ROad **S**afety **ATT**ributes exchange infrastructure in **E**urope

Deliverable D1.2

Requirements and Overall Architecture

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Abstract: This document defines the project scope, users, user requirements and derived system requirements. It also gives suggestions on information model and a high)level system structure

Keyword list: Safety attributes, ADAS, digital maps, data exchange, database, public/private cooperation, requirements, architecture.

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Executive Summary

This report presents the result of ROSATTE WP1.2 and WP1.3.

Using the technical annex, questionnaires, meetings and teleconferences, the requirements and overall architecture have been developed. External factors like the INSPIRE directive, the EuroRoadS project and others, have been used as guides in the process.

The defined requirements consist of high-level functional- and quality requirements which should be satisfied to meet the project objectives.

The overall architecture is made up of functional viewpoint, information viewpoint, process viewpoint and component viewpoint, giving an overall view of the envisioned system.

This document should be used as a template for the more detailed specifications to be developed in the later work packages.

Table of Contents

Index of Tables

Index of Figures

Abbreviations

Table 1 - Abbreviations

Term	Definition
ADAS	Short for "Advanced Driver Assistance System".
AGORA-C	Referencing method which allows the determination of a location on-the-fly.
Component	A component is the whole or part of a software system, seen from the outside as one unit.
Dataset	A dataset is an identifiable collection of data.
INSPIRE	Infrastructure for Spatial Information In the European Community initiative, www.ec-gis.org/inspire/
Interface	An interface is a gateway to the functionality that a component exposes to other components or external systems.
Location referencing	Location referencing aims to provide a universal reference for any location.
User	A user is an external entity (person, organization, system) interacting with the system.
Use case	A use case is a series of interactions with the system to perform one unit of work. Can also be defined as a high-level function initiated by a user.
Role	A role is an area of responsibility. One user has one or more roles. One role can be shared by many users.
Metadata	Metadata is data about data, information making it possible to discover available data types and structures, quality parameters, geographic coverage etc., without reading the actual datasets.
Service	A service is a software system running on its own, not relying on user input, used by external components.
SOA	Service Oriented Architecture

Term	Definition
Spatial data	Spatial data is data pertaining to the location and spatial dimensions of geographical entities.
UML	Unified Modelling Language. Includes a set of graphical notation techniques called UML models.

References

1. eSafety Forum. *Final report of the eSafety Working Group on Road Safety*. 2002 [cited 2008 May 30th.]; Available from: http://ec.europa.eu/information_society/activities/esafety/doc/esafety_library/esafety_wg_final_report_nov02.pdf.

2. eSafety Forum. *Digital Maps Working Group, Final Report*. 2005 [cited 2008 June 30th.]; Available from: http://www.esafetysupport.org/download/working_groups/DMWGfinalreport.pdf.

3. eSafety Support. *Report on the progress of the 28 eSafety Recommendations - End 2007 Release*. 2008 [cited 2008 June 30th.]; Available from: http://www.esafetysupport.org/download/28_recommendations/Progress%20note%20TO%20PRINT%20end%202007.pdf.

4. European Union, DIRECTIVE 2007/2/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 14 March 2007: establishing an Infrastructure for Spatial Information in the European Community (INSPIRE), in Official Journal of the European Union. 2007: Strasbourg.

5. International Organisation for Standardization (ISO), *ISO 19115 Geographic Information - Metadata*. 2003.

6. International Organisation for Standardization (ISO), *ISO 19119:2005 Geographic Information - Services*. 2005.

7. International Organisation for Standardization (ISO), ISO/TS 139 Geographic information – Metadata – XML schema implementation. 2007.

8. International Organisation for Standardization (ISO), ISO 19110:2005, Geographic information – Methodology for feature cataloguing. 2005.

9. Natvig, M., et al., ARKTRANS - The Norwegian system framework architecture for multimodal transport systems supporting freight and passenger transport V.5. 2006, SINTEF: Trondheim.

10. IEEE, *IEEE Recommended Practice for Software Requirements Specifications*, I. The Institute of Electrical and Electronics Engineers, Editor. 1998, The Institute of Electrical and Electronics Engineers, Inc.: New York. p. 1-31.

11. Kaufmann, T. and T. Wiltschko. *Deliverable D6.8 - Metadata Catalogue*. 2006 [cited 2008 May 20th]; Available from: http://www.euroroads.org/php/Reports/D6.8%20Metadata%20catalogue.pdf.

12. International Organisation for Standardization (ISO), Intelligent transport systems (ITS) -- Location referencing for geographic databases -- Part 2: Pre-coded location references (pre-coded profile).

13. International Organisation for Standardization (ISO), ISO/DIS 17572-3 Intelligent Transport Systems (ITS) - Location Referencing for Geographic Databases - Part 3: Dynamic Location References (Dynamic Profile). 2007.

14. International Organisation for Standardization (ISO), ISO/AWI 19148 - Geographic information - Location based services - Linear referencing system.

15. Wiltschko, T. and T. Kaufmann. *Report on quality frame for information*. 2004 [cited 2008 May 30th.]; Available from: http://www.euroroads.org/php/Reports/D2.2%20Quality%20frame%20for%20information.pdf.

16. Drafting Team Metadata and European Commision. *INSPIRE metadata implementing rules based on ISO 19115 and ISO 19119*. 2007 [cited 2008 May 15th]; Available from: http://www.ec-gis.org/inspire/reports/ImplementingRules/metadata/Draft_Guidelines%20_INSPIRE_metadata_implementing_rules.pdf.

17. FeedMap. *FeedMAP requirements: Basic Framework*. 2006 [cited May 12th 2008]; Available from: http://www.ertico.com/en/subprojects/feedmap/papers__presentations/.

1 Introduction

1.1 ROSATTE Contractual References

ROSATTE is a STREP submitted for the call FP7-ICT-2007-1. It stands *for ROad SAfety ATTributes exchange infrastructure in Europe.*

The Grant Agreement number is 213467 and project duration is 30 months, effective from 01 January 2008 until June 2010. It is a contract with the European Commission, DG INFSO.

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1.2 Project Objectives

- The ROSATTE project will specify the infrastructure that will give European-wide access to updated road safety attributes. The project will develop the necessary tools/prototypes to validate the usefulness of the project deliverables.

Access to updated road safety attributes is expected to result in improved driver assistance systems, contributing to more efficient road operations and increased traffic safety.

1.3 Project Scope

Figure 1 illustrates that the focus of the project is to establish an infrastructure for transmitting road safety attributes in a reliable and quality assured way, from road authorities, via a suitable exchange infrastructure, to information providers. These road safety attributes will be processed further into suitable services to the end user. However, this processing is not within the scope of the ROSATTE project as the grey area in figure 1 illustrates.

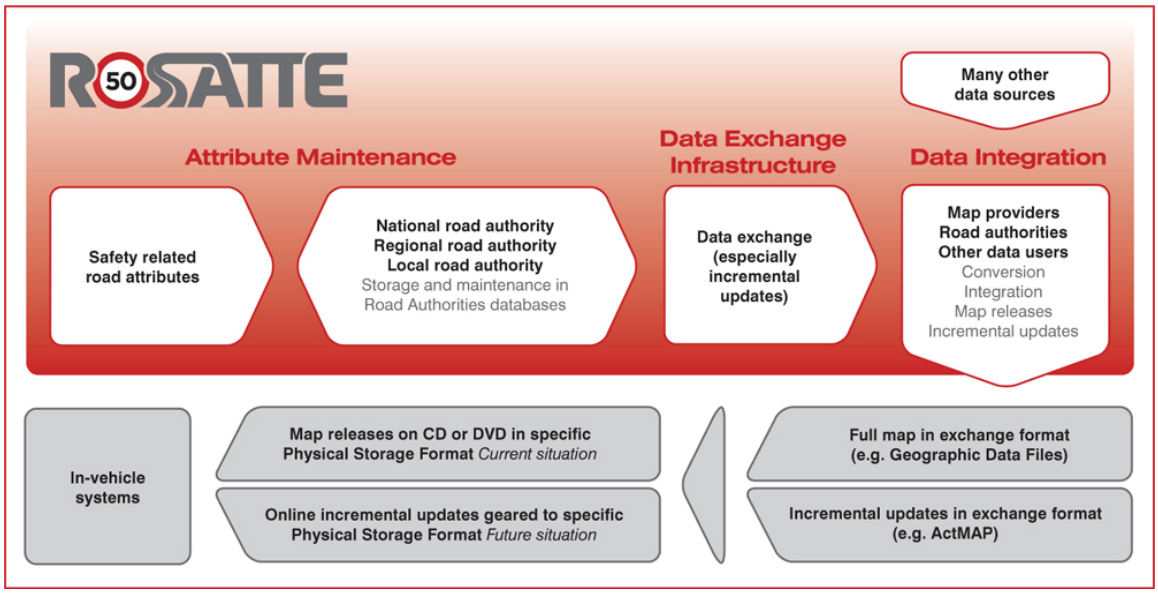

Figure 1 - The scope of ROSATTE

Moreover, we have not included functionality giving direct administrative support to road authorities, like defining regulations, issuing work orders etc. It is an assumption that data entered into the system have gone through the necessary administrative routines.

The quality management to be developed within ROSATTE is one of the project challenges. Since the end user expects a product of high quality, the quality of the ROSATTE data has to be evaluated and documented throughout the complete processing chain. Therefore a method to describe data quality has to be developed and refined in WP 2, WP 3, WP 4 and WP 5. Existing procedures have to be analyzed and recommendations of improvement have to be provided.

1.4 Purpose of Document

This document describes the requirements and overall architecture for achieving the objectives of the ROSATTE project. The requirements are described as functional requirements, non-functional requirements and context requirements.

The overall architecture is a description on the logical elements of ROSATTE, and how they interact. This is done using role descriptions and a collection of four different viewpoints, describing it from different perspectives.

The purpose is to create a common understanding of scope and required functionality, and consequences in terms of data flow, information structure and system structure. This will be an input to later specification and development, making it possible to create suitable and compatible tools and systems.

1.5 Structure of Document

The planned deliverable D1 has been split into two parts, D1.1 and D1.2, for practical reasons. D1.1, 'State of The Art', is a big document as it is, and has value as a reference on its own. This document, 'Requirements and Overall Architecture', has also grown in size, and can also be used independently of the other part. One single document would be unpractical to manage, while not giving any advantages.

Besides this introduction, the document consists of the following chapters:

- Chapter 2 – **External factors**, discusses a few external factors that must be considered during the project.
- Chapter 3 - **Methodology**, gives a short description of concepts and procedures.
- Chapter 4 - **Functional viewpoint**, describes ROSATTE as a whole, using roles and use cases.
- Chapter 5 – **Process viewpoint**, describes interaction and dataflow between entities in the system.
- Chapter 6 - **Information viewpoint**, describes the information structure at a conceptual level.
- Chapter 7 - **Component viewpoint**. This chapter presents an overall view of ROSATTE, indicating physical layout and dataflow.
- Chapter 8 – **System Requirements**. This chapter lists the requirements derived from earlier chapters.
- Chapter 9 – **Conclusion and Summary**, gives a brief description of work procedures and results, and some thoughts about how to proceed.

2 External factors

The area covered by the ROSATTE project has been the focus of many initiatives. Some of these are also mentioned in D1.1, State of the Art. Here is a brief description of a few which has influenced the project, and will continue to do so during later specification and implementation.

2.1 eSafety Forum

The eSafety Forum[1] was established by the European Commission in 2002 in close collaboration with the industry, industrial associations, and the public sector. Its general objective is to support the development, deployment and use of intelligent vehicle safety systems. The Forum established different Working Groups (WGs) focusing on domain-specific priority areas. The aim is to support the progress in the specific areas, stimulating the dialogue and cooperation among the different parties and formulating recommendations to the stakeholders.

The Final Report of the eSafety Working Group on Road Safety of November 2002 [1] provides a set of recommendations, among which "*Create a public-private partnership to produce, maintain, certify and distribute this digital road map database. It should be made available for all users at affordable prices (possibly free of charge). National, local and regional authorities and operators should provide safety-related data on road configurations within their network, with target dates for implementation.*"

The eSafety Digital Maps Working Group, jointly chaired by NAVTEQ and Tele Atlas, concluded its work in November 2005 [2]. This WG seeked to coordinate activities concerning road traffic safety-related elements of digital map databases and to bring together relevant stakeholders, such as digital map producers, mapping agencies, automotive industry, road authorities, user organisations, safety authorities, road operators, universities and research institutes. Its objectives were as follows:

- Define a business model for Public-Private partnerships, to ensure availability of attributes relevant to eSafety in digital maps.
- Define requirements for an eSafety digital map database which, in addition to roadmap data, contains agreed safety attributes for Advanced Driver Assistance Systems purposes.
- Create Public/Private cooperation model to collect, maintain, certify and distribute the eSafety attributes that can be integrated into the digital roadmap database.

The WG recognised the need for a gradual and step-wise approach and agreed that for this the following three phases may be distinguished:

1 http://ec.europa.eu/information_society/activities/esafety/forum/index_en.htm and http://www.esafetysupport.org

- **Phase 1 – Cooperation:** supply of safety attributes in the form that they are currently available at road authorities
- **Phase 2 – Quality Assurance:** Standardisation of information provision and output quality testing
- **Phase 3 – Optimisation:** Standardisation of transfer format and transfer media and optimisation of the transfer process

At the end of 2007, the Report on the Progress of the 28 eSafety Recommendations [3] reads that the "*the process of creating a European digital maps database is delayed by the lack of availability and, in many cases, of the accessibility of road safety attributes. The completion of the cooperation phase of the road map defined by the Digital Maps WG still needs efforts to be completed*".

The ROSATTE project provides a significant contribution to the conclusions of the Digital Maps WG by creating tools to establish cooperation between the private and public sectors, and by stimulating continued cooperation after the project. ROSATTE will ease the access to road safety attributes such as speed information. Also, within ROSATTE, road authorities and operators commit themselves to providing safety-related data by means of common specifications, and targeted for fixed-time trials.

2.2 INSPIRE

The INSPIRE directive specifies an infrastructure consisting of metadata, spatial data themes and spatial data services. It gives instructions on how public spatial information for the transport sector and others, shall be made available. Here are a few excerpts from the directive [4], showing the relevance for ROSATTE:

Point (6): "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 easy to discover available spatial data, to evaluate their suitability for the purpose and to know the conditions applicable to their use."

Point (12): "This Directive should apply to spatial data held by or on behalf of road authorities and to the use of spatial data by road authorities in the performance of their public tasks…."

Point (15): "The loss of time and resources in searching for existing spatial data or establishing whether they may be used for a particular purpose is a key obstacle to the full exploitation of the data available. Member States should therefore provide descriptions of available spatial data sets and services in the form of metadata."

Point (17): "Network services are necessary for sharing spatial data… Those network services should make it possible to discover, transform, view and download spatial data…"

INSPIRE gives general requirements for the metadata, the spatial data themes and the network services involved. Some of these general requirements are included in the requirements chapter as "Context requirements".

INSPIRE metadata implementing rules will be based on standards like **ISO 19115** [5]**,** metadata elements, **ISO 19119** [6], geographic information services, and **ISO/TS 19139** [7], implementation of metadata in XML. A feature catalogue describing available spatial object types is also required, based on **ISO 19110** [8].

2.3 EuroRoadS

The EuroRoadS project, which is also described in D1.1, State of The Art, defines a specification framework consisting of a road data structure, description of data content, data exchange mechanisms and interoperability specifications. This framework defines many structures and mechanisms needed to realise a project like ROSATTE, and is expected to be a central part in later specifications.

3 Methodology

3.1 Introduction

The methodology used to describe the ROSATTE infrastructure is using concepts from the Unified Modelling Language (UML). We are using a collection of viewpoints to describe the high-level architecture of ROSATTE. The viewpoints are inspired by guidelines specified in the framework architecture ARKTRANS[2] [9]. These are Functional viewpoint, Process viewpoint, Information viewpoint and Component viewpoint and each viewpoint describe its particular perspective upon the overall architecture. These viewpoints will be described in more detail in the following sections.

3.2 Functional viewpoint

The functional viewpoint focuses on architectural elements that deliver the systems functionality. This includes the internal and external entities, the users and the roles associated to them, and the user requirements. Finally, use cases are used to define the high-level functionality of the system.

3.2.1 Entities, users and roles

Entities are the most general concept when describing the elements of a system and its surroundings, since it includes humans, infrastructure, and hardware and/or software modules. Any entity is defined by a description and the role(s) it has in the system. In order to define the ROSATTE world, we have to identify all entities outside the ROSATTE system, which are in relation to this system, and all entities inside the ROSATTE system necessary to describe the use.

Users are external entities (an organisation or some outside system) that interact with the ROSATTE system. Users can play different roles.

A role represents all stakeholders with the same set of responsibilities. In ROSATTE for instance, the Information Provider role represents all stakeholders providing information services based on road safety attributes from the road authorities. This may be a map provider holding this role, but also some other user carrying the same responsibility. Thus, roles make it easier to make references to stakeholders and units in a generic way: It is favourable to use roles instead of using the unique labels or names that the stakeholders and units have in the real world.

2 ARKTRANS' viewpoints are using concepts from ISO RM/ODP (ISO 10746) and the CONVERGE TR 1101 project (http://cordis.europa.eu/telematics/tap_transport/research/projectsum/converge.html).

Stakeholders that implement multiple roles can be handled by focusing on each role separately. A road authority may for example hold the role as an Enacting authority that make legal decisions relevant for traffic regulations, and the same road authority may also possess the Data Store Operator role which is responsible for operating a storage of road safety attributes.

3.2.2 User requirements

User requirements emanate from the users and are entirely user-oriented. They will not necessarily be consistent, and are likely to be expressed in plain text, with informal diagrams if necessary to be more comprehensive. User requirements are statements in natural language (or an informal diagram) of what the system is expected to provide and the constraints under which it must operate.

3.2.3 Use cases

Use cases define a subset of the functionality of a system. They are primarily used to define the behaviour of a system without specifying its internal structure. If needed, a more formalised UML presentation can be used.

3.3 Process viewpoint

The process viewpoint further elaborates on the use case definitions. The process view combines roles, functionalities and information elements that should be a part of the system. Using such a view aids in discovering the sequences of the system functionalities, what roles are responsible for them, and what information flows between them.

3.4 Information viewpoint

The Information viewpoint consists of the information elements that are used within the system and between the different sub-domains. Typically, the required information elements are discovered in the process view when the relations between different functionalities and roles are visualised.

The Information view may be realised by the use of a data model or a class diagram. It does not specify how a data model shall be implemented, but it defines the most important pieces of information, and how they are related.

3.5 Component viewpoint

The Component viewpoint presents an overview of the internal system entities in the ROSATTE infrastructure.

3.6 System requirements

The primary system requirements will come from the use cases, process-, information- and component viewpoints, and in addition the system engineers and system architect(s) will add derived requirements to provide the working characteristics of the system.

The System requirements are often classified as functional, non-functional and context requirements:

Functional requirements - these specify the service(s) that will be expected from the system, and/or the functions needed to provide a working system.

Non-functional requirements - these specify the performance and/or quality attributes of a workable system.

Context requirements - these specify the reaction to the constraints imposed by the environment on the introduction of the system. They may be statements on the assumptions that have been made about that environment, or statements as to what is needed for the system to work effectively within the environment.

In the following figure, a simplified schema of the process to identify different user requirements and system requirements is reported:

From the different users, identified in the first stage of the process, **general user requirements** are collected.

Secondly, the user requirements are elaborated into functional viewpoints, process viewpoints, information viewpoints and component viewpoints.

From these viewpoints, the **system requirements** are identified and categorised.

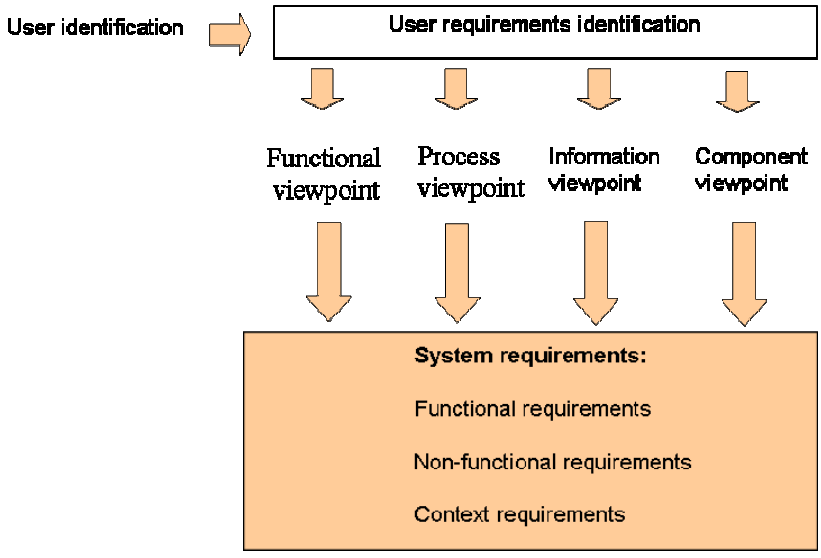

Figure 2 – Identifying requirements

To present these system requirements, recommendations from the IEEE standard 830-1998, IEEE Recommended Practice for Software Requirements [10] are applied to present the requirements as correct and user friendly as possible. From this standard, the following recommendations for the system requirement specification are considered:

- **Correct**: The requirement specification is correct if every requirement in it is one that the software shall meet, i.e. that the software reflects the user needs.
- **Unambiguous**: The different requirements shall have only one interpretation.
- **Complete**: The requirement specification shall contain all significant requirements.
- **Consistent**: The requirement specification shall comply with any higher-level document.
- **Ranked for importance and/or stability:** The requirements are not equally important. Each requirement should be identified to make these differences clear and explicit. For instance, one could divide the requirements into essential requirements, conditional requirements and optional requirements.
- **Verifiable**: A requirement specification is verifiable if all requirements in it are verifiable. A requirement is verifiable if there exists a process with which a person or machine can check that the system meets the requirements.
- **Modifiable**: A requirement specification is modifiable if its structure and style are such that any changes to the requirements can be made easily, completely and consistently while retaining the structure and style.
- **Traceable**: A requirement specification is traceable if the origin of each requirement is clear and if it facilitates the referencing of each requirement in future development or enhanced documentation.

4 Functional viewpoint

Some of the entities and use cases defined here are based on the assumption that the data exchange infrastructure is made up of a number of distributed data services, and that these services can be found by querying a common discovery service, i.e. a service oriented architecture (SOA). Given the diversity of data sources, organizational differences among regions and countries, and a possibly huge information volume, we think that this is a reasonable assumption. If ROSATTE is going to conform to the proposed INSPIRE directive, it is even a requirement.

4.1 Users and roles

The definitions of relevant users and roles, and the connection between them, are shown in the following table:

Table 2 - Users and roles

Roles		Users	Comments Examples
Name	Definition		
Enacting Authority	Responsible for supervising the establishment of laws and regulations for transport and traffic. Also responsible for correct maintenance of road safety attributes in Data Store.	Road authority or entity in charge of supervising the regulation of the road network	SRA in Sweden or OBB in Bavaria, municipalities, districts, state, police
Data Store Operator	Responsible for initiating and operating the Data Store. (Defined in 3.3)	Road authority in charge of a data store	SRA in Sweden, OBB in Bavaria
Information Provider	Responsible for the provision of maps and datasets for use in ADAS applications. The Information Provider is the receiver of road safety attributes from data services.	Map providers	NAVTEQ, Tele Atlas, others.
Data Provider	Supplier of basic data to the enacting authority to enable proper location referencing for their road safety attributes	Map providers, Enacting authority.	NAVTEQ, Tele Atlas, NPRA, others.

4.2 Additional roles

There are roles that are not linked to any specific users, but are used in the detailed use cases.

Table 3 - Additional roles

Roles		Users
Name	Definition	
Data Service Operator	Responsible for initiating and operating the Data Service. (Defined in 4.3)	Not decided
Discovery Service Operator	Responsible for initiating and operating the Discovery Service. (Defined in 4.3)	Not decided
Subscription Service Operator	Responsible for initiating and operating the Subscription Service. (Defined in 4.3)	Not decided

4.3 Entities

In addition to users and their roles, additional entities must be defined.

Table 4 - Entities

Entity		Description
Name	Definition	
Data Store	Data storage with road safety attributes, like traffic signs, speed limits, regulations etc.	Typically a central national or regional database, but can also be one or more local data stores with relevant information.
Data Service	Service providing data from Data Store.	One service can provide data from one or more data stores, in a standardised way.
Discovery Service	A single service providing information about available data services.	Used by Information Provider to discover available Data Services, and their content.
Subscription Service	A single service storing and using information about information providers and their preferences.	Used by Data Service to send change notifications to Information Providers.
Information Provider Service	Service kept by Information Provider.	At a minimum, the service receives and handles notifications from Subscription Service.

4.4 User requirements

For each of the users there are requirements, what the user expects and requires from the system. In ROSATTE, there are two main users or user groups, of which requirements need to be collected in particular. These two are the map providers and the road authorities. The map providers have *one* main role, as the Information Provider. The road authorities have two roles. These are Enacting Authority and Data Store Operator.

For each of these two users or user groups we describe their requirements and their specific roles. These general requirements are derived from "Annex 1, Description of work", discussions with project partners and questionnaire replies.

4.4.1 Map providers

This list of map provider requirements was developed during WP1 meetings.

Table 5 - Map Provider requirements

User requirement		Additional explanation	Roles involved
Number/ID	(short) Definition		
UR-1	Data discovery	Map providers need to be able to find providers of available road safety attributes.	Information Provider
UR-2	Data subscription	Map providers need notifications when relevant data changes.	Information Provider
UR-3	Unified access	Map providers need a unified way of access and retrieval of road safety attribute data across the Europe.	Information Provider
UR-4	Data updates	Map providers need both full and incremental updates of road network safety attributes, expressed according to one unified data model. Updates can be initiated by change notifications from road authorities.	Information Provider
UR-5	Location referencing	Map providers need a location reference which enables unambiguous decoding and interpretation of the referenced location.	Information Provider
UR-6	Quality	Map providers need quality assured data to integrate into their own databases in order to ensure the quality of the end user products	Information Provider
UR-7	Update delays	Map providers need notifications and	Information Provider

		data updates at a rate that is suitable compared to the lifetime of the affected data.	

4.4.2 Road authorities

This list of road authority requirements was developed during WP1, based on questionnaires and later discussions. The table below refers to relevant use cases provided from project partners. The use cases are included in Appendix A.

Table 6 - Road authority requirements

User requirement		Additional explanation	Roles involved	Partner use cases
Number/ID	(short) Definition			
UR-7	Data Store initiation	If missing, road authorities need guidelines for data store design and initiation. (These guidelines are one expected result of WP2.)	Data Store Operator	LRAd1
UR-8	Initial supply / Data import	Road authorities need a way to import road network and road safety attributes from different sources. This includes both the initial supply and updates.	Data Store Operator	AS5, LRAd2-LRAd6, LRUp9
UR-9	Integration of the attribute supply in to the work flow of regulations	Road authorities need a way to integrate data maintenance into the legal work flow, with minimum extra effort.	Data Store Operator	AS1, AS2, AS3, FL0-FL11, LRUp9, Np09-Np11, Np19-Np21, Ob1, Ob2, Sr1-Sr10
UR-10	Data presentation and maintenance	Road authorities need tools for data presentation and maintenance.	Enacting Authority	AS4-AS6, Sr1, Sr3, Sr8 Ob2, Np17, LRUp7, LRUp8, Np01-Np08
UR-11	Data publishing, both for the ROSATTE infrastructure, and for public websites.	Road authorities need a data publishing mechanism which is flexible and easy to adapt.	Enacting Authority	AS7, Np12,Ob4, Sr2
UR-12	User feedback	Road authorities need feedback from users to improve quality.	Information Provider,	AS8, FL10, Np18, Ob6

User requirement		Additional explanation	Roles involved	Partner use cases
Number/ID	(short) Definition			
			Enacting Authority	
UR-13	INSPIRE conformance	INSPIRE has become a directive, and conformance is a requirement for data owners.	Enacting Authority	
UR-14	Existing work and standards	To protect investments, ensure acceptance, and save time and effort, work should build on existing work and standards.	Enacting Authority, Data Store Operator	Derived from Technical Annex
UR-15	Quality management	Road authorities need quality management in order to guarantee the provision of quality assured data.	Enacting Authority, Data Store Operator	LRUp10, Np16, Ob5, Sr10

4.5 Use cases

The total amount of use cases can be significant, and a logical division is required. Based on the structure of the project itself, see figure 1, the total functionality of the ROSATTE system can be divided into three composite use cases:

- Maintain attributes, which is mainly about keeping Data Store up to date.
- Exchange attributes, which describes the data flow from Data Store to Information Provider.
- Integrate attributes, which describes finding and using road safety attributes.

Use case notation

The use case diagrams below use the following notation techniques:

Association: The *straight line* illustrates an association to a use case. In most cases that mean that an actor is in one way or another involved in the functionality of the use case.

Include association: These dotted lines with the *include* tag illustrates that a use case includes another use case functionality.

Extend association: These dotted lines with the *extend* tag illustrates that the functionality of one use case may be extended into another use case.

Composite use case: The *infinity symbol* illustrates that the use case is composed of on or more sub use cases. This is also called a composite use case.

System boundary: The named frame around the use cases signifies the system boundary and that the use cases within the frame are subordinate this system or system component.

The overall use case presented in the use case diagram in Figure 3 shows the three main areas of the ROSATTE infrastructure. These are *Maintain attributes*, *Exchange attributes* and *Integrate attributes.*

The *Maintain attributes* concerns the initiation of the Data store, the data import, the maintenance of attributes, and the quality management of road safety attributes up until the point where they are published. In addition, reception of feedback is a part of this use case scenario.

The *Exchange attributes* composite use case is concerned about the actual exchange procedures and services involved in the road safety attribute exchange process. Three services are defined and these are described in more detail in sub use cases.

The *Integrate attributes* composite use case concerns the location of road safety attributes and integration of them at the Information provider side.

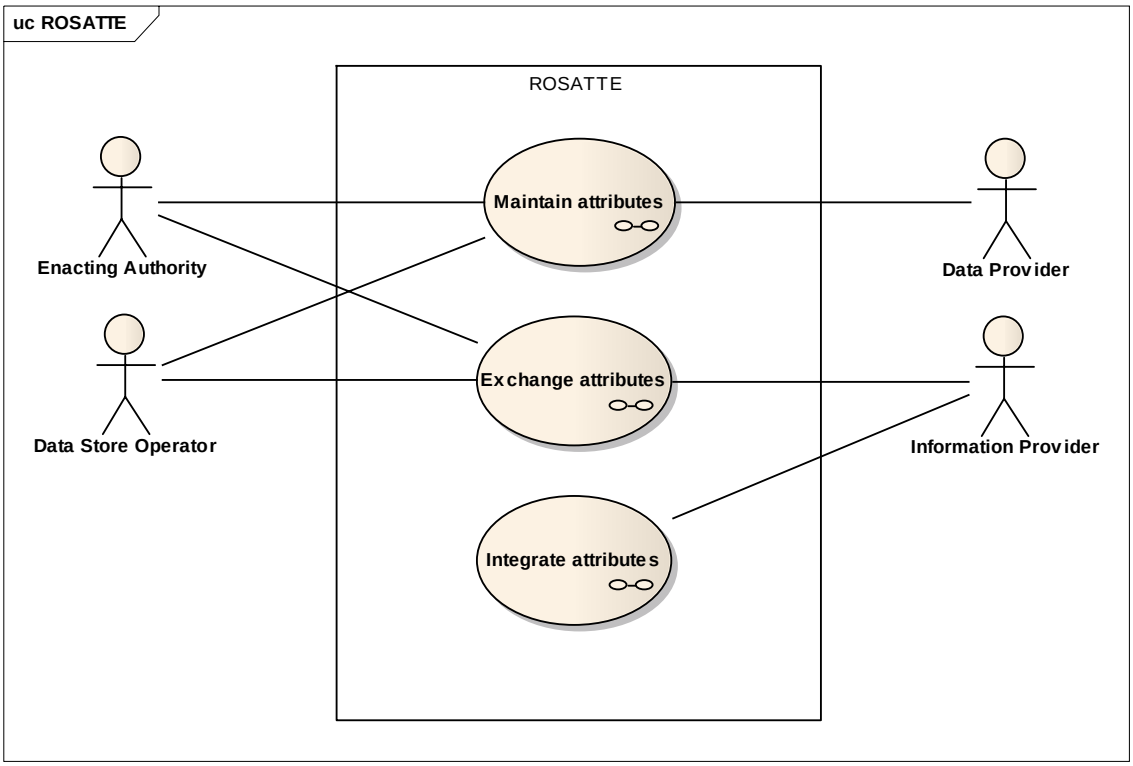

Figure 3 – Top level use case

4.5.1 Maintain attributes

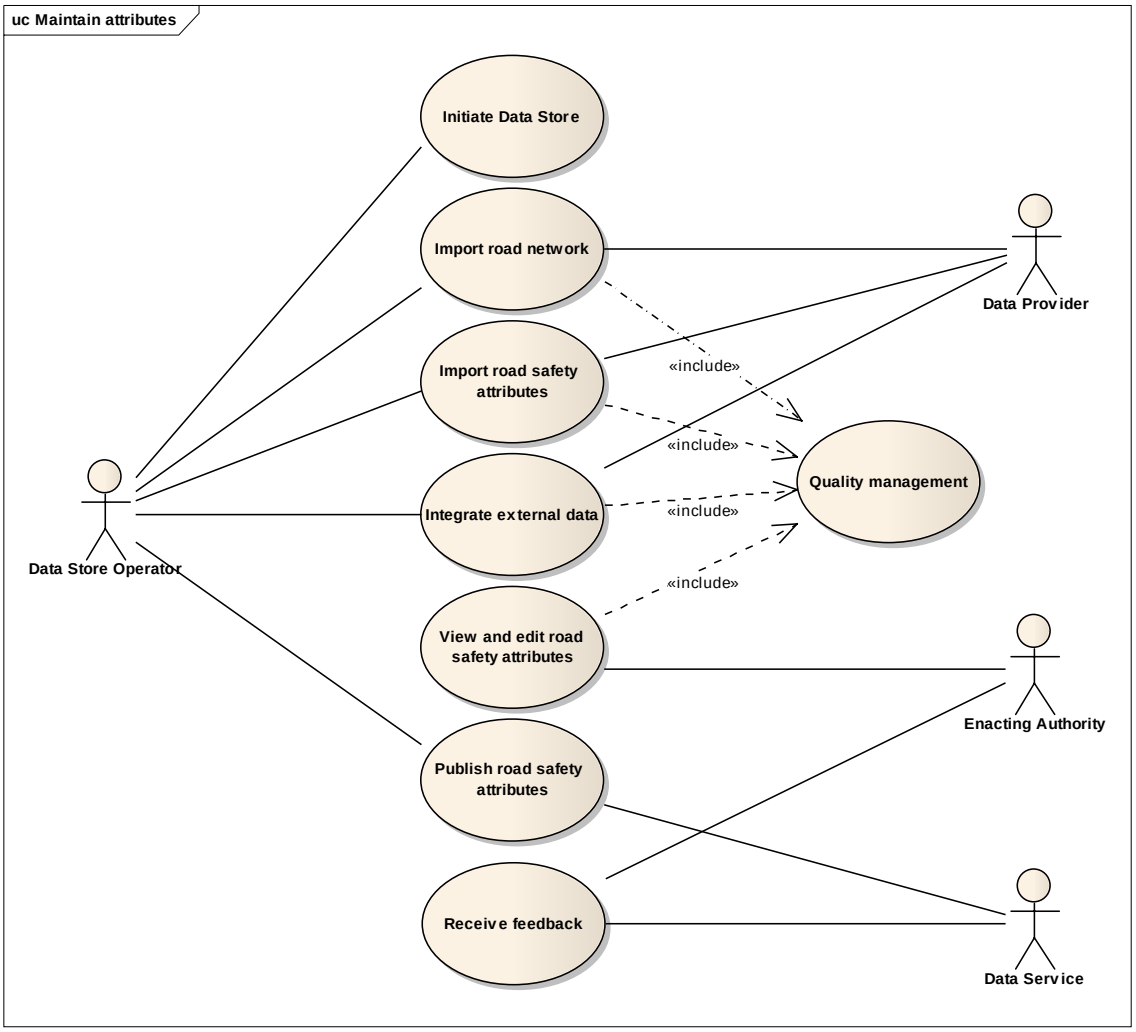

Figure 4 - Maintain attributes

Table 7 - Use cases in "Maintain attributes"

Name	Description	Roles involved
Initiate Data Store	The initiation includes operations such as initiate hardware and software structures necessary to store attributes and to communicate with the other ROSATTE components.	Data Store Operator
Import road network	Road network data is imported from Data Provider. Relevant only if road network is not maintained by road authorities and necessary agreements exists.	Data Store Operator, Data Provider

Name	Description	Roles involved
Import road safety attributes	Attribute data (with references to regulations, if available) is imported from various Data Providers (e.g. Map Providers and Enacting Authority holding the role as Data Provider). Metadata like quality characteristics may be updated.	Data Store Operator, Data Provider
Integrate external data	External data, like legal decisions, may be integrated with data in Data Store.	Data Store Operator, Data Provider
View and edit road safety attributes	Functionality for updating (create, modify, delete) and viewing attributes should be provided, preferably using GIS software.	Enacting Authority
Publish road safety attributes	Road safety attributes are made available for public websites, if any, and for the Data Service. Notification is generated and sent to the Data Service.	Data Store Operator, Data Service
Receive feedback	Feedback concerning quality of road safety attribute integration must be received and handled. This includes conflict resolution handling.	Enacting Authority, Data Service
Quality management	This use case is included in all import and editing operations. See 8.1.2 for a general discussion. Details will be developed in WP2 and WP5.	

4.5.2 Exchange attributes

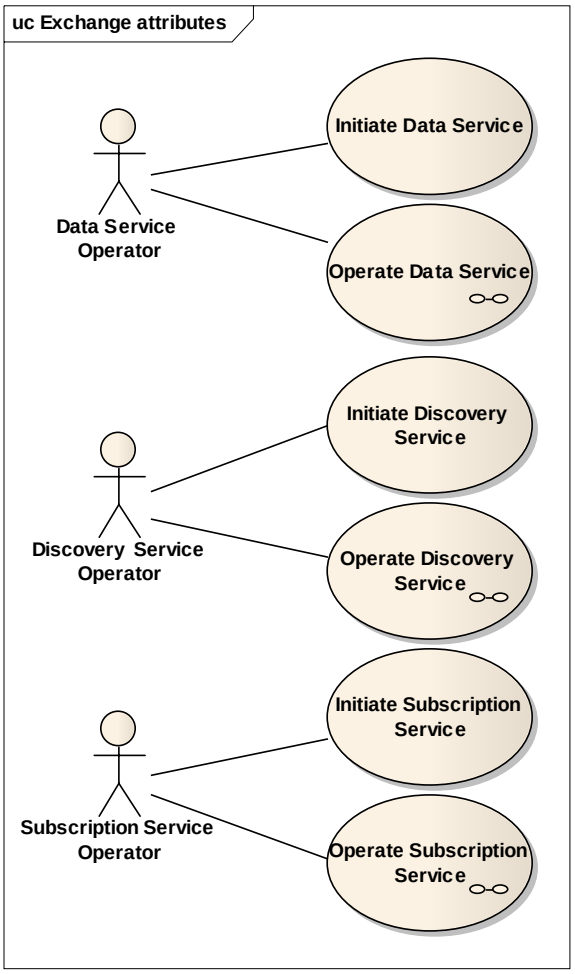

Figure 5 - Exchange attributes

Table 8 - Use cases in "Exchange attributes"

Name	Description	Roles involved
Initiate Data Service	Establish necessary software and hardware, and register Data Service in Discovery Service and Subscription Service.	Data Service Operator
Operate Data Service	Composite use case further described below.	Data Service Operator
Initiate Discovery Service	Establish necessary hardware and software, and register the Discovery Service in the INSPIRE geo-portal.	Discovery Service Operator

Operate Discovery Service	Composite use case described next.	Discovery Service Operator
Initiate Subscription Service	Establish necessary hardware and software.	Subscription Service Operator
Operate Subscription Service	Composite use case described next.	Subscription Service Operator

4.5.2.1 Operate Data Service

Figure 6 – Operate Data Service

Table 9 - Use cases in "Operate Data Service"

Name	Description	Roles involved
Receive change notifications from Data Store	Provision of new data in Data Store initiates change notifications, which are sent to Data Service. Triggers "Forward change notifications"	Data Store
Forward change notifications	Notifications are forwarded to Subscription Service. This use case triggers use case "Read published data from Data Store".	Subscription Service
Read published data from Data Store	Data Service reads data from Data Store, in the sense that data from Data Store is made available for Information Provider Service. Triggers use case "Create metadata".	Data Store
Provide published data	Information Provider Service sends queries and reads the resulting datasets.	Information Provider Service
Create metadata	Metadata describing available road safety attributes is generated automatically. Also includes metadata created by Enacting Authorities (e.g. quality characteristics). See "Read published data from Data Store". Triggers "Provide metadata".	
Provide metadata	Metadata is sent to/ read by Discovery Service, keeping it up to date.	Discovery Service
Receive feedback from Information Provider Service	Feedback messages concerning provided data are sent from Information Provider Service.	Information Provider Service
Forward feedback	Feedback messages are sent to Enacting Authority for review	Enacting Authority
Maintain Data Service	Data Service must be maintained.	Data Service Operator

4.5.2.2 Operate Subscription Service

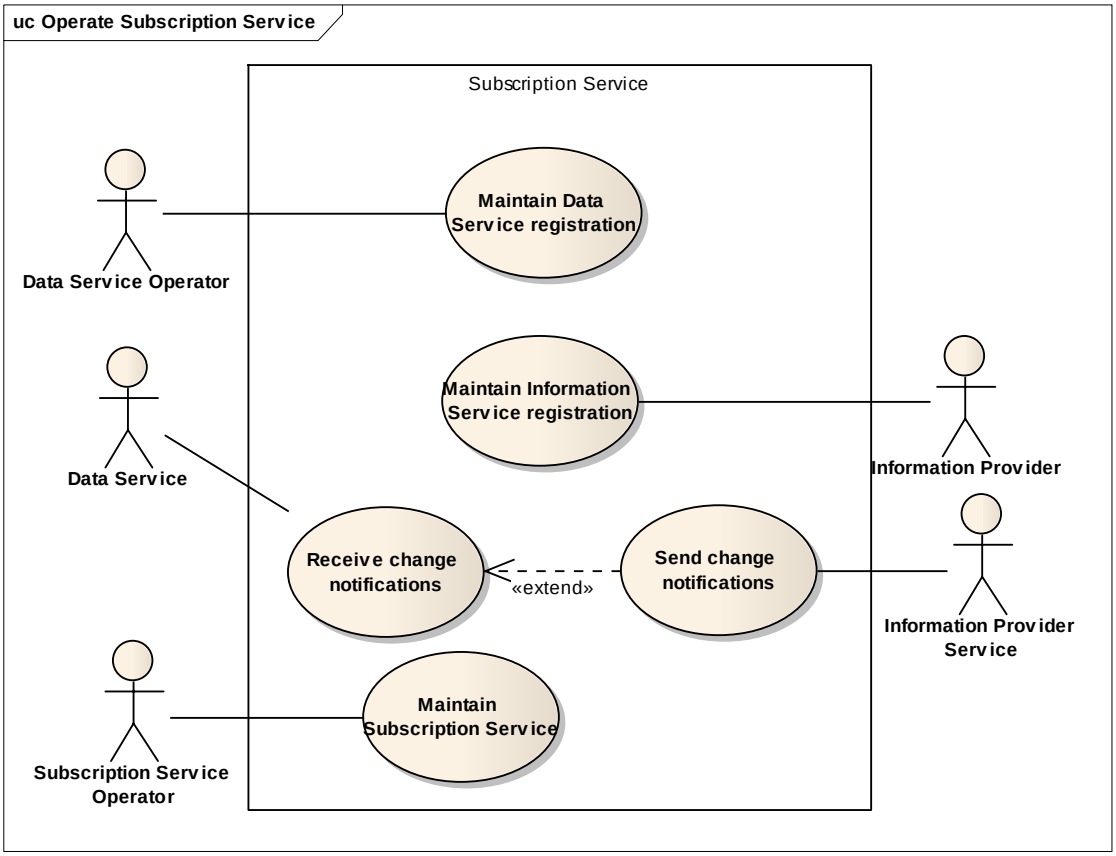

Figure 7 - Operate Subscription Service

Table 10 - Use cases in "Operate Subscription Service"

Name	Description	Roles involved
Maintain Data Service registration	Data Service Operator maintains own registration information.	Data Service Operator
Maintain Information Service registration	Information Provider maintains own registration information, including notification preferences.	Information Provider
Receive change notification	Change notification from Data Service received	Data Service
Send Change notification	Content of notification preferences examined, and change notifications sent to appropriate Information Provider Services.	Information Provider Service
Maintain Subscription Service	Maintain Subscription Service involves handling change notification and subscription information.	Subscription Service Operator

4.5.2.3 Operate Discovery Service

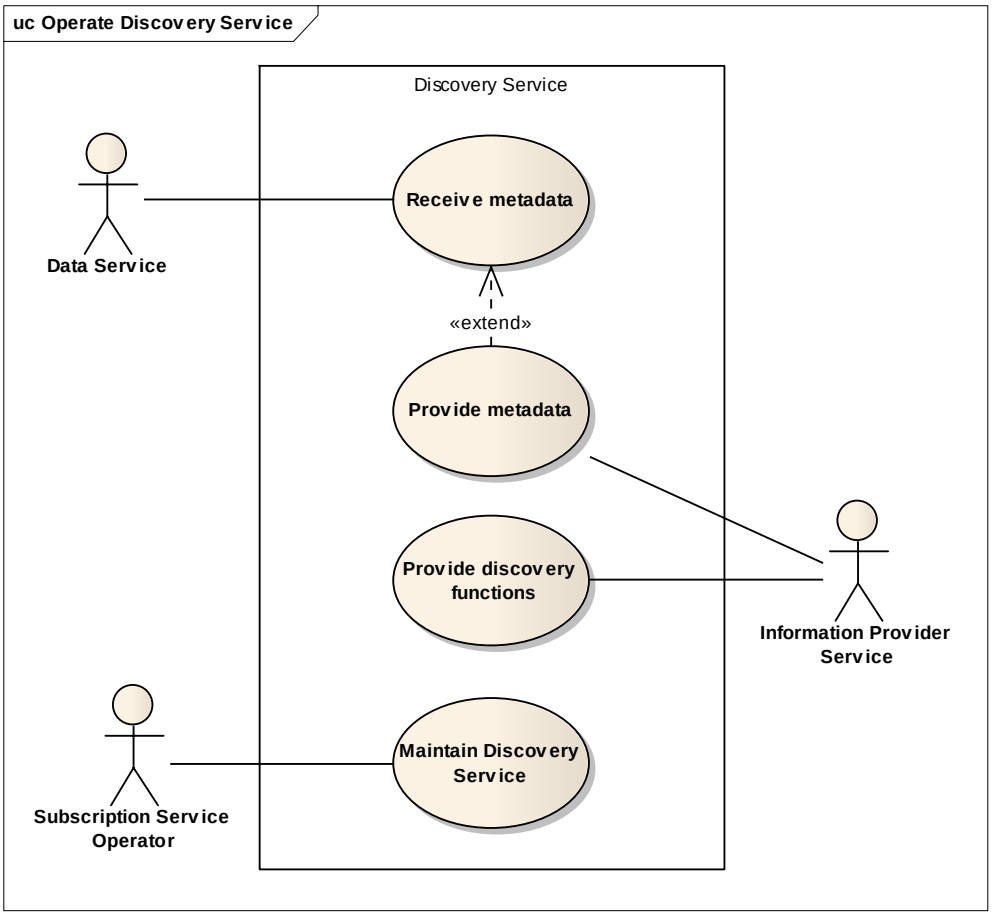

Figure 8 - Operate Discovery Service

Table 11 - Use cases in "Operate Discovery Service"

Name	Description	Roles involved
Receive metadata	Metadata are received, reflecting current status and data content of Data Service. The INSPIRE directive defines a minimum set of attributes which must be provided.	Data Service
Provide metadata	The metadata is made available for the Information Provider to query metadata for relevant data services and attributes.	Information Provider Service
Provide discovery functions	Discovery functions are provided, using received metadata. INSPIRE defines a minimum set of search criteria. Search functions provided, returning lists of suitable Data Services.	Information Provider Service
Maintain Discovery Service	Discovery Service must be maintained, and the services registered must be monitored.	Discovery Service Operator

4.5.3 Integrate attributes

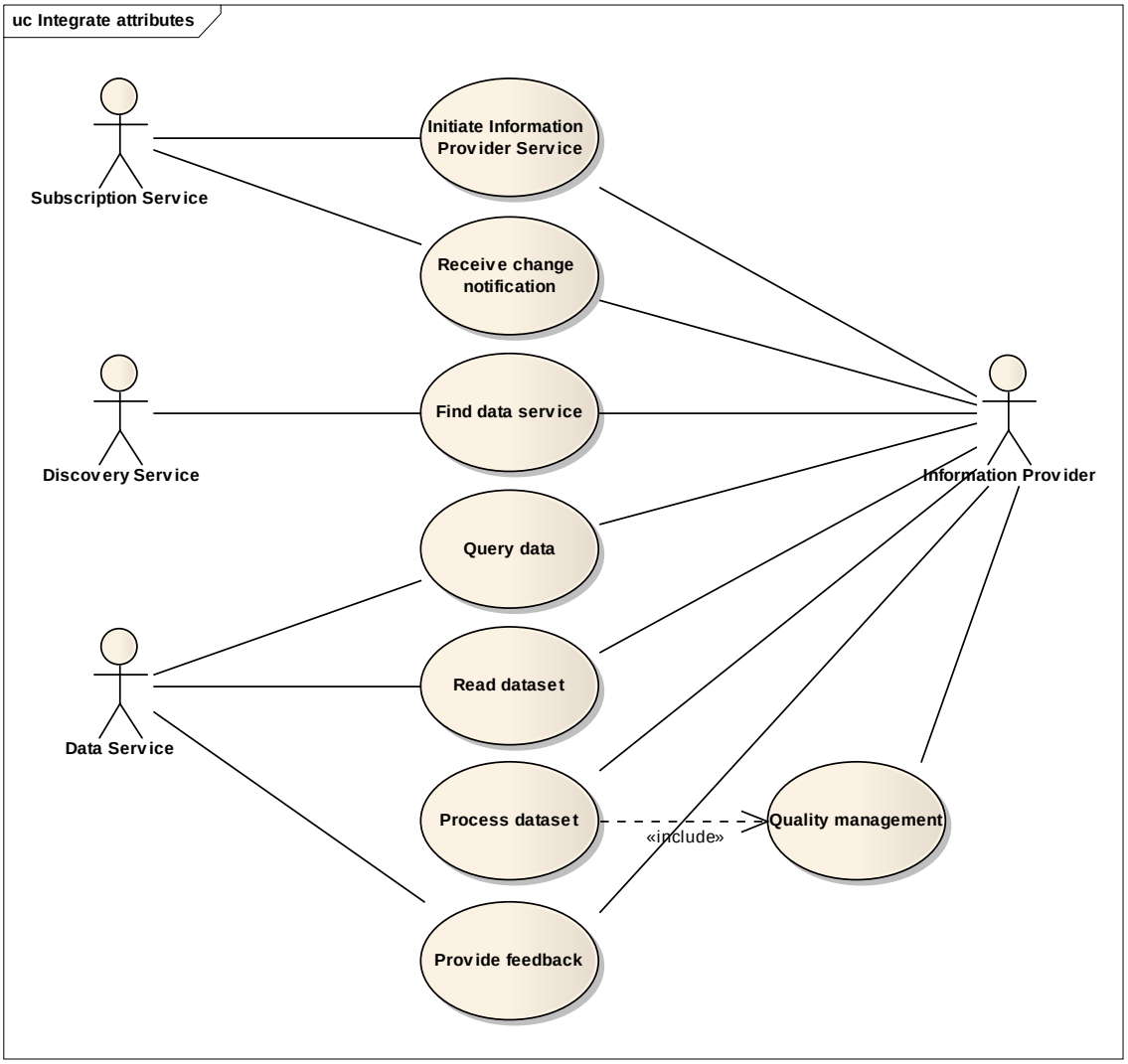

Figure 9 - Integrate attributes

Table 12 - Use cases in "Integrate attributes"

Name	Description	Roles involved
Initiate Information Provider Service	Establish necessary hardware and software, and register the service with Subscription Service, together with notification preferences.	Information Provider, Subscription Service
Receive change notification	Change notification is received, based on registered preferences. Can trigger use case “Query data” directly, or can be accumulated for later use.	Subscription Service, Information Provider Service
Find Data Services	Search for relevant data services using Discovery Service. Already described in use case diagram “Operate Discovery Service”.	Information Provider, Discovery Service
Query data	Based on the discovered services, change notifications or other information, query Data Service. Receive a dataset handle, and metadata describing the resulting dataset, including quality parameters, version numbers, dates, coverage etc.	Information Provider, Data Service
Read dataset	Referenced dataset are read from Data Service. Depending on query parameters used, the dataset represents a full or incremental update.	Information Provider, Data Service
Process datasets	Datasets are combined with map data and others, resulting in new value added datasets. Triggers use case “Quality management”.	Information Provider
Quality management	Received dataset is controlled during processing. See chapter 5.1 for a general discussion. Details will be developed in WP4 and WP5.	Information Provider
Provide feedback	During processing and quality management, a number of problems can be detected. These feedback messages are sent back to originating Data Service, using original Data Store identifiers.	Data Service

5 Process viewpoint

The process view further elaborates on the use cases presented in the previous chapter. While the use cases define the functionalities and what roles are responsible for them in the ROSATTE infrastructure, the process view describes a sequential order of these functionalities together with the relevant information elements flowing between the functionalities.

The process view is drawn as a UML activity diagram and uses a pragmatic approach where we in addition to the regular control flow also use the object flow to illustrate information elements communicated between the functionalities.

There are two process views defined in this chapter. These are:

- Maintain attributes
- Exchange and integrate attributes

Compared to the use cases presented in the previous chapter, we have combined the 'Exchange attributes' functionalities with the 'Integrate attributes' functionalities. These two use case scenarios contain many interdependent functionalities and it is more descriptive to combine them in the same diagram.

The process diagrams should be considered as examples, as they cannot cover all possible situations at all authorities.

5.1 Maintain attributes

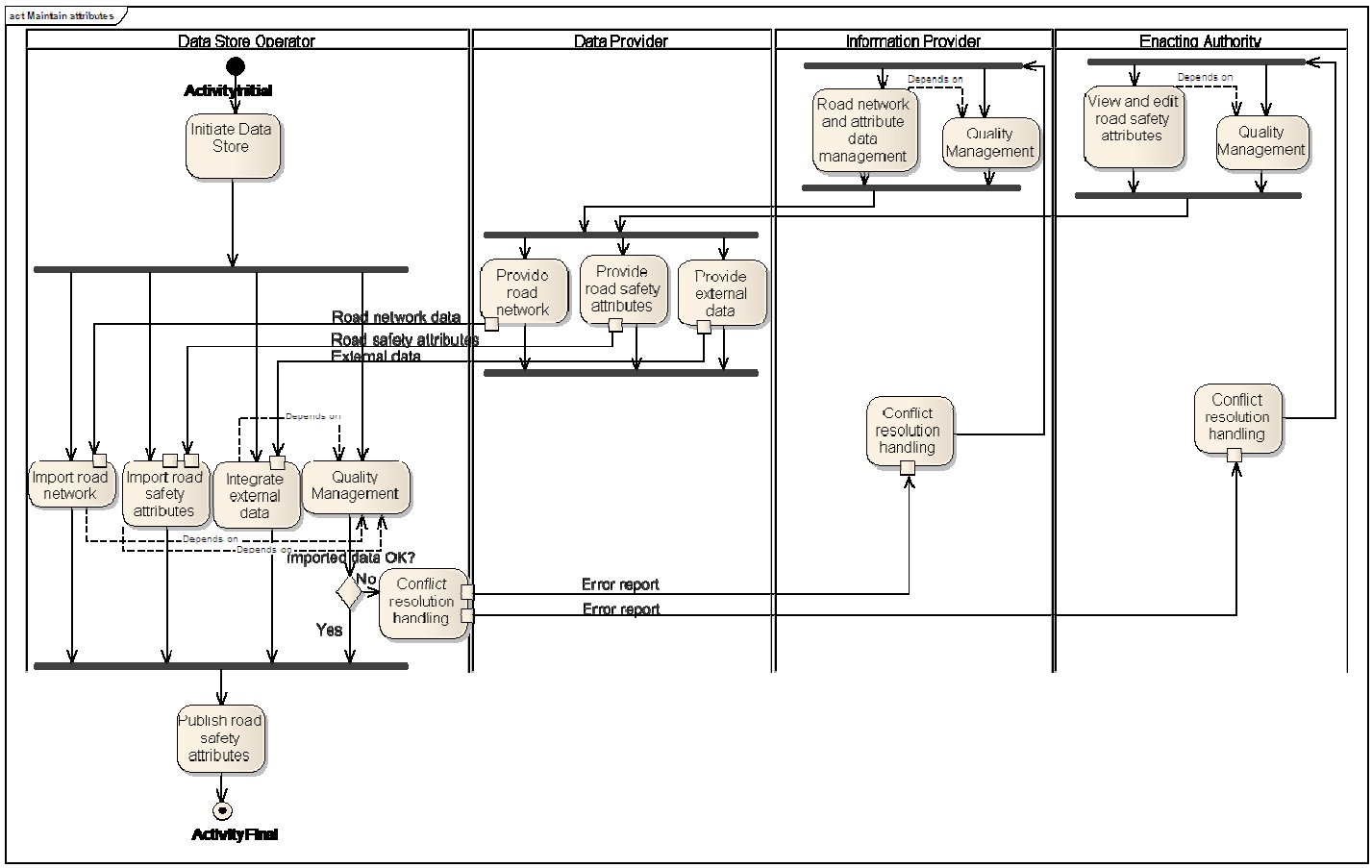

Figure 10 - Maintain attributes

The Data Store is initiated (hardware and software arrangements as well as management procedures). Then the road network, the road safety attributes and other external data is imported into the Data Store from the Data Provider. It is important to note that at this point both the Enacting authority and the Information Provider may possess this role.

All these import operations are highly dependent on proper quality management procedures to ensure that the imported data has sufficient data quality. If the quality management operations locate erroneous data or data which does not satisfy the quality characteristics (see 8.1.2 for a description), conflict resolution handling is commenced and error reports stating the conflicts are issued back to the Enacting authorities and the Information Provider. If the imported data is of sufficient quality the road safety attributes are made available for the Data Service.

5.2 Exchange and integrate attributes

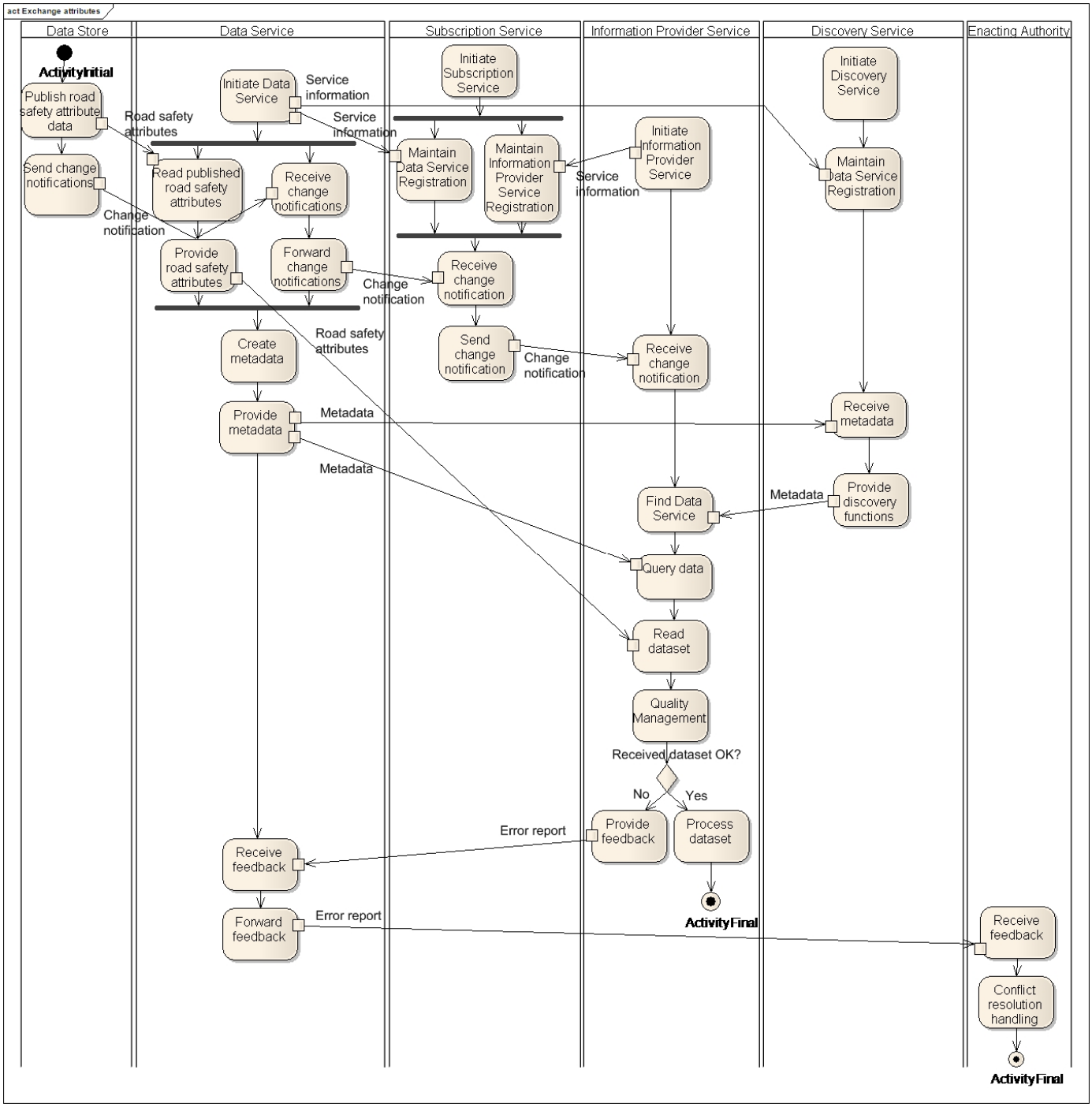

Figure 11 - Exchange and integrate attributes

The processes in this diagram are initiated by the activity Publish road safety attributes (Data store responsibility). As these attributes are published a change notification is sent to the Data Service. The Data Service receives this change notification and forwards it to the Subscription Service. The Subscription Service forwards it to the Information Provider Service. The Information Provider Service is now aware that new road safety attributes are available.

The notifications can be used directly to build queries for small update datasets, or accumulated for larger ones. When a query is run against Data Store, it returns metadata describing the resulting dataset. The dataset can then be discarded or downloaded.

Quality management procedures will verify that the road safety attributes received in the dataset is of sufficient quality. If so, the dataset is processed into suitable end-user services. If the quality is not satisfactory, an error report is sent as feedback to the Data Service which relays this further back to the Enacting authority who does the conflict resolution handling.

6 Information viewpoint

6.1 Metadata

In a decentralized environment, metadata serves the important purpose of describing and declaring available data. The content and structure of the metadata shall use necessary elements from existing metadata standards and rules such as ISO 19115 [5], INSPIRE implementing rules for metadata and other relevant work such as the EuroRoadS metadata catalogue [11]. Since the INSPIRE rules may become European law, they may also be viewed as a requirement for ROSATTE. Therefore, the metadata package should at least conform to the INSPIRE metadata implementing rule in order to support INSPIRE discovery services.

6.2 Safety attributes

Road safety attributes are central items within ROSATTE. They are so far not clearly defined, different road authorities have different data types available, and it is likely that the meaning of "road safety attributes" will change over time.

To cope with that situation, the ROSATTE data model must be extensible, meaning it must be easy to add new road safety attribute definitions as a need arises. This must also be possible without changing the ROSATTE specification.

Safety attributes have variable validity, from static to temporal, i.e. validity periods from infinite down to hours, and maybe shorter. Attributes with shorter validity are considered dynamic and out of scope. It should however be possible to define attributes with recurring values, e.g. speed limits based on the time of day, as the rules regulating the limits can be considered static or temporal.

The infrastructure itself is not expected to rule out dynamic data, but handling such data may require formats and routines not discussed in this project.

6.3 Location references

Location references specify the location of the road safety attributes. There are several ways of dealing with this, many of them are also already standardised or at least currently being standardised.

ISO 17572 defines two principles for location referencing:

- Pre coded location referencing (ISO 17572-2 [12])
- Dynamic location referencing (ISO 17572-3 [13])

The pre coded type uses some kind of persistent identification of locations or objects such as road elements. The pre coded principle assumes that the parties agree on the identification of objects, the objects themselves and the other principles that are needed to specify locations with an accuracy that is precise enough. One example of a pre coded location referencing method is linear referencing which is implemented in a number of flavours and it is currently standardised within ISO 19148 [14]. Typical methods use identification of links, nodes or routes together with some means for measuring lengths along the linear elements in the road network.

Dynamic location referencing uses various characterizing properties such as geometry, form of way, functional road class, road name, road number to identify the location. In this case the parties have to agree on the definitions of some basic attribution for the network. Of course the matching of locations will be more successful the more the data corresponds at the sender and receiver side. The method mostly used today is called AGORA-C.

For ROSATTE, a decision must be made regarding what methods will be supported short term. However, an open ended solution will be preferable, since new methods may evolve over time.

The location referencing method used must work whether road authority and information providers share the same road network or not.

Road safety attributes can be located using points, lines along a road, or areas.

6.4 Geometry

Access to geometry is a requirement for location referencing, quality control and attribute presentations.

If possible, geometry should be defined using ISO19100-series of standards. Conformance to these are also requirements in the INSPIRE data specification.

6.5 Conceptual data model

The package diagram below identifies the different types of information that must be specified.

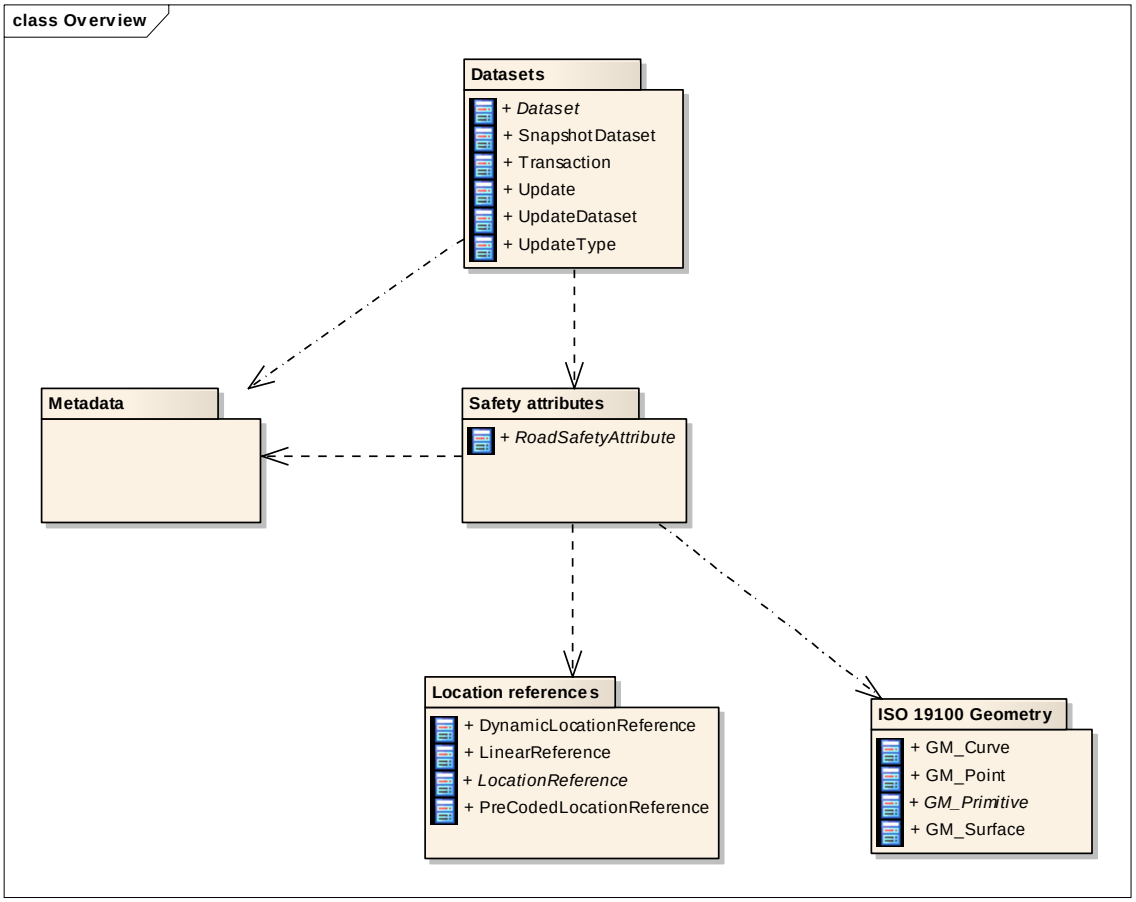

Figure 12 - Data model package diagram

A description of the possible content of package "Safety attributes" can be found below.

A line between boxes indicates a relationship. A diamond on the line indicates that the element is contained within the element at the diamond's end. In order to illustrate a more complete model of a speed limit, we added corresponding TrafficSign and SignPlacement classes. These classes may also be used to describe signs for other safety attributes. All safety attributes have some kind of validity specification.

This is still a conceptual data model, and the details will be elaborated in other work packages.

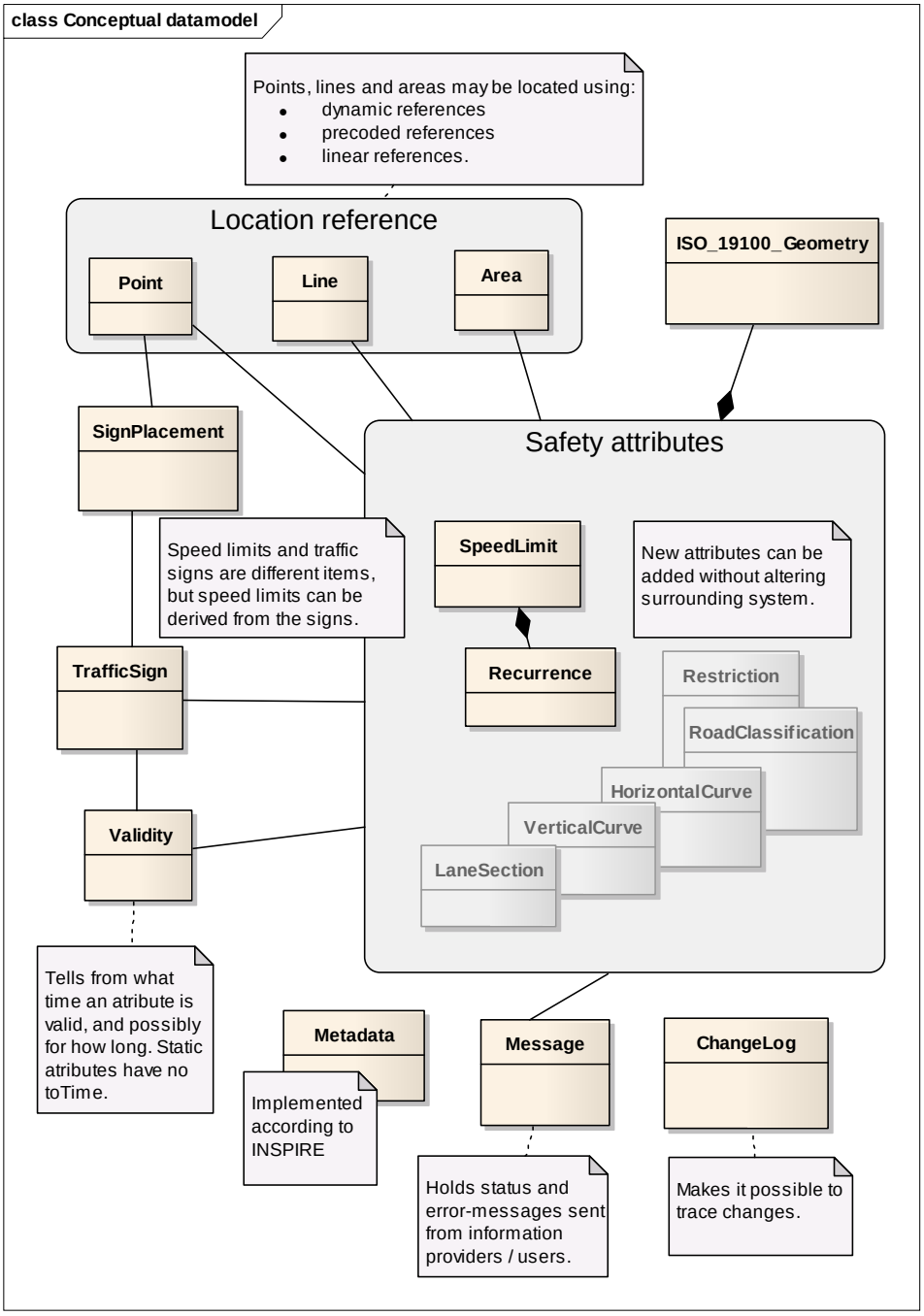

Figure 13 - Conceptual data model

7 Component viewpoint

As already stated, a common data model and common interfaces are needed to create standardised services, services that can be used across borders without custom programming. In order to visualize the connection between components, use cases and dataflow, we have drawn Figure 14 which at the same time is an expansion of figure 1. Arrows indicate data flow, with names corresponding to the described use cases. Thick arrows indicate flow of road safety attributes. The publish-find-bind pattern used in service oriented architectures is illustrated with "1" for publishing, "2" for finding, and "3" for binding.

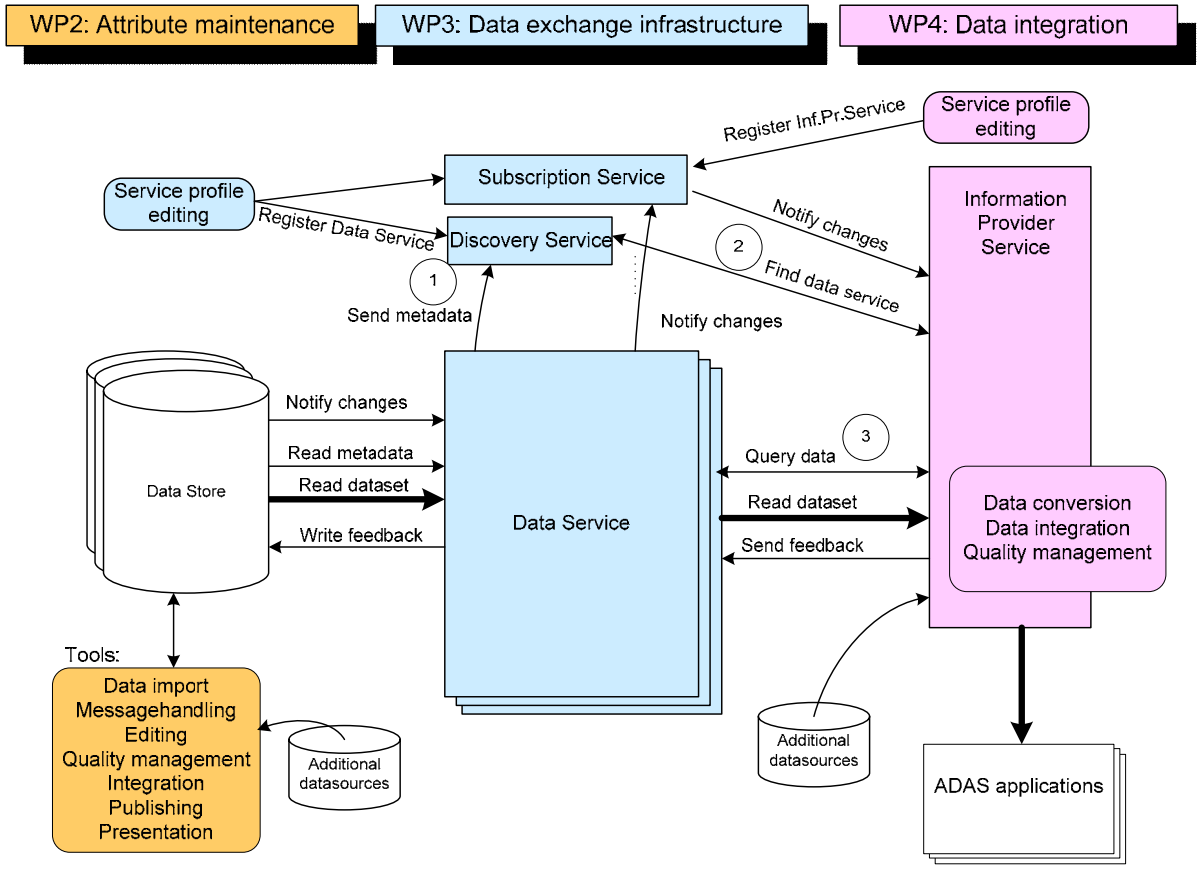

Figure 14 - Components and data flow

8 System requirements

8.1 Introduction

The requirements presented in this chapter are divided into functional requirements, non-functional requirements (quality requirements) and context requirements.

8.1.1 Functional requirements

The functional requirements described in this chapter are mainly derived from the user requirements collected using a questionnaire. The results from this questionnaire have been analyzed, commented and discussed and further transformed to UML (use cases and process viewpoints) to create definitions that are more precise. The UML documents also include conceptual definitions of important data models and interfaces. A possible system architecture has been proposed and discussed. A later specification may include many of the same elements found here, only more detailed.

8.1.2 Non-functional requirements (Quality requirements)

These requirements are mainly concerned with the quality of the data and the quality management routines involved in the ROSATTE infrastructure and are mainly linked to the user requirements UR-6 and UR-15. The quality of both the data exchanged and the processes involved in the data exchange is something that should be emphasised in the continuing work.

The quality of geographic information is not fixed within the data processing chain. Each processing step not only affects the data but also its quality. Therefore, quality management and assurance is necessary from the beginning up to the final step of the data processing chain. Each step has to be evaluated regarding its effect on the quality characteristics of the data. Knowing the values for the initial quality parameters and the influence of the data processing on them, one is able to compute the quality parameters for the finally processed data.

In case of ROSATTE, the data processing chain starts at the data capture of the local authorities over the mapping process into the Data Store up to the integration of the data into the map providers' databases. A deeper analysis of the data processing steps at the project's test sites will follow in work package 2. Out of that analysis, quality measures for both the data processing and the final data will follow. Recommendations for further improvements of the processing chain will also be given where needed.

Quality management for geographical data was studied in the EuroRoadS project. One of the main results of this project was the derivation of the 6 fixed quality characteristics that are applied in order to determine the quality of geographical data [15]. The characteristics are:

- Availability
- Up-to-dateness
- Completeness
- Correctness

- Consistency
- Accuracy

The structure of the quality model can be seen in Figure 15. The quality characteristics describe the quality phenomena. They are fixed and universally applicable. But the characteristics need to be concretised by variable quality parameters. The parameters need to be found for each individual problem.

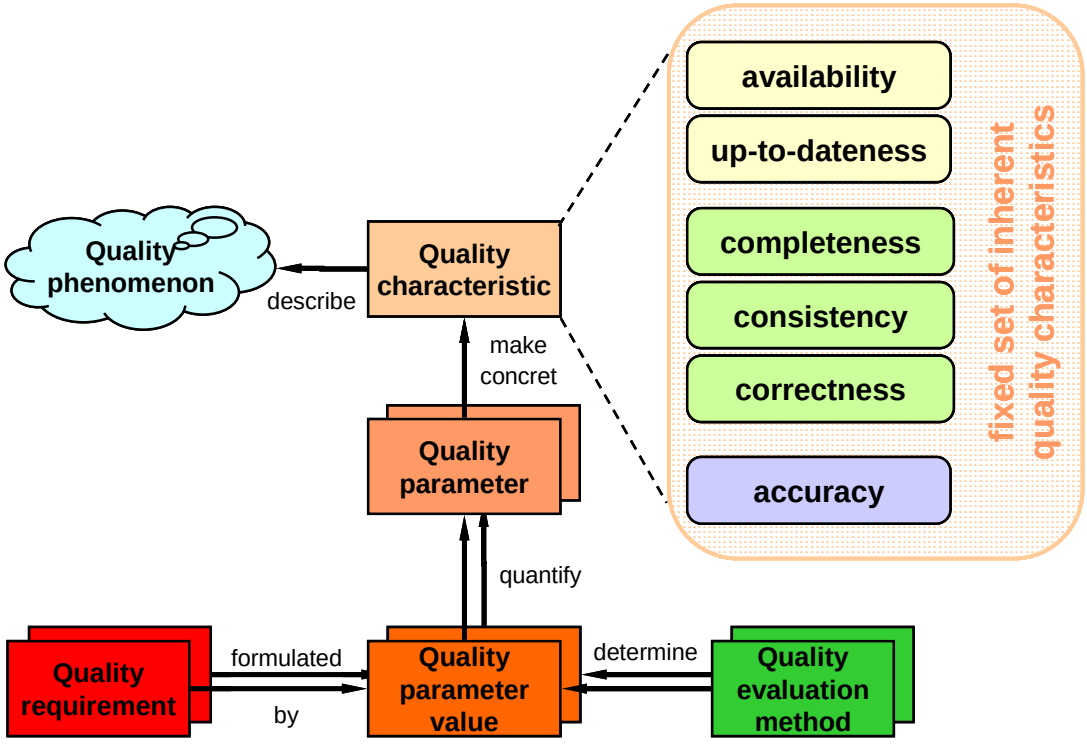

Figure 15 - Structure of the quality model

For organisations which already have Road Data System installed, a set of practical guidelines will be given as a result in WP 5.

8.1.3 Context requirements

The context requirements relevant for the ROSATTE project mainly emanates from the INSPIRE directive [4]. The INSPIRE directive does, among other things, describe how to provide services and data containing spatial information in Europe to ensure that users of this kind of data may find relevant services. This includes a description of the services that are needed and how the data should be described by the use of metadata [16].

8.2 System Requirements listing

To present the requirements we have followed the approach used in the FeedMap project [17], with some adaptations. From the left, the *ID* column designates a unique ID for the requirement. The ID naming convention used also specifies whether this is a functional (FRx) or a non-functional (NFRx) requirement. The *Name* column designates a descriptive name for the requirement, and then a *short definition* presents the essence of the requirement. The *Type* column defines what kind of requirement the given requirement is classified within. The *Priority* column designates the importance of the requirement. The *Link to user requirement* has a referral to the corresponding user requirement from chapter 4.4, and finally, there is a column for additional comments, links to other requirements or open issues.

Table 13 - List of System requirements in ROSATTE

ID	Requirement name	Short definition	Type F: Functional N: Non-functional C: Context	Priority: C: Critical S: Significant I: Of interest	Link to user req.	Comments, links to other requirements, open issues
FR-1	Data discovery	A specification of a Discovery service with metadata shall be available.	F	C	UR-1	The ROSATTE infrastructure shall provide discovery service with suitable metadata, that enables the Information Provider to easily find services providing road safety attributes.
FR-2	Standardised access	Data Services and their use shall be specified.	F	S	UR-3	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 standardised 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.	F	S	UR-2	Information Providers can subscribe for change notifications for their individual needs. Data subscription functionality is created by combining with FR-5.
FR-4	Specification of Quality management procedures	Guidelines specifying how to quality assure received road safety attributes shall be specified.	F	C		Guidelines for automatic and semi-automatic quality check routines must be specified. These guidelines should be incorporated into existing procedures.

ID	Requirement name	Short definition	Type F: Functional N: Non-functional C: Context	Priority: C: Critical S: Significant I: Of interest	Link to user req.	Comments, links to other requirements, open issues
FR-5	Incremental updates	The ROSATTE infrastructure shall provide both incremental updates and full updates of road safety attributes.	F	C	UR-4	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.	F	C	UR-5	
FR-7	Data Store initiation	The project shall provide guidelines for Data Store design and initiation.	F	I	UR-7	

ID	Requirement name	Short definition	Type F: Functional N: Non-functional C: Context	Priority: C: Critical S: Significant I: Of interest	Link to user req.	Comments, links to other requirements, open issues
FR-8	Data import	The project shall define guidelines for import of road safety attributes and road network data. If suitable import tools are non-existent, new tools shall be developed.	F	S	UR-8	
FR-9	Workflow support	The project shall produce a specification of tools and guidelines for integrating data maintenance with legal workflow.	F	I	UR-9	
FR-10	Presentation and maintenance tools	The project shall develop specifications of how to present and maintain the road safety attributes. If existing tools are not suitable, new tools shall be developed.	F	C	UR-10, UR-14	Where suitable existing tools do not exist, tools that enable presentation, maintenance and publishing of the road safety attributes must be developed and implemented. The tools shall be built on existing work and standards where suitable.

ID	Requirement name	Short definition	Type F: Functional N: Non-functional C: Context	Priority: C: Critical S: Significant I: Of interest	Link to user req.	Comments, links to other requirements, open issues
FR-11	Feedback loop	A feedback channel from information providers back to enacting authorities shall be provided.	F	C	UR-12	
FR-12	Integration tools	Tools to integrate road safety attributes into existing information providers systems shall be developed if existing tools does not provide the satisfactory functionality.	F	S		Generic software components must be developed to integrate the road safety attributes in a quality assured (ref FR-4) and automated manner.
FR-13	Flexible type definitions	The meaning of “Road safety attributes” is not finally decided. Changes will occur in the future.	F	C		It shall be possible to add and change (to some degree) the available type definitions describing road safety attributes.
NFR-1	Availability	Valid quality parameters related to availability shall be declared in the metadata associated with the road safety attributes.	F	C	UR-6, UR-15	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.

ID	Requirement name	Short definition	Type F: Functional N: Non-functional C: Context	Priority: C: Critical S: Significant I: Of interest	Link to user req.	Comments, links to other requirements, open issues
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.	N	C	UR-6, UR-15	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.	N	C	UR-6, UR-15	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.	N	C	UR-6, UR-15	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

ID	Requirement name	Short definition	Type F: Functional N: Non-functional C: Context	Priority: C: Critical S: Significant I: Of interest	Link to user req.	Comments, links to other requirements, open issues
NFR-5	Consistency	Valid quality parameters related to consistency shall be declared in the metadata associated with the road safety attributes.	N	C	UR-6, UR-15	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.	N	C	UR-6, UR-15	Degree of adherence of geographic data to the most plausible or respectively the true value. ▪ Absolute position accuracy ▪ Relative position accuracy ▪ Quantitative attribute accuracy
NFR-7	Reduced data update delay	The time delay from Public Authority regulations are effective, to end user data are updated, shall be reduced.	N	S	UR-7	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.

ID	Requirement name	Short definition	Type F: Functional N: Non-functional C: Context	Priority: C: Critical S: Significant I: Of interest	Link to user req.	Comments, links to other requirements, open issues
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	C	UR-9	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**

9 Conclusion and Summary

9.1 Working method

User requirements were collected using two questionnaires, one concerning functional requirements, and later one concerning organizational aspects. See appendix A and B for details. The answers were generalized into one list of user requirements. These requirements, and the derived use cases and process diagrams, have been discussed during 5 full project meetings, a few minor meetings, and about 5 teleconferences. At the same time we worked to agree on concepts, scope, and structure and content of this document. During the process, this document was circulated among the partners for commenting, giving valuable input.

9.2 Results

High level user requirements, use cases and data flow have been defined, both at road authorities and information providers.

Functional and non-functional system requirements have been derived from these.

General quality requirements and management have been discussed, including use of quality parameters describing the actual quality of the datasets. Details will be developed in WP2, WP 3, WP 4 and WP5, when road referencing, conversions etc. are fully known. We expect that much of the work done in EuroRoadS on quality management can be used.

Work has been done to see that the requirements and architecture is aligned with existing standards and the INSPIRE directive. Building on existing work, standards and previous projects, e.g. EuroRoadS, would help to ensure that systems are compatible.

9.3 Next steps

This document is not a detailed specification, but should be used as a common template when developing specifications and tools in WP2, WP3 and WP4.

User requirements, use cases, data model, process diagrams, component diagrams, quality management and system requirements should be revised with an added level of detail:

- Use cases should be described at a detailed level. New use cases might be discovered.
- The data model should be completed with all details, including road referencing, quality parameters and other metadata.
- A detailed component view, with necessary interfaces, should be specified.
- The most critical use cases should be tested against the resulting architecture.

Participants in WP2, WP3, and WP4 must cooperate to ensure that data flowing between their respective domains uses common interfaces and data models whenever possible. Even then it is likely that the specifications to be developed in different WPs have to go through one more iteration before they are fully compatible. This document should also be updated in the process.

Unnecessary conversions between data models and references in the data chain must be avoided, since it will reduce data quality and increase software costs.

Appendix A, user requirements questionnaire

Use cases and high-level user requirements were collected using a simple questionnaire.

Here are the contributions from the partners. The "id" is used as a reference when a use case is referred to in chapter 4.4. These descriptions should be useful in specification work to come as well.

These use cases represents both functionality covered by existing systems, which shall not be replaced, and functionality required for ROSATTE. That is why we cannot use them directly as user requirements for ROSATTE. Instead we use a subset of them which we find relevant, and generalize them into the user requirements found in chapter 5.

ASFA

Contributor	ASFA
Actor(s), if known	Local centres (motorway company), control operator (motorway company), police authority, Autoroutes Trafic (service provider)

Id	Detail use-case	Purpose
As1	Set up a new speed limit	Decide a new speed limit and get authorization
As2	Set up speed regulation	Decide a speed regulation and get authorization
As3	Register new speed limit	Register data in the database
As4	Register dynamic speed limit (works, heavy traffic, pollution, bad weather)	Get information in the database
As5	Update static speed limits	Incremental update in the database
As6	Update dynamic information	Real time exchange
As7	Update web application	Make new SL appear on the website
As8	Receive error message from a user	Correct errors in the database

Vlaamse Overheid

Contributor	Vlaamse Overheid
Actor(s), if known	Public authority, contractor, map provider, citizen, police

Id	Detail use-case	Purpose
FL0	Traffic signs along a newly built road	When a new road is constructed, appropriate traffic signs will have to be placed along that road.
FL1	New regulation that requests new traffic signs	A new regulation is approved that requests some new traffic signs.
FL2	New regulation that allows removal of some traffic signs	A new regulation is approved that makes some traffic signs redundant.
FL3	Design and registration of new traffic signs	The process of designing and registering new traffic signs.
FL4	Change of existing traffic sign/speed limit	An existing traffic sign at a certain location needs to be replaced by another traffic sign at the same location.
FL5	Query for number of certain type of traffic signs in a specified area	Query in order to find out how many times a certain traffic sign is used in a specific area.
FL6	Monitoring the process of damaged traffic signs	A patrolman notices in the field that a certain traffic sign is damaged. Appropriate action needs to be taken.
FL7	Receiving information about accident that has damaged an existing traffic sign	An accident occurs. In the accident, one or more traffic signs have been damaged. The police records the accident and the damage that has occurred. The public authority should be notified about the damaged traffic sign(s).
FL8	Maintenance of traffic signs	One wants to check if some traffic signs have passed the normal lifetime, require a maintenance operation (e.g. cleaning of signs in tunnels, trimming of bushes to guarantee visibility of traffic signs, …)
FL9	Ordering and placement of new traffic signs	A traffic sign is ordered and placed at the required location.
FL10	Receive error message from map provider/citizen	A map provider or citizen gives feedback about an inconsistency between traffic sign database and the actual situation on the road.

FL11	Visualisation of database	Make a visualisation of the traffic sign database
FL12	Temporary traffic signs in case of road works	In case of road works, specific traffic signs are needed during the duration of the works.

MEDAD/DREIF/LROP and SETRA

Contributor	MEDAD/DREIF/LROP and SETRA
Main use-case, if any	Administrate the SL database / Update SL data / Produce and delivery SL datasets
Actor(s), if known	DB Administrator / Enacting road authorities, Field superisor, DB administrator / DB administrators, Enacting road authorities, End-users

Id	Detail use-case	Purpose
LRAd1	Create the SL database	Creating the SL database structure on the server
LRAd2	Initialise the SL database	Initializing the SL database with the map database
LRAd3	Create the map database	Creating the map database structure from the map data provided by the mapmaker
LRAd4	Initialise the map database	Import the data from the map data
LRAd5	Update the map database	This use case is important if the map database is updated externally (new release from a mapmaker)
LRAd6	Manage the background data	Including raster maps, land cover,…
LRUp7	Create, modify and delete a SL section	The user must be able to create, modify and delete a speed limit section
LRUp8	Create, modify and delete a SL area	The user must be able to create, modify and delete an (generally built-up) area with a specific SL
LRUp9	Integrate the SL field survey data (by	Integrating the data from field supervisor

	Field supervisor)	
LRUp10	Control data quality (by DBA)	Establishing rules, methods for the quality control of data
LRPr11	Consult frame map data	To help the DBA to manage and produce the SL data by using frame data
LRPr12	Produce a SL map dataset	Before making it available
LRPr13	Transmit (or make available) a SL map dataset	The mapmakers are intended to receive or download these SL datasets
LRPr14	Update the SL website	The administrator maintains the website
LRPr15	Consult the SL website (road authorities & end-users)	Consultation of data from Internet

NPRA

Contributor	Norwegian Public Roads Administration
Actor(s), if known	Public Authority (NPRA, NMA (Norwegian Mapping and Cadastral Authority), municipalities, police), Contractor, Service provider, Map provider, Citizen, DB Administrator

Id	Detailed use-case	Purpose or description
Np01	Create road network	Update NRDB (National Road Data Base) with new roads
Np02	Delete road network	Delete roads in NRDB that at closed down
Np03	Change road network	Change geometry of existing roads in NRDB
Np04	Create speed limits	Update NRDB with new speed limits
Np05	Delete speed	Delete speed limits for NRDB that are not longer valid

	limits	
Np06	Change speed limits	Change existing speed limits in NRDB
Np07	Create road signs	Update NRDB with new road signs
Np08	Delete road signs	Delete road signs from NRDB that are no longer valid
Np08	Change road signs	Change existing road signs in NRDB
Np09	Create regulations	Update database with information about new regulations
Np10	Delete regulations	Delete from database regulations that are not longer valid
Np11	Change regulations	Change existing regulations in database
Np12	Distribution of data	Distribution of road network, speed limits and information about traffic signs to Service provider and Map provider
Np13	Create download services	Create a download service for approved users. Download of road network, speed limits and information about traffic signs
Np14	Make product specifications	For road network, speed limits and traffic signs
Np15	Create metadata	For road network, speed limits and traffic signs
Np16	Quality assurance	According to specifications in ROSATTE
Np17	Visualisation of road network, speed limits and road signs	Web-application with possibilities for feed-back from users
Np18	Feedback from Service providers and Map providers	Feedback or corrections to data, both road network, speed limits and information about traffic signs
Np19	Create new traffic signs	Along a new road or an existing road
Np20	Remove traffic signs	Remove traffic signs that are no longer valid
Np21	Change traffic signs	Change traffic signs that are damaged

OBB, PTV

Contributor	OBB, PTV

Id	Detail use-case	Purpose
Ob1	Data maintenance at enacting authority – Use of INTREST regulation interface and order processing software	Provide enacting authorites who use order processing software with tool to georeference regulations and transmit data to central repository
Ob2	Data maintenance at enacting authority – Use of INTREST regulation interface without order processing software	Provide enacting authorites without order processing software with tool to georeference regulations and transmit data to central repository
Ob3	Provide incremental updates of traffic attributes from central repository to map provider	Transmission of aggregated data from central repository to map provider according to ROSATTE specifications
Ob4	Visualisation of content of central repository for public information and feedback	Web-Frontend with map view of relevant traffic attributes to allow feedback from citizens to operator of central repository
Ob5	Quality management of the data supply side and the central repository	Increase quality of ROSATTE data in central repository as well as in data sent to map providers
Ob6	Conflict resolution handling for feedback from map provider and citizens	Establish workflow to handle feedback from map provider and citizens

SRA

Contributor	SRA
Actor(s), if known	Public authority

Id	Detail use-case	Purpose
Sr1	Register a traffic regulation	Register a legally decided traffic regulation

Sr2	Publish a traffic regulation	Publish a registered traffic regulation and make it available.
Sr3	Remove a traffic regulation	
Sr4	Attach a traffic regulation to the road network.	By positioning traffic regulations in the road network aided by map interface as well as services that will translate coordinates into actual road network.
Sr5	Subscribe to changed traffic regulations	Subscribe to changed traffic regulations depending on the type of traffic regulation, geographical area and deciding authority.
Sr6	Make available traffic regulations	Fetch all regulations or changes given its identity, regulation type, geographical area, legal authority, etc. Further export these into other systems.
Sr7	Fetch data catalogue	Fetch the entire data catalogue or parts of it based on traffic regulation type.
Sr8	Edit a published regulation.	Alter a published traffic regulation where the legal authority has made changes. Complete a published traffic regulation with road network information.
Sr9	Show event log	All changes related to a traffic regulation are being logged. This may be used as basis or proof in potential conflicts.
Sr10	Validate a traffic regulation	Validate traffic regulations against quality requirements. This includes its attachment to the road network.
Sr11	Extract the most significant traffic regulations (AF01)	Extract the most significant traffic regulations seen from the road user's point of view. Such an extraction may be initiated by the following three procedures: By using a schema that initiates a deduction once every day. By initiating services where the administrator can start the deduction manually (AF13). Evaluate a traffic regulation by running a simulated extraction (AF10). One extraction may be composed of other extractions, one for each type of traffic rule.
Sr12	System administration (AF02)	Used in the administration of system parameters such as response time, etc.

Sr13	Make available deduced traffic regulations (AF03)	This use case is used for maintaining deduced traffic regulations according to the systems business model in xml-format according to Swedish standard (SSxx) through a Web Service. The Web Service is used irrespective of the receivers of the traffic regulations, such as deliveries to NVDB or Lastkajen. The export can be limited based on: Business type What kind of legal authority (municipality, county, or state public authority) From date. If there is no from date the initial date and forward. If the complete dataset or only incremental updates will be provided. With lower priority, but even though desirable is the possibility to limit the export based on the range of the traffic regulations (a list of reference links).
Sr14	Import RDT regulations (AF04)	The aim with this use case is to get published traffic regulations from RDT. RDT's web services for the provision of traffic regulations are used to get data delivered in XML-format according to Swedish standard. The system imports all published changed traffic regulations since the last import and stores a copy of these.
Sr15	System monitoring (AF05)	This use case is used to show information about occurrences in the system. The occurrences may be based on import, extracts, simulated extracts or provision. In this document the term "job" is used as a common notion for import, extractions, simulated extractions or provision. The use case has three views: Work view (Demonstrates running and finished jobs Result view (Demonstrates detailed information about the content in a certain job and when the job was finished. The Result view contains detailed information at several levels in a tree structure. Search view (Gives the user the possibility to search for one or several specific jobs, results or occurrences. The Job view and the Result view may besides the user interface (Web form) as the system administrator is using also be reached through a web service interface for other systems.
Sr16	Administrate data catalogue (AF06)	The use case is used for administrating data catalogues from RDT as well as the data catalogue that will be common for NVDB and Beata. The system needs to store these data catalogues so that "translations" will be achievable between

		RDTs traffic regulations and traffic rule types. The use case describes the following functionality: Import data catalogue Show historic events of the data catalogue Publish new versions of the data catalogue Data catalogues are being versioned, meaning that an import of a new version of data catalogues results in a new current version. However, the previous version will be stored as a closed version. By doing this, the system administration use case (AF05) may trace previous versions. An imported version is valid only after the user has chosen to publish the new version of the data catalogue according to the use case Publish new version of data catalogue. En temporary "working version" of the data catalogue is stored in mean time. Only one "working version" is possible at a given time. Changes of event types and attributes which will affect the rules of extraction (AF07) will result in a warning that the rules must be updated.
Sr17	Administrate rules and regulations (AF07)	This use case is being used to administer the rules that the system used to accomplish the extraction. The rules are a description about how tasks in RDTs traffic regulations will result in traffic rules and what values these attributes will have. These include: Administrate implicit values for attributes Administrate basis rules Administrate rules for storage hierarchies Administrate attributes for cancelled traffic regulations Marking of occurrence types Changes in the rules above will result in new versions of the rules. This is done so that AF05 (Show extraction log) will be able to trace the extraction.
Sr18	Administrate data catalogue mappings (AF08)	The use case is used to create relations (mapping) between the systems data catalogue and RDTs data catalogue (or other external systems data catalogues). The mapping describes how traffic regulations in RDT are translated into traffic rules in the system.
Sr19	Evaluate traffic regulation (AF10)	The use case is used by legal authorities of traffic regulations to control what traffic rules a traffic regulation result in after the extract within it is being transmitted and published in RDT. With this function the legal authorities may see whether the intention of the traffic regulation is being

		satisfied. The use case requires that the traffic regulation contains BTR-data. The use case is implemented as a web service which service providers may use in their products. The use case uses AF01 Extract the most significant traffic regulations.
Sr20	Initiate services (AF13)	This use case is used by the administrator to initiate import and extraction manually. The function is meant to be used if the schema job fails. The use case consists mainly of a common interface to control the systems services handling import and extraction.
Sr21	Validate data from local authorities (AF14)	This use case is used to mark all traffic regulations to a local authority (e.g. municipality) before they are sent to RDT. In addition it shows whether a local authority is approved.
Sr22	Deliver data to NVDB (AF12)	This use case is used to deliver the most significant occurrences (for the road user) which have emerged during the extraction process to NVDB. The use case is usually initiated by a schema determined export or by the administrator which by using a user interface initiates a delivery to NVDB.

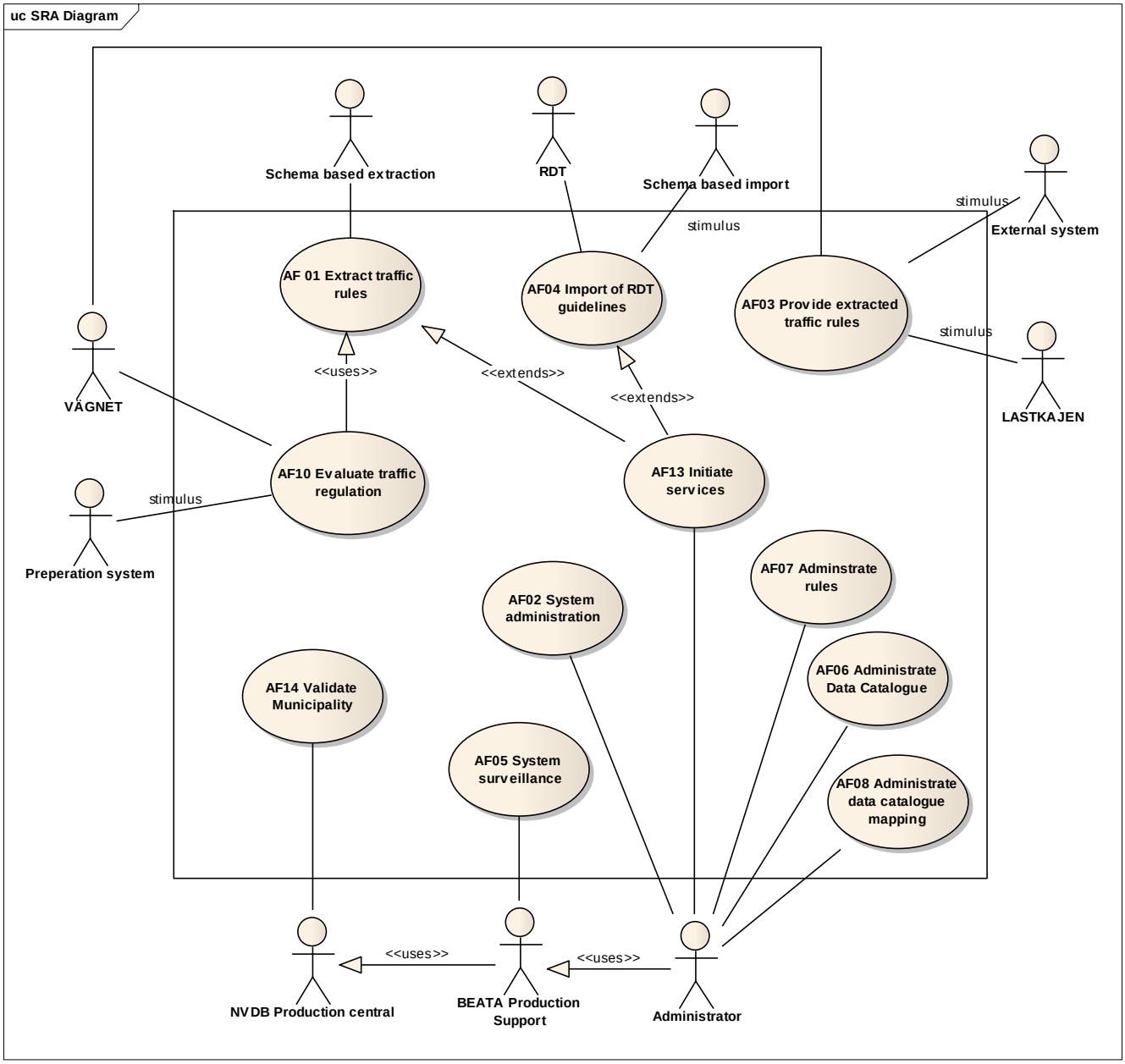

Figure 16 - SRA Use case diagram

Appendix B, organizational aspects questionnaire

A questionnaire concerning organizational aspects of ROSATTE was prepared and sent to partners, as part of the WP6. The results have been useful when working with project scope and component view. The answers from the questionnaire are listed below:

-According to you, what are the main barrier(s) to the deployment of such an infrastructure in your country? In other EU member states?

OBB and PTV

In Germany the federal structure might be a barrier for the implementation of a country-wide system. Top-down implementation of innovations is hindered by the federal structure of responsibilities. Cooperation with representatives of the Federal Ministry or the Highway Research Institute BASt will be necessary. In other member states the low technical standards in some countries might be the main barrier.

Flemish government

The main barrier will probably be the fragmentation of power between the different regions, provinces, cities and municipalities. In Belgium there are 3 regions, 10 provinces and 589 municipalities. Each organisational level has a certain degree of autonomy.

The answers to the questions in this questionnaire will be given from the viewpoint of the Flemish region. We can not speak for the other authorities involved.

NPRA

The main barrier(s) to the deployment of such an infrastructure in Norway is:

Our local level, i.e. the municipalities and in a few municipalities (or cities) the police

The Norwegian Public Roads Administration (NPRA) is not distributing data directly to any clients i.e. Tele Atlas and NAVTEQ, we are only distributing data through Norsk Eiendomsinformasjon AS (NE, Norwegian Land Information who is the main distributor of land information towards the professional market in Norway).

We do not have a national system for storing our resolutions regarding traffic regulation.

Except Finland, Sweden and Norway we believe no other EU member state has a national repository or database

The great number of municipalities or organisational levels in the different member states and their low level of collaboration.

-According to you, what would be the major barrier(s) with respect to national/regional/local organisation in your country?

OBB and PTV

The responsibility for traffic ruling is divided according to the road category in Germany in a very complex way. The Bavarian Ministry only has direct influence only on its subordinate authorities for highways, federal and state roads. District and community roads are not in the responsibility of the Bavarian Ministry and more or less independent.

Flemish government

As can be deduced from the answer to question 1, a good cooperation between the different authorities will be necessary. This will not be obvious however, since there are so many authorities involved.

A good cooperation will depend on the goodwill of the different actors that are involved.

NPRA

The local organisation with 429 municipalities is the major barrier in Norway.

-Taking into account the organisational levels and legal entities in your country, what are the actors (roles) needed to create, store and distribute safety attributes (legal, executive, operator, etc.)?

OBB and PTV

In Bavaria, the levels needed for achieving a full coverage is the Ministry level including its local offices (2 for highways, 20 for federal and state roads), the district level (70 districts and 25 “district-free” large cities) and the communities level (approx. 2000).

Flemish government

Public authority level 1: Vlaamse Overheid

Role: data provider, road manager, road maintenance

Public Authority level 2: Municipalities

Role: data provider, road manager, road maintenance

NPRA

The different decision-making authorities or actors in Norway are:

Norwegian Public Roads Administration (NPRA) who is also keeping up the Norwegian road network database and registers.

The Norwegian Mapping and Cadastral Authority.

The municipalities.

The police.

NE which is the sole distributor of land information in the professional market in Norway.

-What is the position of your country about making the safety attribute database available to third parties? Under which conditions would your country be willing to do so?

OBB and PTV

Bavaria wants to deliver high-quality data to commercial data-users. Therefore Bavaria has founded a public-private partnership for traffic information ("VIB"). The terms have to be negotiated with this company.

Flemish government

In first instance, the Vlaamse Overheid takes the position that the traffic sign database can be made available to third parties like the map makers Tele Atlas and NAVTEQ under the condition that they will integrate the traffic signs into their maps.

In the framework of this, a contract will probably be concluded with the third parties that wish to have access to the Flemish traffic sign database.

NPRA

Today Norway distributes their data through NE. NE are making i.e. the safety attribute database available to third parties through subscription.

Our policy is to make these data available to third parties at cost.

-How do you see the interaction between the ROSATTE infrastructure and the databases already existing in your country?

OBB and PTV

The existing databases can be extended with the ROSATTE infrastructure and content, both the maintenance database in use and the VIB database called INTREST.

Flemish government

The 2 central databases of traffic signs in Flanders (for the motorways, highways, main roads and regional roads on the one hand and the other roads on the other hand) that are currently being established will act as a data source for ROSATTE.

NPRA

We see the interaction between the ROSATTE infrastructure and the databases already existing by a data interchange file on standard file format, preferably through NE. But in the future perhaps we have to look for other ways to distribute data than through NE.

-Will it be feasible in your country to have the same infrastructure operating at the different organisational levels? Which barriers need to be overcome?

OBB and PTV

If simple and self-explaining online tools can be developed, all players will be able to use them. The georeferencing system and road database that will be used in Bavaria for ROSATTE covers all types of roads and can thus be used in all Bavaria.

Flemish government

Yes, this will be the case. The database of the traffic signs along the roads under the jurisdiction of the Agency of Roads and Traffic in Flanders was elaborated first. It will be specified in a public tender that will be published in April/May 2008 that the same system need to be used to make an inventory of the traffic signs along the other roads in Flanders.

NPRA

Yes it will be feasible in Norway to have the same infrastructure operating at the different organisational levels because we have a national database - NVDB. NVDB contains data on all public and private roads, of more then 50 metres length, which are allowed for automobile use.

But the quality of the municipal and private roads is poor so that is a barrier we need to be overcome. One way to overcome it is to get better reporting or feedback from the municipalities, but NPRA have no authority to instruct the municipalities to report to NPRA.

-What would be the main administrative benefits and draw-backs of such an infrastructure?

OBB and PTV

The benefits for the ordering authority should be intelligent storing of data, improved cooperation between the players and georeferenced information added to the textual information within the order. A draw-back that can hopefully be avoided might be additional work during the ordering procedure.

Flemish government

Administrative benefits: the standardisation/specification/uniformisation of the data exchange between public authorities and map makes will facilitate the data transfer process between the public authorities and the map makers. It will also facilitate the mutual data exchange between the different public authorities involved.

NPRA

The users will have great benefits from quicker access to updated data.

One draw-back of such an infrastructure is that we have to make modifications in our database to make adaptation to the EuroRoads format.

-Any IPR issue to be raised?

OBB and PTV

The possible use of AGORA-C within the ROSATTE system might inflict concerns about necessary licensing fees among partners.

Further IPR issues will have to be discussed with the VIB.

Flemish government

We do not think so.

NPRA

It's no IPR issue to be raised, NPRA have all intellectual property rights to all data and software.

It might be raised IPR issues if data from Tele Atlas and NAVTEQ are used (also when getting feedback or data corrections from them)?

-Should the ROSATTE project also consider the standardisation/certification of some processes and data flows (product specifications and formats)?

OBB and PTV

European-wide standardisation would surely improve the chances for international application of the systems. If commercial players get the chance to receive data from different regions in a standardised format the chances for successful cooperation in this field would rise.

Flemish government

It could be beneficial to consider the standardisation/certification of the dataflow from authorities to map providers (exchange format).

NAVTEQ

Yes, strongly recommended, based on the experiences in the GST IP, where the CERTECS SP developed a standardization/certification model and draft organization.

Main arguments:

It's a MUST for the car-industry. They only will include equipment, which has been standardized.

Standardization will help the various EU countries to define the requirements for the various applications to be used. Certification by an independent Third Party will confirm if an application/system meets the standard requirements.

NPRA

Yes to standardisation/certification on product specifications and formats.

And yes to standardised data feature catalogue (features with attributes).

And no to standardised procedures, but will request for best practice.

-Would you consider the creation of a "certification body" useful in order to ensure that the ROSATTE infrastructure, tools and mechanisms are run properly?

OBB and PTV

The establishment of a certification body might be a good way to assure certain quality standards. On the other hand such an institution might be a big effort. Only if many regions join the ROSATTE initiative, this investment will pay.

Flemish government

Yes.

NAVTEQ

Yes, strongly recommended. See Question 9.

NPRA

The most important is that the data fulfil demands on format, product specifications and quality, but we are sceptical to a centralized certification body.

-How would the ROSATTE infrastructure improve your position and capability towards data collection, exchange and information update?

OBB and PTV

For Bavaria the database and georeferencing infrastructure has been set-up already and is in good condition. Regarding the exchange infrastructure EuroRoadS has given good results already. Data collection can be organised from various sources. The concepts have been developed already. The main improvement for Bavaria will be an efficient tool for updating of the information especially together with the multitude of players.

Flemish government

The ROSATTE infrastructure should reduce the delay between an update in the traffic sign database of a public authority and the moment at which this update is available in a car. Reducing this delay will be beneficial for traffic safety and traffic liveability.

NAVTEQ

When ROSATTE infrastructure is in place it will help the data collection in a way that it is possible to negotiate with the data provider the structure and the formats in which the data should be delivered. By doing this the data collection process can be structured / simplified, which in general will save money.

The ROSATTE platform will also bring a major added value to the map provider by shortening the time between a change at the public authority side and a change at the private map provider side and by extension at the end-user too.

NPRA

We will get increased focus on data and data quality and better comprehension for increased resources to this kind of work.

We might get feed back on data quality and corrections on the data from the map providers and end-users.