reporting units and coastal zone management areas.
Natural risk zones	(INSPIRE, 2007) Vulnerable areas characterised according to natural hazards (all atmospheric, hydrologic, seismic, volcanic and wildfire phenomena that, because of their location, severity, and frequency, have the potential to seriously affect society), e.g. floods, landslides and subsidence, avalanches, forest fires, earthquakes, volcanic eruptions.
Atmospheric conditions	(INSPIRE, 2007) Physical conditions in the atmosphere. Includes spatial data based on measurements, on models or on a combination thereof and includes measurement locations.
Meteorological geographical features	(INSPIRE, 2007) Weather conditions and their measurements; precipitation, temperature, evapotranspiration, wind speed and direction.
Oceanographic geographical features	(INSPIRE, 2007) Physical conditions of oceans (currents, salinity, wave heights, etc.).
Sea regions	(INSPIRE, 2007) Physical conditions of seas and saline water bodies divided into regions and sub-regions with common characteristics.
Bio-geographical regions	(INSPIRE, 2007) Areas of relatively homogeneous ecological conditions with common characteristics
Habitats and biotopes	(INSPIRE, 2007) Geographical areas characterised by specific ecological conditions, processes, structure, and (life support) functions that physically support the organisms that live there. Includes terrestrial and aquatic areas distinguished by geographical, abiotic and biotic features, whether entirely natural or seminatural.
Species distribution	(INSPIRE, 2007) Geographical distribution of occurrence of animal and plant species aggregated by grid, region, administrative unit or other analytical unit.
Energy resources	(INSPIRE, 2007) Energy resources including hydrocarbons, hydropower, bio-energy, solar, wind, etc., where relevant including depth/height information on the extent of the resource.
Mineral resources	(INSPIRE, 2007) Mineral resources including metal ores, industrial minerals, etc., where relevant including depth/height information on the extent of the resource.

All of the above themes are described in separate data specifications which are all based on the INSPIRE Data specification development framework:

- D2.3: Scope and definition of themes **Feil! Fant ikke referansekilden.**
- D2.5: Generic Conceptual Model **Feil! Fant ikke referansekilden.**
- D2.6: Methodology
- D2.7: Encoding guidelines
- D2.9: Guidelines for the use of Observations & Measurements

- D2.10: Common models (Coverage, Network, Activity Complex)

Briefly, this means that the data specifications conform to ISO 19131, and that the application schemas within the data specifications conform to ISO 19109 and ISO 19103/UML 2.1. The data specifications also contain a feature catalogue according to ISO 19110.

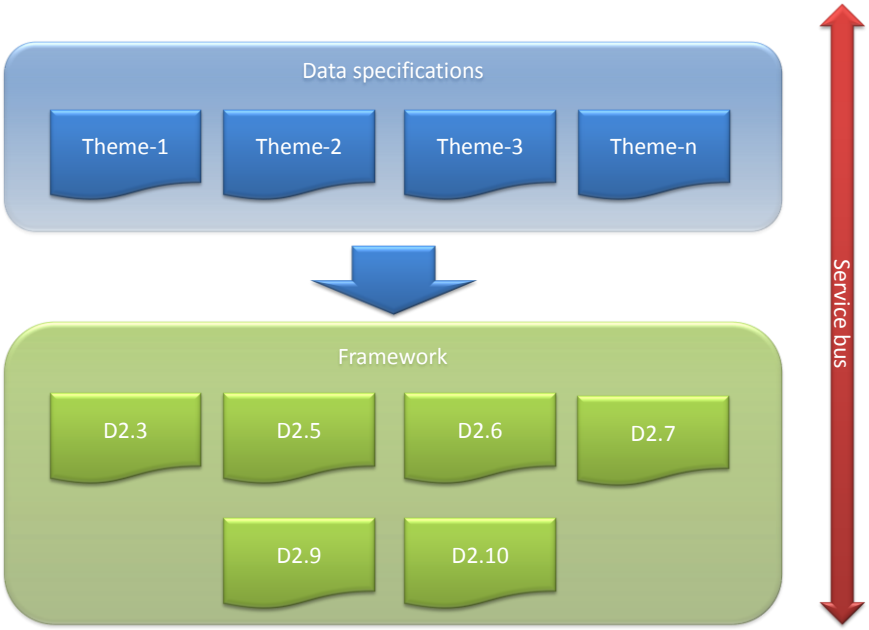

Figure 3 - Organisation of data specifications within INSPIRE

All data specifications use the same framework. This means that all themes are modeled using a common language and that common or shared spatial objects relevant in multiple themes have been identified and modeled in a consistent manner.

In D2.7 – Guidelines for the encoding of spatial data contains a default encoding rule which use ISO 19136 – GML and ISO 19139 – Metadata – XML schema implementation. This means that there exists a default encoding rule which is common across all themes.

The content of each theme specific data specification in INSPIRE relies on identified theme specific requirements and input. As an overall guiding rule for all themes, the INSPIRE Generic Conceptual Model uses the following figure:

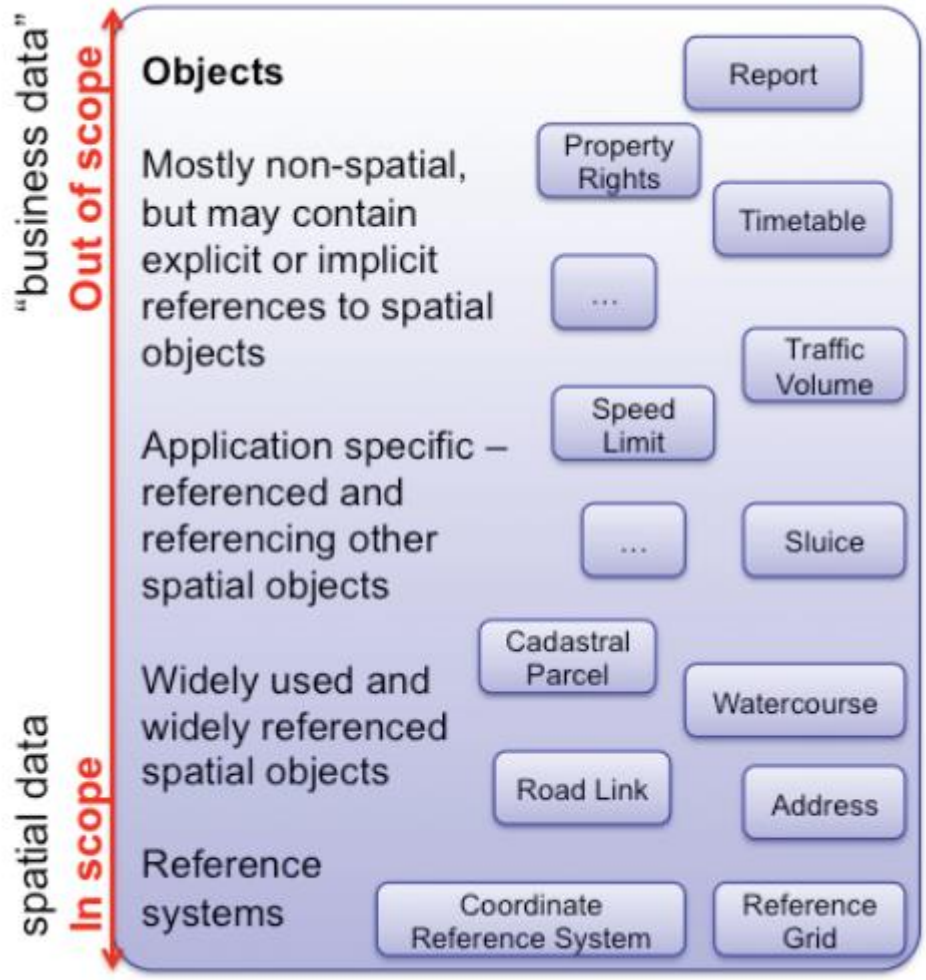

Figure 4 - Spatial data vs. "business data"

Even though it might be difficult to know where to "draw the line", the focus of the INSPIRE data specifications shall be on reference systems and widely used and widely referenced spatial objects and not business data.

3 Overview of ROSATTE

3.1 Introduction

The major problem that ROSATTE addresses is how to ensure timely and easy access to road information owned and maintained by thousands of road authorities. In addition mechanisms are needed to enhance the quality of the available data in terms of accuracy, correctness and up-to-datedness, and to enable multilevel (local/national/European) aggregation of the data. With respect to a future continuous delivery and integration of updates of road attribute data, road authorities that provide such updates will be responsible for the timeliness delivery (within an agreed time period after the change of the attribute on the road), and for the correctness and positional accuracy of the data. Data integrators on their side will be responsible for correct interpretation of the received data, and correct inclusion in their digital map databases. For certain safety critical attributes an independent certification body may be created that will be responsible for surveillance of the methods and procedures used.

The ROSATTE project was divided in several work packages:

- WP1 Requirements and overall architecture:

- WP2 Methods and tools for safety attributes access and maintenance
- WP3 Data exchange infrastructure, methods and tools
- WP4 Data integration into digital databases
- WP5 Quality, Test and Validation of the data chain
- WP6 Organisational aspects and expected benefits
- WP7 Dissemination and Liaison
- WP8 Project Management

Three of these directly address different parts of the data chain. This is illustrated in the figure below:

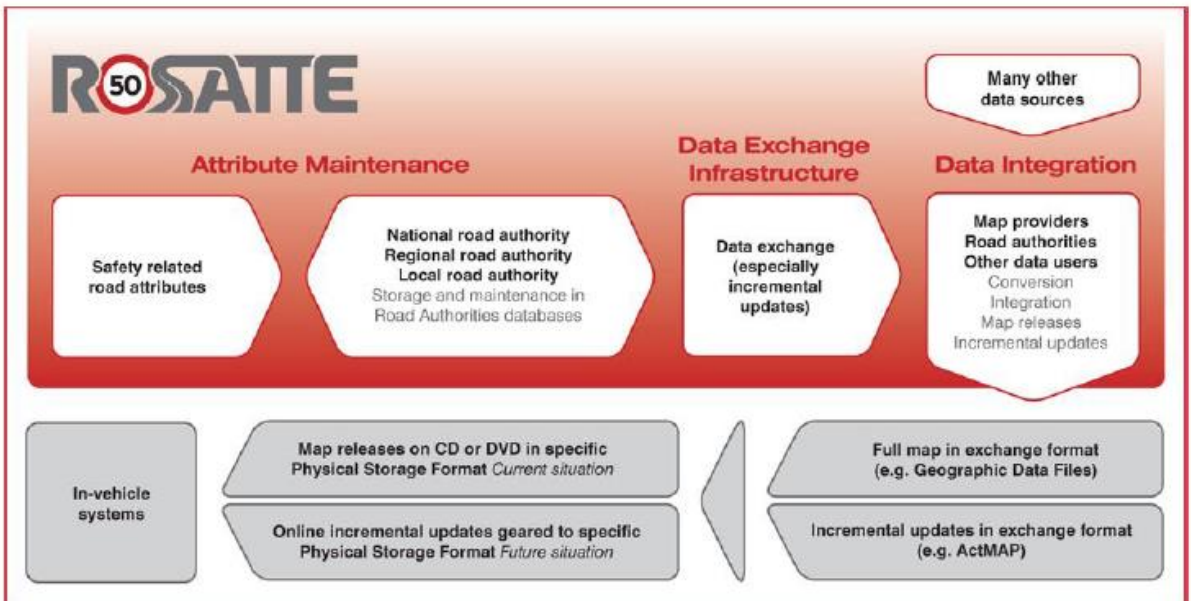

Figure 5 - Overview of the data chain in relation to the ROSATTE project activities

The “attribute maintenance” package (WP2) is concerned with methods for capturing changes in the attribute data and maintaining these in the digital storage systems in use by authorities.

The “data exchange infrastructure” package (WP3) addresses the infrastructure for data exchange between the databases of road authorities and the databases of data users.

The “data integration” package (WP4) addresses the data integration and aggregation in the databases of the data users.

Of these packages, the one most closely related with the INSPIRE Network Services Architecture is WP3 – Data exchange infrastructure.

3.2 ROSATTE data exchange infrastructure

3.2.1 Requirements

The table below is a selection of requirements (those that primarily concern data exchange) from the ROSATTE deliverable D3.1 – Specification of data exchange methods **Feil! Fant ikke referansekilden.**.

ID	Requirement name	Short definition	Priority: C: Critical S: Significant I: Of interest	Comments, links to other requirements, open issues

ID	Requirement name	Short definition	Priority: C: Critical S: Significant I: Of interest	Comments, links to other requirements, open issues
FR-1	Data discovery	A specification of a Discovery service with metadata shall be available.	C	The ROSATTE infrastructure shall provide discovery service with suitable metadata, that enables the Information Provider to easily find services providing road safety attributes. Note: Within ROSATTE WP3, due to time constraints, the discovery service has not been prioritized. The INSPIRE implementing rules for discovery services are believed to be valid also for ROSATTE.
FR-2	Standardized access	Data Services and their use shall be specified.	S	No matter what the content is, accessing and using Data Service's is done the same way across the Europe. Guidelines stating how to access Data Services in a standardized way shall be defined.
FR-3	Data subscription	Guidelines specifying how to subscribe to road safety attributes in the ROSATTE exchange infrastructure shall be provided.	S	Information Providers can subscribe for change notifications for their individual needs. Data subscription functionality is created by combining with FR-5.
FR-5	Incremental updates	The ROSATTE infrastructure shall provide both incremental updates and full updates of road safety attributes.	C	Incremental update datasets can be defined using received change notifications.
FR-6	Unambiguous location referencing	The road safety attributes provided through the ROSATTE infrastructure shall be structured to enable unambiguous decoding and interpretation of the referenced locations. Different locating methods allowed.	C	
FR-11	Feedback loop	A feedback channel from information providers back to enacting authorities shall be provided.	C	
FR-13	Flexible type definitions	The meaning of "Road safety attributes" is not finally decided. Changes will occur in the future.	C	It shall be possible to add and change (to some degree) the available type definitions describing road safety attributes.

ID	Requirement name	Short definition	Priority: C: Critical S: Significant I: Of interest	Comments, links to other requirements, open issues
NFR-1	Availability	Valid quality parameters related to availability shall be declared in the metadata associated with the road safety attributes.	C	Degree to which geographic data is available at a certain place and at a defined time. Possible quality parameters: - Communication failure rate These quality parameters should be specified in the metadata attached to delivering system.
NFR-2	Up-to-dateness	Valid quality parameters related to up-to-dateness shall be declared in the metadata associated with the road safety attributes.	C	Degree of adherence of geographic data to the reality changing with time. Possible quality parameters: - Date of last update - Date of origin - Rate of change
NFR-3	Completeness	Valid quality parameters related to completeness shall be declared in the metadata associated with the road safety attributes.	C	Degree of availability of all information needed to describe the reality. Possible quality parameters: - Missing data - Surplus data
NFR-4	Correctness	Valid quality parameters related to correctness shall be declared in the metadata associated with the road safety attributes.	C	Degree of accordance of geographic data (feature(s), attributes, functions, relationships) to corresponding elements in reality, up-to-dateness being presumed. Possible quality parameters: - Geometric correctness - Topological correctness - Thematic correctness
NFR-5	Consistency	Valid quality parameters related to consistency shall be declared in the metadata associated with the road safety attributes.	C	Degree of accordance of geographic data (data structure, their features, attributes and relationships) to the models and schemas (conceptual model, conceptual schema, application schema and data model). - Geometric consistency - Topological consistency - Thematic consistency
NFR-6	Accuracy	Valid quality parameters related to accuracy shall be declared in the metadata associated with the road safety attributes.	C	Degree of adherence of geographic data to the most plausible or respectively the true value. - Absolute position accuracy - Relative position accuracy - Quantitative attribute accuracy

ID	Requirement name	Short definition	Priority: C: Critical S: Significant I: Of interest	Comments, links to other requirements, open issues
NFR-7	Reduced data update delay	The time delay from the moment a Public Authority regulation is effective, until the end user data have been updated, shall be reduced.	S	Related to NFR-2. The infrastructure itself may have minor delays, but the administrative routines on public authority side must be adapted to the lifetime of the data handled. Update frequencies of 24 hours or less is a reasonable requirement.
CR-1	Conformance with European law.	The ROSATTE infrastructure shall offer its services in a way that conforms with the INSPIRE directive. This includes creation and maintenance of metadata, a discovery service using it with a minimum set of search criterions, view services, download services and supporting services.	C	SOA Web Services Minimum metadata elements required: Identification (Name,type,URL) Classification Keyword Geographic location Temporal reference Quality and validity Conformity. Access conditions Access limitations Responsible organization Minimum search criteria: Classification Keywords Geographical location Quality and validity Access conditions Responsible organization **Links to functional requirement FR-1**

3.2.2 Selection of technologies

In ROSATTE a number of packages for which to select technologies where identified:

- The data content specification
    - Safety features such as speed limit
    - Location references and geometry. Ways of specifying the locations for the safety features
    - Update information. In the case of incremental updates, signals what occurred with the data.
    - Metadata including data quality declarations
- Data exchange specification. The physical exchange structure for ROSATTE data.

- Service specification. A specification of services needed at either side.

In the process of selecting technologies, a number of INSPIRE requirements from D2.5 (Generic Conceptual Model **Feil! Fant ikke referansekilden.**) were adopted by ROSATTE. For the data content specification, the following INSPIRE requirements were considered:

INSPIRE Requirement/Recommendation	**Description**
Requirement 4	The reference model specified in ISO 19101 shall be used as the reference model of the INSPIRE data specifications
Requirement 5	Every INSPIRE data specification shall conform to ISO 19131
Requirement 8	Every INSPIRE application schema shall contain a comprehensive and precise description of its spatial object types.
Requirement 9	Every INSPIRE application schema shall conform to the General Feature Model as specified in ISO 19109 7.3-7.7.
Requirement 10	Every INSPIRE data specification shall include one or more INSPIRE application schemas modeled according to ISO 19109 Clause 8, with particular attention to 8.2.
Requirement 13	Spatial object types shall be modeled according to ISO 19109 7.1-7.2, 8.1, 8.5-8.9 and according to the additional rules in Clauses 9-12, 18, and 22 of this document.
Requirement 16	Basic types as specified in ISO/TS 19103 6.5 shall be used in an INSPIRE application schema, whenever applicable.
Requirement 19	Every INSPIRE application schema shall be specified in UML, version 2.1.

The following requirements from the INSPIRE D2.7 document (Guidelines for the encoding of spatial data **Feil! Fant ikke referansekilden.**) was considered for the data exchange specification:

INSPIRE Requirement/Recommendation	**Description**
Requirement 1	Every encoding rule in INSPIRE shall conform to ISO 19118. In particular, it shall specify schema conversion rules for all elements of the application schemas to which the rule is applied.
Recommendation 2	Encoding rules should be based on open standards. GML (ISO 19136) and ISO/TS 19139 are promoted as the default encoding in INSPIRE. The main reasons for this are: - GML and ISO/TS 19139 cover encoding rules for large parts of the INSPIRE application schemas. This is not the case for any other commonly used encoding. - GML specifies a XML based encoding rule for ISO 19109 conformant application schemas specifying spatial object types that can be represented using a restricted profile of UML that allows for a conversion to XML Schema. In addition, GML provides a standardized encoding for many commonly used types from core standards of the ISO 19100 series (in particular ISO 19107, ISO 19108, ISO 19111, and ISO 19123) that form the foundation of the Generic

	Conceptual Model (D2.5). - ISO/TS 19139 specifies a XML based encoding rule for conceptual schemas specifying types that describe geographic resources, e.g. metadata according to ISO 19115 and feature catalogues according to ISO 19110. - The reference material provided by SDICs and LMOs shows that GML is increasingly used in Member States and international communities to represent and transfer geographic information. - GML and ISO/TS 19139 are well integrated with the current candidate standards of the network services. - The use of these standards is in line with the recommendations of CEN TR 15449 on encoding which promotes GML as the encoding method when transferring spatial objects and ISO/TS 19139 as the encoding method when transferring information related to spatial data such as metadata, feature catalogues and data dictionaries. - A default encoding rule allows for a coherent encoding approach inline with the overall interoperability requirements of the Directive.
Recommendation 4	For every INSPIRE application schema, a GML application schema should be specified.
Recommendation 5	The encoding rule specified in ISO 19136 Annex E should be applied. For types within the scope of the ISO/TS 19139 encoding rule, the encoding rule of ISO/TS 19139 should be applied.

Regarding the services specification it was assumed that the requirements and recommendations from the INSPIRE document D3.7 **Feil! Fant ikke referansekilden.** and the INSPIRE Network services Architecture **Feil! Fant ikke referansekilden.** available at that time where valid.

The following criterions where used for selecting technologies (in priority order):

Nr	**Criterion**	**Remark**
1	Fulfill ROSATTE requirement	
2	Comply to European/International standard	
3	Comply with de facto standard/have a widespread acceptance such as the recommendations from the world wide web consortium.	
4	Positive contribution to ROSATTE specifications	If the top three criterions are not fulfilled, the technology may still make a contribution which is equal or better than something that is invented within the project

The table below shows the selected technologies for the ROSATTE specification of data exchange specification:

Specification element	**Selection**	**Rationale**
Data content specification –	UML	Fulfills all criterions and is the conceptual schema language which is most widely accepted in the world

conceptual schema language		today. INSPIRE requirement
	ISO 19103	Fulfills all criterions and is the conceptual schema language which is most widely accepted in the world today. INSPIRE requirement
	ISO 19109	Fulfills all criterions and is the conceptual schema language which is most widely accepted in the world today. INSPIRE requirement
Data content specification – Safety features	ISO 14825 – GDF INSPIRE Data specification on transport networks EuroRoadS, deliverable D6.5	All of the referenced specifications contain potential definitions usable in the context of ROSATTE.
Data content specification – Metadata definition	INSPIRE Metadata implementing rule ISO 19115 EuroRoadS D6.8	Fulfills all criterions
Data content specification – Location referencing	ISO 17572-3, AGORA-C	Fulfills all criterions. The normal case for ROSATTE is that the database representations of the underlying road network differ between enacting authority and information provider. Therefore, an on-the-fly location referencing method is needed where available and significant attribution can be used to identify safety feature locations on the road network. Note: Currently, INSPIRE transport networks only support linear referencing as location referencing method. This covers the case where linear referencing systems are shared between parties or when also the network elements are exchanged. This method does not fulfill all the immediate requirements for ROSATTE.
Data exchange specification – schema and physical format	ISO 19136	Fulfills all criterions. No specific requirements have been specified for ROSATTE regarding compactness and such which could have indicated the use of something more compact. Recommended from INSPIRE

Service specification	REST OGC Catalogue services	Fulfills all criterions except #2. SOAP/WSDL is recommended by INSPIRE. However, since SOAP/WSDL is not a requirement and it is believed that a REST approach is better suited for ROSATTE purposes, REST is the current choice for ROSATTE.

3.2.3 Data content specification

Basically, the data content specification of ROSATTE consists of the following packages:

- Dataset information
    - Dataset identification, metadata etc
- Safety features
    - A generalized safety feature model with one class representing all kinds of safety features (e.g. Speed Limit, Restriction for vehicles, pedestrian crossing etc) with identity, location, type, values and applicability conditions (e.g. time, weather, vehicle type, weight etc)
- Location reference
    - Direct location reference (restricted to AGORA-C within ROSATTE)
    - Indirect location reference (not elaborated further within ROSATTE)
- Updates
    - Add, Modify, Remove
- Metadata
    - According to the INSPIRE implementing rule for metadata
- Feedback information
    - Specifies information sent from the recipient of safety feature indicating the result of the import/integration on the recipient side

3.2.4 Physical exchange format – structure and coding

This part specifies a set of GML compliant xml schemas (xsd).

3.2.5 Service specification

Focus lies on specifying the interfaces (abstract and concrete) needed for downloading data (both complete datasets and incremental updates). Since incremental updates are a major concern for ROSATTE, the majority of the work has been focusing on the scheme for publishing and downloading incremental updates.

The main principles for handling incremental updates relies on either the push or the pull principles:

- Push
    - The client registers itself at the server as a subscriber. The server is responsible for pushing incremental updates to the subscribers
- Pull
    - The client is responsible for querying the server for available update datasets. A parameter specifying the last successful transfer is sent with the query (no parameter gives all available datasets as a response)

For testing within ROSATTE and for time and simplicity reasons, a simple REST interface was specified for the Pull scenario. Examples:

http://baseURL/download/querydatasets – Returns an xml response which lists links to all available datasets (in chronological order)

http://baseURL/download/querydatasets?lastValidDataSetID=<dataset-id> - Returns an xml response which lists links to all available datasets that where produced after the specified dataset (in chronological order)

http://baseURL/download/readDataSet?dataSetID=<dataset-id> – Returns the specified GML dataset.

The corresponding interface has been defined for feedback information, however in that case the roles (client/server) are reversed in that case.

4 Comparison of ROSATTE and INSPIRE

4.1 Introduction

This comparison between ROSATTE and INSPIRE considers the various components in the INSPIRE Network Services Architecture, i.e. the technical aspects. The political aspects are handled elsewhere. Also, from a ROSATTE perspective, only the components needed to support the data exchange infrastructure are considered.

4.2 Data specifications

In the table below, the shaded rows needs some attention from a ROSATTE-INSPIRE harmonization perspective. The other rows are either already harmonized or the requirements are basically different, so harmonization is not possible for that reason.

Component	ROSATTE	INSPIRE (DS TN)	Comment
Conceptual schema language	UML (ISO 19103/ISO19109)	UML (ISO 19103/ISO19109)	Harmonized
Documentation	Reports	Data product specification (ISO 19131)	Needs harmonization
Road network (geometry/topology)	Not included	Included	Different requirements. May need harmonization if ROSATTE shall support linear referencing. As stated earlier in this document, It might be useful in a ROSATTE context to be able to exchange the road network geometry.
Dataset	Datasets have identifier according to the ROSATTE versioning scheme for updates	Datasets are spatial objects that should have an inspireId	Needs harmonization
Safety features	Main issue for ROSATTE	Out of scope	Different requirements. No action
Modelling style	One generic safety feature type with type/value where type is a code list for extandability reasons	Explicit modeling per transport property type	May need harmonization. Action or decision is needed.
Identity	Identity with provider/local-id	inspireId also for transport properties.	Identity name “InspireId” may need harmonization.

	according to INSPIRE. Not named “inspireId” though.		Structure is the same. To achieve complete harmonization, maybe the attribute needs renaming in ROSATTE.
Real world validity	Yes (validFrom, validTo)	Yes (validFrom, validTo)	Harmonized. No action.
Database validity	No	Yes (beginLifespanObject/endLifespanObject)	Different requirements. No action.
Pedestrian crossing	Yes	No	Different requirements. No action.
Restriction for vehicles	Yes	Yes (se modeling style above)	May need harmonization. The same concept is modeled in different ways. Action or decision needed.
Speed limit	Yes	Yes (se modeling style above)	May need harmonization. The same concept is modeled in different ways. Action or decision needed.
Prohibition of overtaking	Yes	No	Different requirements. No action.
Prohibited turn	Yes	No	Different requirements. No action.
Use of audible warning devices prohibited	Yes	No	Different requirements. No action.
Passing without stopping prohibited	Yes	No	Different requirements. No action.
Motorway	Yes (also a part of AGORA-C/OpenLR)	Yes (formOfWay)	May need harmonization. Action or decision needed.
No entry	Yes (also a part of AGORA-C/OpenLR)	Yes (TrafficFlowDirection)	May need harmonization. Action or decision needed.
Closed to all vehicles in both directions	Yes	Yes (AccessDirectionValue=forbiddenLegally)	May need harmonization. Action or decision needed.
Direction to be followed	Yes (also a part of AGORA-C/OpenLR)	Yes (TrafficFlowDirection)	May need harmonization. Action or decision needed.
Snow chains compulsory	Yes	No	Different requirements. No action.
Compulsory direction for vehicles carrying dangerous goods	Yes	No	Different requirements.No action.
Road for motor vehicles	Yes	No	Different requirements. No action.

Built up area	Yes	No	Different requirements. No action.
Residential area	Yes	No	Different requirements. No action.
Warning sign	Yes	No	Different requirements. No action.
Conditions (Time, Vehicle etc)	Yes	Partly as part of SpeedLimit	May need harmonization. Action or decision needed.
TransportProperty	No	Yes, as a base class for information attached to the road network using linear referencing	May need harmonization. Action or decision needed.
MaintenanceAuthority	No	Yes	Different requirements. No action.
OwnerAuthority	No	Yes	Different requirements. No action.
VerticalPosition	No	Yes	Different requirements. No action.
ConditionOfFacility	No	Yes	Different requirements. No action.
AccessRestriction	No	Yes	Different requirements. No action.
FunctionalRoadClass	No (but part of AGORA/OpenLR)	Yes	AGORA/OpenLR and INSPIRE uses the same concept. No action
FormOfWay	No (but part of AGORA/OpenLR)	Yes	AGORA/OpenLR and INSPIRE uses the same concept. No action
RoadWidth	No	Yes	Different requirements. No action.
NumberOfLanes	No	Yes	Different requirements. No action.
RoadName	No (but part of AGORA)	Yes	AGORA uses road name as part of the road descriptor, but that is not considered as a conflict here. No action.
RoadServiceType	No	Yes	Different requirements. No action.
RoadSurfaceCategory	No	Yes	Different requirements. No action.
RoadNumber	No (but part of AGORA)	Yes (Road/ERoad)	AGORA uses road number as part of the road descriptor, but that is not considered as a conflict here. No action.
Metadata	INSPIRE metadata implementing rule +	INSPIRE DS TN adds elements to dataset	Each INSPIRE theme may add its own theme specific metadata. Not

	additional elements	level metadata	considered a conflict. No action.
Location referencing	Map agnostic location referencing (AGORA) is the selected option. Tests have been carried out also for OpenLR. A place-holder for indirect location referencing (e.g. linear referencing) is present in the model.	Linear referencing is the only option. The information needed to generate AGORA/OpenLR are defined also in INSPIRE DS TN: - FormOfWay (according to GDF) - Functional road class (According to GDF) - Road name/Road number - Driving direction - Geometry/topology	Needs harmonization. Action or decision needed.
Feedback	Yes	No	Different requirements. No action.
Update information	Yes	No	May need harmonization. Action or decision needed.

4.3 Data encoding

Component	ROSATTE	INSPIRE	Comment
Physical encoding of features	GML (ISO 19136)	GML (ISO 19136)	Harmonized. No action.
Physical encoding metadata	ISO 19139 (However not used in ROSATTE testing for simplicity reasons)	ISO 19139	Harmonized. No action.
Physical encoding location referencing	XML or binary string according to AGORA-C/OpenLR	GML encoding for linear referencing	Needs harmonization. Action or decision needed.
Physical encoding feedback	GML encoding	No	Different requirements. No action.
Physical encoding update information	A part of a safety feature and also an attribute on the dataset (snapshot/update). GML encoding.	No	May need harmonization. Action or decision needed.

4.4 Services

Component	ROSATTE	INSPIRE	Comment
Discovery	Needed but not defined in ROSATTE. Points to INSPIRE	Yes	No action.
View	Needed but not defined in ROSATTE. Points to INSPIRE	Yes	No action.
Download	REST interface for downloads of either complete datasets or update datasets	Pre defined datasets download - ATOM - WFS Direct access download - WFS	Needs harmonization. Action or decision needed.
Transformation	Neither coordinate transformation nor schema transformation has been identified as a requirement within ROSATTE	Both coordinate transformations and schema transformations.	Different requirements. No action.

5 Options for aligning ROSATTE with INSPIRE

5.1 Introduction

Since it is reasonable to assume that road authorities in a EU member state are providers of both INSPIRE and ROSATTE data, the ideal solution would be to fit the ROSATTE framework into the INSPIRE Network Services Architecture. If this can be achieved, both the authorities and the data consumers will benefit.

The road authorities benefit since one single technical platform may be used for publishing all data which results in lower costs for development and maintenance which in turn possibly leads to better overall quality.

Besides from benefitting from increased data and service quality, the data consumers benefit since common portals with common services/interfaces and data formats can be used to access public authority data.

The figure below shows what we, from a technical perspective, believe to be an ideal picture for aligning ROSATTE with INSPIRE:

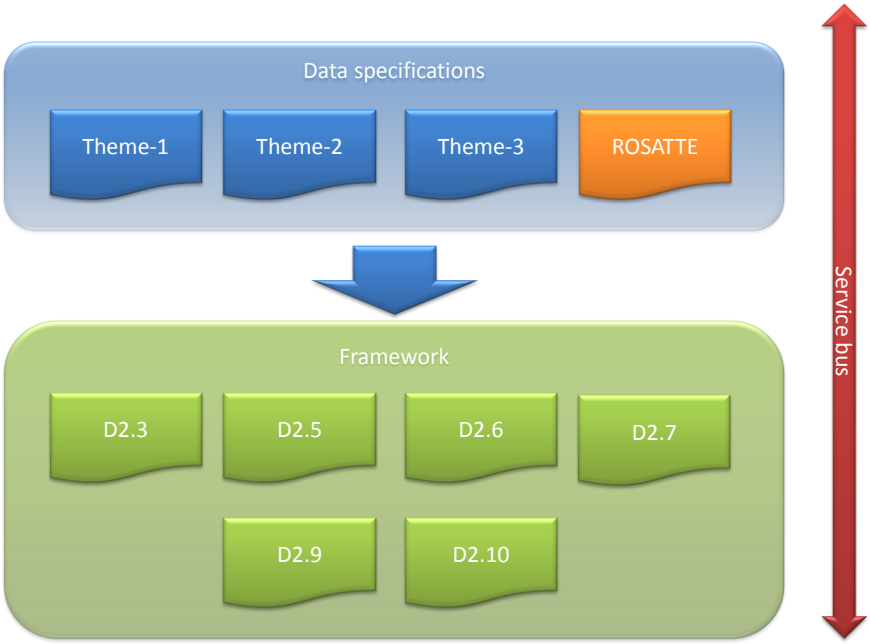

Figure 6 - Ideal alignment of ROSATTE with INSPIRE

From the comparison in the previous chapter, all the shaded items need to be resolved. Some of the items need to be resolved because the item is of a generic nature (i.e. exposes functionality which is not unique to a single data theme). Below are the areas that need attention and a recommended resolution. For each area, a resolution is proposed and the effort and a priority is estimated. To simplify effort estimation, the following rough classification is used:

- Low. Effort is counted in hours or days
- Medium. Effort is counted in weeks
- High. Effort is counted in months

Regarding priority, the following classification is made:

- Low. Nice to have but not necessary for things to work
- Medium. Important, but not essential
- High. Essential area to resolve.

5.2 Data specifications

5.2.1 Documentation

Problem: INSPIRE requires a data specification to be written according to defined templates which are compliant to ISO 19131. The ROSATTE data specification is written as a project report. An INSPIRE data specification has a disposition according to the table below. A brief comment on how to produce the corresponding for ROSATTE is also supplied. The INSPIRE DS for transport networks should serve as a template.

Data specification clause	Comment
Executive summary	Should be mostly text from ROSATTE Annex 1 description of work
Scope	Produce a short scope description
Overview	Cut and paste, mostly from the ROSATTE D3.1
Specification scopes	Refer to the general scope for INSPIRE

Identification information	A combination of writing and cut/paste
Data content and structure	The data specification from ROSATTE D3.1 with some formatting and other minor modifications that are specified separately. Some can maybe be automatically generated with INSPIRE scripts for Enterprise architect
Reference systems	OpenLR and AGORA use WGS 84 lat/long. Temporal reference system : Gregorian calendar/UTC
Data quality	Mostly from ROSATTE D3.1 and D5.2
Dataset level metadata	Mostly from ROSATTE D3.1
Delivery	Mostly from ROSATTE D3.1 Text for aligning ROSATTE services to INSPIRE ATOM download service Also describe download service (REST) from ROSATTE D3.1 here
Data capture	Perhaps material from ROSATTE D2.1 and D2.2 could fit here. Also recommendations for using AGORA/OpenLR may fit here.
Portrayal	No portrayal rules have been specified for ROSATTE. Decision has to be made if that is needed and possible
Bibliography	
Abstract test suite	Just copy text from DS TN

Proposed resolution**/action**: Produce an INSPIRE compliant data product specification for ROSATTE

Concerns: ROSATTE

Estimated effort: High.

Priority: High

5.2.2 Road network geometry/topology

Problem: ROSATTE does not have any data structures for describing road network geometry. It might be a need in a ROSATTE context to be able to transfer road network updates especially when location referencing fails and the reason is data on new/updated road network which is not updated at both ends. INSPIRE lacks the ability to transfer data updates and ROSATTE lacks the ability to reference locations of the safety features to road elements in the same dataset.

Proposed resolution/action: If road network geometry is needed in a ROSATTE context, INSPIRE data structures should be used. Also, there might be a need to be able to reference this INSPIRE data within a ROSATTE dataset (perhaps using linear referencing). A solution for this has to be specified.

Concerns: ROSATTE and INSPIRE DS TN (updates)

Estimated effort (technical): Medium.

Estimated effort (political): High.

Priority: Medium

5.2.3 Dataset identification

Problem: Datasets are not identified the same way within ROSATTE and INSPIRE.

Proposed resolution/action: Align ROSATTE with INSPIRE. Should be no problem – just add a provider id and leave the rest as is.

Concerns: ROSATTE

Estimated effort: Medium. Both Providers and consumers need to adjust implementations.

Priority: High

5.2.4 Modelling style

Problem: Spatial objects (ROSATTE safety features) are modeled using a generic approach with one single class representing all types of safety features whereas INSPIRE DS TN explicitly models every single concept as a separate class.

Proposed resolution/action: No action. If the ROSATTE schema could be separate from INSPIRE DS TN, the different modeling styles are less of a problem.

Concerns: -

Estimated effort: -

Priority: -

5.2.5 Safety feature identity

Problem: Spatial objects in INSPIRE shall have an attribute “InspireId”. Within the ROSATTE data specification the SafetyFeature class has an “Id” attribute. The structuring and idea, with two parts (providerId + id), is the same. The attribute names representing the same concept should be the same.

Proposed resolution/action: Change ROSATTE data specification and model SafetyFeature according to the rules for spatial objects within INSPIRE.

Concerns: ROSATTE

Estimated effort: Low. Both Providers and consumers need to adjust implementations.

Priority: High

5.2.6 Competing definitions of the same concept

Problem: In some instances, the same concept exists in both ROSATTE and INSPIRE DS TN but with different definitions. This concerns the following definitions:

- Restriction for vehicles
- Speed limit
- Motorway
- No entry
- Closed to all vehicles in both directions
- Direction to be followed
- Safety feature conditions
- Transport property

Proposed resolution/action: Decide if this should be allowed (due to different views/different applications) or not. If not, decide which specification (ROSATTE or INSPIRE DS TN) that rightfully owns the definition and adjust the other accordingly. Take into account the different modeling approaches that have been used in the specifications (see 5.2.4).

Concerns: ROSATTE and/or INSPIRE DS TN

Estimated effort: High

Priority: High

5.2.7 Location referencing

Problem: INSPIRE DS TN does not allow other location referencing methods than linear referencing. ROSATTE allows only for map agnostic location referencing. Both specifications could benefit from opening up regarding the use of different location referencing methods.

Proposed resolution/action: Develop a single specification for location referencing which allows for several kinds of location referencing methods. Provide a solution which is backwards compatible on dataset level. In practice, add a base-class “LocationReference” to the INSPIRE model which includes “NetworkReference” as a subclass. This could be done without affecting existing data (if LocationReference is a class with no mandatory attributes).

Concerns: ROSATTE and INSPIRE DS TN

Estimated effort: Medium.

Priority: High

5.2.8 Update information

Problem: ROSATTE has transfer of incremental updates as primary use case. INSPIRE does not include incremental updates as an option at all.

Proposed resolution/action: Evaluate if incremental updates is a valid use case for INSPIRE. If not, no action is needed. If it is a valid use case, a generic solution should be described which can be used by both INSPIRE and ROSATTE. It has to be decided if incremental updates are an issue for the data specification or if it should be solved as part of the encoding guidelines.

Concerns: ROSATTE and INSPIRE DS TN if action is needed

Estimated effort: High.

Priority: High

5.3 Data encoding

ROSATTE uses the same encoding guidelines as INSPIRE. If data specifications are harmonized, also data encoding will be harmonized. The ROSATTE xsd files might need review though.

5.4 Services

5.4.1 Download services

Problem: To simplify testing and use, ROSATTE specified a simple RESTful interface to support the download of both snapshots of data and sequences of incremental update datasets. No implementation according to the download service guidelines of INSPIRE has been specified. INSPIRE has guidelines which includes a specification for ATOM and WFS which support predefined and direct access download services. No solution which explicitly supports download of incremental updates exists within INSPIRE.

Proposed resolution/action: Keep the current ROSATTE specification as a valid option for ROSATTE data. Decide whether INSPIRE guidelines for download services shall also be a valid option. In that case, it has to be clarified if and how INSPIRE guidelines for download services have to be revised to support incremental updates.

Concerns: ROSATTE and INSPIRE DS TN

Estimated effort: High. Data consumers need to support all valid options which mean more work on their side.

Priority: Medium

6 Recommendations for aligning ROSATTE with INSPIRE

Even though, there is room for improvements, we believe that it is unrealistic to propose any changes to the current INSPIRE framework in the short run.

If ROSATTE should be aligned with INSPIRE, we believe that it is important that some “good enough” and successful alignment actually happens. Therefore, we propose a “minimum resistance solution” which means that any alignment work occurs on the ROSATTE side and that the INSPIRE is untouched.

From all the activities listed above, we have selected the most important that represent the bare minimum of what we think needs to be done with regards to INSPIRE alignment.

6.1.1 Produce an INSPIRE compliant data specification for ROSATTE (DS ITS)

The most central and unique part for an INSPIRE theme is the data specification (DS). It is required that a data specification follow the INSPIRE rules and frameworks. Therefore, such a data specification, following the INSPIRE rules and templates should be produced. During the writing of a ROSATTE DS, it should be verified against the rules in INSPIRE D2.x. This includes harmonizing ROSATTE datasets and safety features to adhere to INSPIRE rules for dataset and spatial object identification. The various clauses in an INSPIRE DS have been listed above.

In principle, the specifics of the ROSATTE data structure, i.e. incremental updates, map agnostic location referencing etc, is kept local to the ROSATTE DS. No ROSATTE concepts are generalized to become generic INSPIRE concepts.

This is work that concerns expertise from a mix of the ROSATTE work packages. Also it is essential to clarify a review process with experts from the INSPIRE community.

6.1.2 Review ROSATTE xsd files

The ROSATTE xsd files might need some updating if the application schema is harmonized against the INSPIRE framework. Furthermore, the schemas needs to be validated to be fully compliant with INSPIRE.

The xsd validation needs expertise from the INSPIRE community.

6.1.3 ROSATTE download services

The Technical Guidance for the implementation of INSPIRE Download Services describes the following options for data download:

- Pre-defined Dataset Download Service
    - ATOM implementation
    - WFS implementation
- Direct Access Download Service
    - WFS implementation

The principles for ROSATTE fit very well into a pre-defined dataset download scenario since all data download (both initial download and download of incremental updates) is based on datasets.

A description on how the current REST based services in ROSATTE can be aligned with the INSPIRE technical guidance for the implementation of download services is needed. A decision has to be made where to put such a description:

- it could be an option to add descriptions to an updated version of the ROSATTE D3.1 report, Chapter 8
- another option is to add it to the delivery clause in the DS. This is perhaps the preferred option.

This description needs review from INSPIRE download service expertise.

Below are some ideas on how to align the download services.

ROSATTE: QueryAvailableDatasets

It’s unclear if the following ROSATTE request, which returns a list of links to download all datasets produced after the specified dataset, fits into a WFS scenario.

`http://baseURL/download/querydatasets?lastValidDatasetId=<dataset-id>`

The corresponding ATOM implementation should be a feed where each entry links to the corresponding dataset. The client would have to find out which datasets are more recent than the ones already downloaded.

ROSATTE: Download

In principle it should be possible to define a mapping between ROSATTE and WFS at the level where the client downloads a specific dataset:

ROSATTE request: `http://baseURL/download/readDataSet?dataSetID=<dataset-id>`

Could correspond to

WFS request:
`http://baseURL/request=getFeature&storedquery_id=readDataset&dataSetID=<dataset-id>`

In the ATOM case the linked datasets in the entries of the feed could directly link the dataset using the ROSATTE request.

ROSATTE: QueryFeedbacks

It's unclear if the following ROSATTE request, which returns a list of links to download all feedback datasets produced after the specified dataset, fits into a WFS scenario.

`http://baseURL/feedback/queryfeedback?datasetId=<dataset-id>`

The corresponding ATOM implementation should be a feed where each entry links to the corresponding feedback dataset. The client would have to find out and match the feedback datasets to the datasets.

ROSATTE: ReadFeedback

In principle it should be possible to define a mapping between ROSATTE and WFS at the level where the client downloads a specific feedback dataset:

ROSATTE request: `http://baseURL/feedback/readFeedback?feedbackID=<feedback-id>`

Could correspond to

WFS request:
`http://baseURL/request=getFeature&storedquery_id=readFeedback&feedbackID=<feedback-id>`

In the ATOM case the linked feedback datasets in the entries of the feed could directly link the feedback dataset using the ROSATTE request.

6.1.4 Actions for later

A project with the aim of doing the above should also propose concrete actions for later revisions of the INSPIRE framework. Things like map agnostic location referencing and incremental updates could be interesting also for other themes. The ROSATTE/ITS community could also be interested in data and incremental updates, at least around the transport networks theme.

7 References

7.1 Input from people

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Olle Bergman	TrV
Trond Hovland	NPRA
Tom van de Ven	Rapp Trans
Michael Lutz	JRC

7.2 Documents and websites

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