

Ministry of Economic Affairs and Communications
Department of State Information Systems

Instructions for the Semantic Description of Databases and Operations Performed by Databases

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This document is open for proposals from public, private and third sector organisations as well as from other interested parties. Please send your proposals to koosvoime@riso.ee.

The instructions are reviewed and, if needed, updated annually. In new versions proposals made during the previous period will be taken into account. The “Instructions for the Semantic Description of Databases and Operations Performed by Databases” and the “Methodology for the Semantic Interoperability of Databases and Operations Performed by Databases” can be downloaded at <http://www.riso.ee/en/information-policy/interoperability>.

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1 Introduction

Background

These instructions form a part of the “Estonian IT Interoperability Framework”¹ and draw from the “Methodology for the Semantic Interoperability of Databases and Operations Performed by Databases” (v1.0, 2007-01-12).

What are operations performed by databases?

Operations performed by databases are functions in an electronic environment providing added value to the user. There are different types of operations: single information services, long-term process-based procedural operations, e-elections, etc. They can be provided by state agencies, companies or individuals through their own information system. Operations can be both oriented to people or operating between information systems. Within the scope of Version 1 of these instructions, an operation is a web service of the X-Road data exchange layer or other similar environment.

What is semantic interoperability?

Semantic interoperability refers to the ability of organisations to understand the exchanged data in a similar way. Organisational interoperability facilitates the interoperable execution of administrative operations and procedures.

The semantic interoperability of information systems is the ability of software systems to make adequate use of data received from other software systems.

Ways to advance semantic interoperability

Semantic interoperability allows for better implementation of organisational as well as technical interoperability. The main way to advance semantic interoperability between organisations or information systems is to describe semantically the data exchanged and operations performed, i.e. to provide the terms and definitions of these data and operations by opening their meaning. Another important aspect is to name the data structures and operations in a way that would reveal their nature or function as explicitly as possible.

Motivation

1. The quality of data will improve, data from different sources can be integrated, there will be less errors and inaccuracies upon using data and making decisions (related to misinterpretation of data as well as discrepancies arising from duplication of data);
2. Less investment in the production (acquisition) of data will be needed since it will be easier to reuse the data;
3. Parties will have to spend less time on integrating the information systems of different organisations;
4. Sustainability of the application or information system will increase and it will be easier to make further developments.

Purpose of instructions

¹ See <http://www.riso.ee/en/information-policy/interoperability>.

The purpose of these instructions is to provide guidance in compiling the semantic description of databases and operations performed by databases. To this end, rules and examples of naming and defining data structures and operations are outlined.

Target groups

The target groups of these instructions primarily include information system developers (e.g. architects, analysts, designers, programmers, record-keepers, project managers) but also contracting entities, information system owners, auditors, etc.

Prior knowledge necessary for the implementation of instructions

The practical implementation of these instructions calls for a variety of prior knowledge, including XML, XSD, WSDL, SA-WSDL, RDF and OWL from the W3C² recommendations, and UML2 and XMI from OMG's³ standards.

The instructions include examples of the application of the above-mentioned recommendations in the semantic description of operations. However, in-depth knowledge should be obtained through self-learning or in-service training for more effective implementation.

In brief

These instructions answer the following questions:

- WHAT to describe semantically; e.g. an operation of a web service, a column in a database table;
- HOW to describe: which name spaces and labels, naming and defining options to use;
- WHERE to publish semantic descriptions to make them easily found and available.

Answers to more general questions can be found in the "Methodology for the Semantic Interoperability of Databases and Operations Performed by Databases".

2 What to describe and where to publish the descriptions?

2.1 Semantic interoperability architecture

Semantic interoperability – the ability to understand the exchanged data in a similar way and make adequate use of it – requires a system for the semantic description of data in databases and the input and output data used in performing necessary operations. The architecture for such a system proceeds from the following principles:

1. Principle of reuse – one data element or operation should be described only once and in any other use the initial description should be referred to;
2. Simple and standard⁴ compilation, management and search of the descriptions of data elements and operations.

² See <http://www.w3.org/TR/>.

³ See http://www.omg.org/technology/documents/modeling_spec_catalog.htm.

⁴ Compliance with W3C standards and recommendations ensures semantic interoperability at international level, including with regard to relevant EU programmes. See "Interoperability between national administrations for pan-European eGovernment services" (IP/06/216; 2006-02-23).

The semantic interoperability architecture (see Figure 1 – Semantic interoperability architecture below) consists of the following components:

1. **Domain glossary** – central description of the semantics of data elements and operations. The description is divided into domains, e.g. “land survey”. The language used in the semantic description is OWL⁵. The description is stored in the administration system for the state information system (RIHA). For further information see Chapter 2.2 “Domain glossary”
2. ” p. 5;
3. **Semantic description of databases and operations** – includes the description of every single database or operation and its components and, if available, a reference to the respective entry in the domain glossary. The languages used for description are WSDL, SA-WSDL, etc. The description is stored in the administration system for the state information system (RIHA). Further information:
 - Description of operations – Chapter 2.3 “Semantic description of operations”
 - ” p. 8;
 - Description of databases – Chapter 2.4 “Semantic description of databases”
 - ” p. 10.

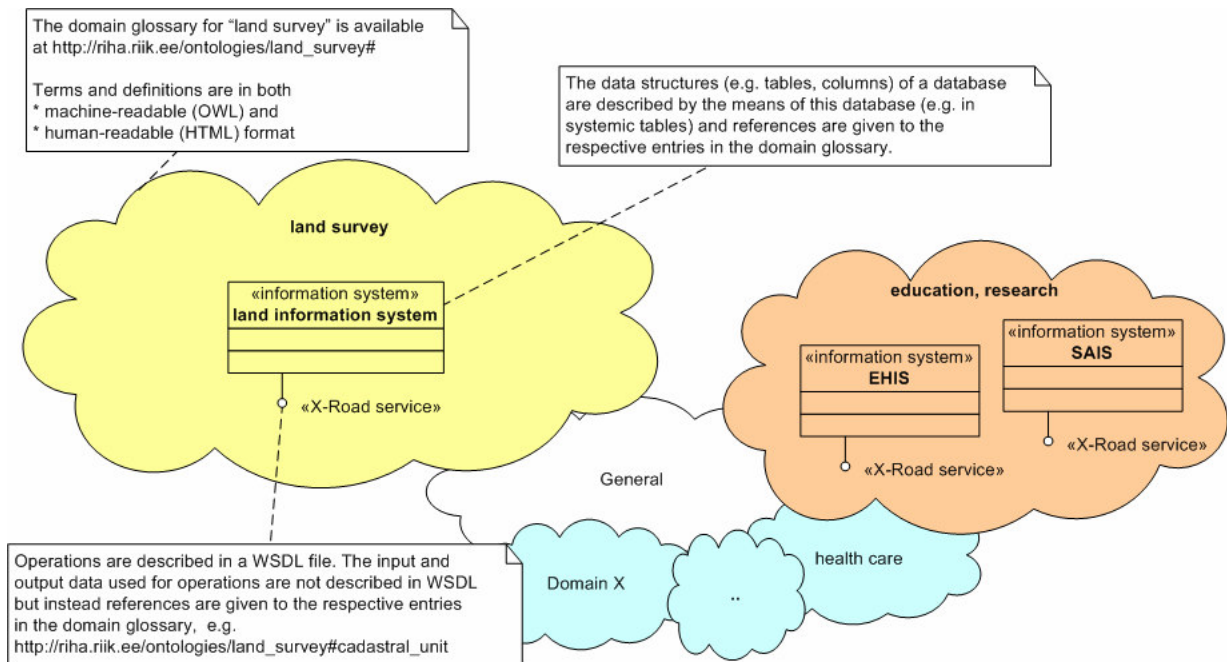


Figure 1. Semantic interoperability architecture

1.1 ⁵ For the relation with human-readable form see Chapter 2.6 “Management and distribution of semantic descriptions”

” p. 13.

2.2 Domain glossary

For the purposes of these instructions, a domain refers to a field of activity within the public sector that may, but need not necessarily, coincide with ministries or executive agencies.

The glossary and description of a domain aims at explaining the terms and relationships between them as well as procedures (business processes) to information system developers or experts of other domains not familiar with that particular domain.

The semantic description of a domain should proceed from the following rules:

[V-R1] The name of a domain should be the one used in either

1. the Estonian Universal Thesaurus⁶, or
2. as a topic in the national information portal eesti.ee.

Examples of domains: "land survey", "health care", "education, science".

[V-R2] The semantic description of a domain should be presented in a way that is understandable to both information system developers and domain experts (the "business side").

[V-R3] The domain description should be compiled and managed by using the Web Ontology Language (OWL).

[V-R4] The domain description should be made freely available in RIHA. The description should be both in human-readable (HTML and UML schemas) and machine-readable (OWL and UML schemas in XMI) format. Artiklit pole vaja description elements should be referable.

[V-R5] The domain description should contain:

1. Domain glossary, i.e. names and definitions of domain terms in accordance with Chapter 3.1 "Using terms in names and rules for naming

2.3 " and Chapter 3.2 "Rules and recommendations for definitions

2. ";
3. Description of relationships between terms (incl. sub-class relationships).

Furthermore, it is recommended that the domain description contains:

4. Description of the states (statuses) of object classes denoted by terms;
5. Description of processes (administrative operations and procedures).

2.3.1 Example: OWL

The following example includes an outline of the semantic description of the domain "land survey". At least one of each significant OWL construct is given as part of the example. To better

⁶ Available on the homepage of the National Library of Estonia at <http://eum.nlib.ee/>.

understand and make real use of the example, explanations in the form `<!--explanation-->` are given.

```
<?xml version="1.0"?>
<!DOCTYPE rdf:RDF [<!ENTITY land "http://riha.government.ee/ontologies/land_survey#">]>
<rdf:RDF
  xmlns="&land;"
  xmlns:xsd="http://www.w3.org/2001/XMLSchema#"
  xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
  xmlns:rdfs="http://www.w3.org/2000/01/rdf-schema#"
  xmlns:owl="http://www.w3.org/2002/07/owl#"
  xmlns:yld="http://riha.government.ee/ontologies/general#"
  xml:base="&land;">
  <!--description of field ontology-->
  <owl:Ontology rdf:about="">
    <rdfs:label>ontology of the domain "land survey"</rdfs:label>
    <rdfs:comment>TBD</rdfs:comment>
    <owl:versionInfo>Version 0.2 2007-01-07 ml</owl:versionInfo>
    <owl:priorVersion rdf:resource="riha.government.ee/ontologies/archive/land_survey_v0.1"/>
    <owl:imports rdf:resource="http://riha.government.ee/ontologies/general"/>
  </owl:Ontology>
  <!--description of field terms in classes-->
  <owl:Class rdf:ID="cadastral unit">
    <rdfs:label>cadastral unit</rdfs:label>
    <rdfs:comment>a plot of land registered in the cadastre as an independent unit</rdfs:comment>
  </owl:Class>
  <owl:Class rdf:ID="cadastral code">
    <rdfs:label>cadastral code</rdfs:label>
    <rdfs:comment>a numeric code which is used to identify cadastral units and to relate data to
other registers. [Land Cadastre Act §2(6)]. E.g. 17008:003:0018. The cadastral code does not
carry a meaning.
    </rdfs:comment>
  </owl:Class>
  <!--establishing relationships between field terms-->
  <owl:ObjectProperty rdf:ID="identified">
    <rdfs:domain rdf:resource="#cadastral unit">
    <rdfs:range rdf:resource="#cadastral code">
  </owl:ObjectProperty>
</rdf:RDF>
```

The following is a schema illustrating the example in OWL.

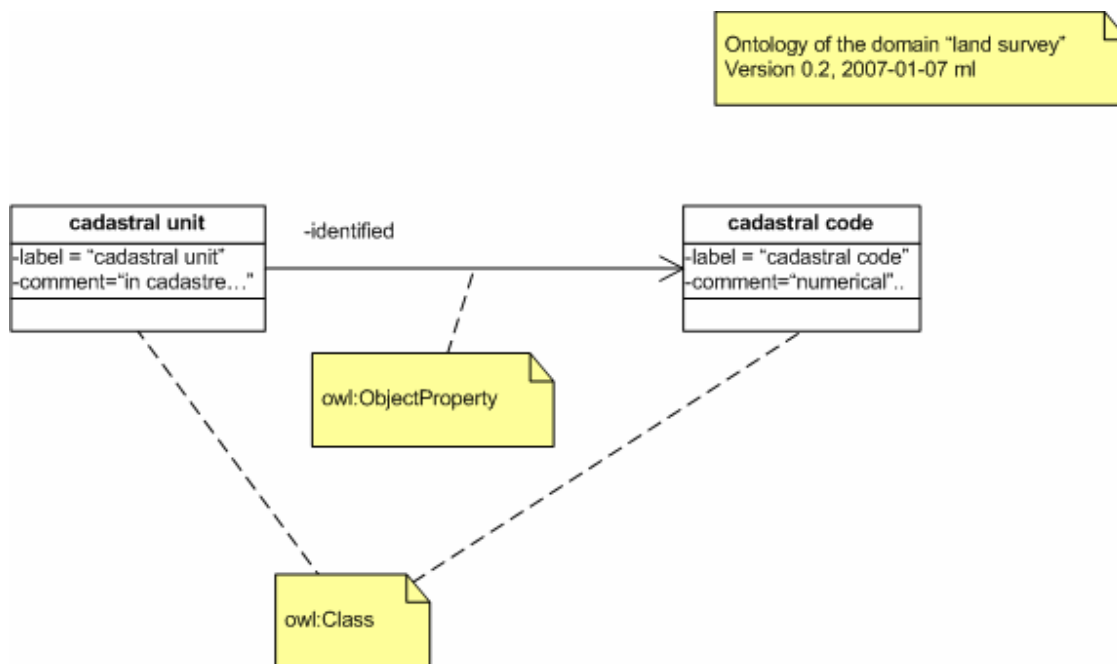


Figure 2. Schema illustrating the example of a domain

2.4 Semantic description of operations

Operations refer to the transmission or receipt of information necessary for executing functions, including performing operations provided as web services. Web services may also use the X-Road infrastructure.

The objectives of the semantic description of operations include:

- Reuse of operations;
- Improved findability of available operations;
- Easy (semi-automatic) integration of operations with other information systems and/or complex operations.

The semantic description of an operation⁷ should proceed from the following rules:

[T-R1] The semantic description of an operation should be two-level:

1. A level understandable to information system developers and domain experts (the "business side");
2. A level understandable to the end end user.

[T-R2] The semantic description of an operation should be made freely available in RIHA. The description should be both in human-readable (HTML) and machine-readable (WSDL together with SA-WSDL) format.

⁷ Here, the definition of operations includes services that can be provided also without the means of IT.

[T-R3] The description file for an operation should contain:

1. Reference (URL) to the description of the organisation and contact persons providing the operation to RIHA.

[AT-R4] The semantic description of an operation should contain:

1. Name of the operation in accordance with Chapter 3.1 "Using terms in names and rules for naming
2. ", using the label `<xtee:title>`.
3. Definition of the operation for the end user in accordance with Chapter 3.2 "Rules and recommendations for definitions
4. ", using the label `<xtee:notes>`.
5. Definition of the operation for the developer in accordance with Chapter 3.2 "Rules and recommendations for definitions
6. In addition, the description file should include
 - Description of the prerequisites for and restrictions on the operation;
E.g. the status of the cadastral unit should be "in survey"
E.g. the surveyor should have a valid licence to conduct a cadastral survey
 - Description of the relationship between the input and output attributes;
E.g. the query service provides the valid restrictions on the cadastral unit
Explanation to the example: input – cadastral unit;
output – restrictions; relationship between the input and output – valid, i.e. not historical, planned or any such restrictions
 - Description of the effects of using the operation;
E.g. cadastral unit's status "checked"

The label `<xtee:technotes>` should be used.

7. URI reference to the description of the input and output attributes in the domain glossary;
E.g. `sawsdl:modelReference="http://riha.government.ee/ontologies/land_survey#cadastral_code"`
8. Description of the classification of attribute values or reference to such description.

The labels `<xtee:title>`, `<xtee:notes>` and `<xtee:technotes>` should be under the label `<documentation>`.

2.4.1 Example

The example includes an outline of the semantic description of the operations provided by an information system of the domain "land survey", namely the land information system (LIS) administered by the Estonian Land Board. At least one of each significant WSDL and SAWSDL construct is given as part of the example. To better understand and make real use of the example, explanations in the form `<!--explanation-->` are given.

```
<wsdl:description
```


The objectives of the semantic description of databases include:

- Increasing the sustainability of databases (facilitating further developments for the present or new developers);
- Making the metadata of databases available to other parties.

The semantic description of a database should proceed from the following rules:

[AK-R1] The semantic description of a database should be presented in a way that is understandable to both information system developers as well as domain experts (the “business side”).

[AK-R2] The semantic description of a database should be made freely available in RIHA. The description should be both in human-readable (HTML and UML schemas) and machine-readable (XSD) format. The description elements should be referable.

[AK-R3] The semantic description of a database should contain:

1. Name of the organisation of the database owner;
2. Data of the contact person responsible for the database.

[AK-R4] The semantic description of a data element (table, column; class, attribute, etc.) should contain:

either (generally)

1. URI reference to the description of the data element in the domain glossary

E.g. `sawsdl:modelReference=`

`http://riha.government.ee/ontologies/land_survey#cadastral_code`

or (if the data element carries a meaning only within the given database):

1. Name of the data element `<xtee:title>` in accordance with Chapter 3.1 “Using terms in names and rules for naming
2. Definition of the data element `<xtee:technotes>` for the developer in accordance with Chapter 3.2 “Rules and recommendations for definitions
3. Description of the classification of data element values or reference to such description.

2.5.1 Example

The example includes an outline of the semantic description of a database in an information system of the domain “land survey”, namely the land information system (LIS) administered by the Estonian Land Board. SQL DDL, the language for administering relational databases, has been used in the example.

```
CREATE TABLE cadastral unit(  
    cadastral unit      NUMBER(15,0)      NOT NULL,  
    ...  
);  
  
COMMENT ON TABLE cadastral unit IS 'sawsdl:modelReference="  
http://riha.government.ee/ontologies/land_survey#cadastral_unit";
```

```
COMMENT ON COLUMN cadastral_unit.cadastral code IS 'sawsdl:modelReference="
http://riha.government.ee/ontologies/land_survey#cadastral code"';
```

2.6 Management and distribution of semantic descriptions

The following table presents a summary of answers to questions where and in what format (language) semantic descriptions should be compiled, managed and distributed to interested parties.

	Domain	Operation	Database
Language for compilation and management of description	* OWL (required) * UML (optional)	* WSDL and SA-WSDL (required)	* SQL DDL or UML or ERD/IDEF etc. ⁸ (required)
Elements to be described	* terms, relationships (required) * operation processes (optional)	* input and output attributes (required as references to domain terms) * operations (required at developer and end user level)	* input and output attributes (required as references to domain terms) * classifications of data element values (required)
Site for publication of description	* RIHA (required) http://riha.riik.ee/ontoloogiad/ * ministry/agency homepage (optional)	* RIHA (required) http://riha.riik.ee/andmeteenused/ * ministry/agency homepage (optional)	* RIHA (required) http://riha.riik.ee/andmemudelid/ * ministry/agency homepage (optional)
Language for publication of human-readable description	* HTML (required). RIHA administrator transforms the given OWL to HTML * UML (optional)	* HTML (required). RIHA administrator transforms the given WSDL to HTML	* HTML (required). RIHA administrator transforms the given XSD to HTML

⁸ Taking into account the needs and opportunities of the database maintainer, a description language that can be transformed to XSD is required.

Language for publication of machine-readable description	* OWL (required) * XMI (optional)	* WSDL and SA-WSDL (required)	* XSD (required). Database owner transforms the database description to XSD
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3 Naming and defining

The most important rule concerning naming and defining data structures and operations is to proceed from the standpoint of database developers or integrators of another database and to provide anticipatory answers to questions they might have.

For naming and defining data structures and operations, various sources might be of help, such as:

- Legislation:
 - Laws and regulations concerning the particular subject field;
 - Statutes for the maintenance of the particular database;
- Internal documents:
 - Operations procedure;
 - List of documents;
 - Rules of procedure;
- Database development documentation, including:
 - Data models (ERD, UML class schemas, etc.), data glossaries;
- Collected "folklore", i.e. interviewing present and previous developers;
- Documentation of database audits;
- etc.

3.1 Using terms in names and rules for naming

Semantic interoperability can be advanced by giving a well-chosen name to the data structure or operation. In other words, well chosen names increase comprehension as they form half of the definition.

Names consist of terms that are clearly distinguishable from each other. The following lists different types of terms. Knowing and understanding types of terms contributes to choosing better names.

Types of terms include:

- Object class term – designates a concept used in the particular subject field;
E.g. building to be demolished, surname of the unemployed, administrative proceeding file; these include object class terms "building", "name" and "file"
- Property term – designates a property common to all objects belonging to a particular object class;
E.g. water craft, aircraft
E.g. stone building, wooden building, clay building
 - Upon the use of property terms, the list of properties should cover the whole extent of the concept (everything under the object class), i.e. there should not be any objects that would not fit under any property term;
 - List of object terms must include discrete terms, i.e. the terms should not cover each other's properties. This calls for proper categorisation.
E.g. the list "clay building, sauna, two-storied building" is incorrect

- Representation term – used for categorising the qualitative properties of name-giving that specify the name. Such terms in names often include the words “name”, “amount”, “measure”, “number”, “sum”, “text”;
E.g. number of children in the family; amount of social tax
- Qualifier term – used in case there is a need to somehow confine the conceptual extent of using the above-listed term types;
E.g. volume of records in records management year. This includes:
 - Records management year – a qualifier term;
 - Record – an object class term;
 - Volume – a representation term.

The naming and coding of data structures and operations should proceed from the following rules:

[N-R1] The terms used in names must be separated by a space.
E.g. restrictions on the cadastral unit

[N-R2] If the coding includes compound words, initial capital letters must *not* be used⁹.
E.g. AirCraft, airCraft – incorrect; aircraft – correct.

[N-R3] If the terms used in coding include extended characters, these must be replaced by ASCII or ISO/IEC 646¹⁰ characters.
E.g. déjà vu – correct; déjà vu – incorrect

[N-R4] The terms used in coding must be separated by an underline (_).
E.g. cadastral_unit_restrictions.

3.2 Rules and recommendations for definitions

The definition of data structures and operations should proceed from the following rules:

[M-R1] Terms must be unique and definitions for concepts must not be equivalent within one domain glossary.

[M-R2] Definitions must render the extension of the concept and the meaning of the term, disclosing its substantial aspects:

- List the properties of the defined object;
- Define the subsystems, i.e. listing the components of the defined object;
- Name the generic system and delimiting characteristics (differences).
E.g. Sidewalk is a pedestrian pathway

[M-R3] Definitions must be adequate, i.e. the concept defined and the term(s) used for that must be equal in terms of extent.

⁹ Do not mix up compound words and terms consisting of several words (see [N-R4]).

¹⁰ ISO/IEC 646:1991 Information technology – ISO 7-bit coded character set for information interchange.

[M-R4] Definitions must not be circular.

E.g. Sidewalk is a part of road defined as a sidewalk

[M-R5] Definitions must be clear and precise, excluding metaphors and allegories.

E.g. Sidewalk is a pathway for the better half of the mankind

[M-R6] Definitions must be stated in the singular.

[M-R7] Definitions must avoid negation and state what the object is, not only what it is not.

E.g. It is not recommended to use a definition like "sidewalk is a pathway not meant for cars"

[M-R8] Definitions must be stated as a descriptive phrase or sentence.

[M-R9] Definitions must contain only commonly understood abbreviations (i.e. understood also outside the given domain).

E.g. It is appropriate to use "etc." instead of "etcetera"

E.g. It is *not* appropriate to use "CRN" instead of "cadastral code"

[M-R10] Definitions should not define the terms included but instead give references to such terms.

[M-R11] Definitions must be located in one place, namely in the domain glossary. Description of a data structure or operation should include references to the respective entry in the domain glossary.

[M-R12] Definitions must include at least one example and it is recommended to use also one counterexample.

Definitions should comply with the following recommendations:

[M-S1] Definitions should be easily understandable in terms of language. Foreign or native terms should be used in line with generally accepted practices.

[M-S2] Definitions should be sufficiently detailed, i.e. they should not specify different concepts with different nuances identically.

[M-S3] Definitions should be sufficiently precise. Sufficient precision is determined by the requirements of the domain experts using the operation.

[M-S4] Definitions should disclose the meaning of the term, i.e. the term should be descriptive.

[M-R5] Definitions should disclose default presumptions – those that may seem self-evident to the creator of a data structure or operation but need not be known to others (e.g. interface creators).

[M-R6] Definitions should list the restrictions.

[M-R7] Definitions should cover special cases.

Definitions and abbreviations

Term, abbreviation	Explanation
Business side	See “domain expert”.
Coding	For the purposes of these instructions, a way of description used for providing machine-readable references to terms. See also “machine-readable description” and compare with “name”.
Concept	A unit of knowledge created by a unique combination of characteristics. [EVS-ISO 1087-1:2002 and EVS-ISO 5127 1.1.1.01]
Database1	Structured collection of data. A collection of data organised according to a conceptual structure describing the characteristics of these data and the relationships among their corresponding entities, supporting one or more application areas. [EVS-ISO 2382 01.08.05] A data structure for accepting, storing and providing on demand data for multiple independent users. [EVS-ISO 2382 04.07.15]
Database2	A database is a structured body of data maintained by the state, a local government or person in public or private law by means of automatic data processing or manual operation of organised forms which allows easy access to or mechanical processing of data. [Databases Act, Section 2(1)]
Data element	The smallest unit of a data structure, e.g. column of a table; a dataset separated by XML tags. Also called “data unit”.
Data structure	A physical or logical relationship among units of data and the data themselves. [EVS-ISO 2382 15.03.01]
Definition	A representation of a concept by a descriptive statement which serves to differentiate it from related concepts.
Description	See “semantic description”.
Description file	See “description file for web service”.

Description file for web service	A file compiled in accordance with the W3C recommendation for WSDL (Web Services Description Language) to describe web services. See http://www.w3.org/TR/2006/CR-wsdl20-primer-20060327 . See also tutorials at http://www.w3schools.com/wsdl/default.asp .
Description of the effects of using the service	A list of changes made in a database as a result of providing a service. E.g. addition of a new object to the class "cadastral unit"; change/deletion of a class object. As at January 2007, there was no W3C recommendation regarding the description of the effects of using the service, including the formal language. One possibility is to use OCL – OMG's Object Constraint Language (see http://www.omg.org/technology/documents/modeling_spec_catalog.htm#OCL) .
Domain	A field of special knowledge. [EVS-ISO 1087-1:2002 and EVS-ISO 5127 1.1.1.07]
Domain expert	A specialist in a field of special knowledge.
End user	A person/role using an operation and usually also the semantic description of this operation.
Glossary	An alphabetical or systematic list of all words in a language or words of certain category, including explanations in that language or translations into one or more languages. [EVS-ISO 5127 2.2.1.16]
Human-readable description	A description in a form readable to both developers and domain experts, disclosing the meaning of data (semantics).
Machine-readable description	A description in a form readable to software systems and conveying the data without changing their meaning (semantics).
Name	A term used for referring to a domain concept (human-readable). See also "human-readable description" and compare with "coding".
Object class	A set of objects classified or grouped on the basis of a common property.
Object status	A status experienced during the object's life cycle.
OMG (Object Management Group)	A consortium which, among other things, develops the UML standard. See http://www.omg.org/ .
Ontology	For the purposes of these instructions, a way of describing a domain both in machine- and human-readable form. Includes a glossary of concepts (terms describing and presenting concepts) and relations (e.g. relation of succession) between them used in the particular domain.
Ontology description language	A language that can express the semantics of terms.

Operation	<p>A function in an electronic environment providing added value to the user. There are different types of operations: single information services, long-term process-based procedural operations, e-elections, etc. They can be provided by state agencies, companies or individuals through their own information system. Operations can be both oriented to people or operating between information systems. <u>Within the scope of Version 1 of these instructions, an operation is a web service of the X-Road data exchange layer or other similar environment.</u></p> <p>See also "description file for operation" and "web service".</p>
OWL (Web Ontology Language)	<p>A markup language for presenting ontologies in the WWW. See http://www.w3.org/TR/owl-features/. More powerful while also more complicated than RDFS.</p>
Prerequisites for and restrictions on service	<p>A list of preconditions to be met before the use of service; also a list of restrictions on the use or user of the service.</p>
Process	<p>A certain operation or sequence of operations of an organisation necessary for fulfilling a task or providing a service. Also called "operational process", "business process".</p>
RDFS (Resource Description Framework-Schema)	<p>A markup language for presenting ontologies in the WWW. See also "OWL" and http://www.w3.org/TR/rdf-schema/.</p>
Recommendation	<p>A requirement that is not mandatory.</p>
RIHA	<p>The administration system for the state information system.</p>
Rule	<p>A mandatory requirement to be followed.</p>
SA-WSDL (Semantic Annotations for WSDL and XML Schema)	<p>A W3C recommendation for the semantic description of web services and data structures. http://www.w3.org/TR/sawsdl/ had the status of W3C Candidate Recommendation as at 25 February 2007.</p>
Semantic description	<p>A description of an operation, database, domain or other object that discloses the meaning of the object.</p>
Semantic interoperability	<p>Refers to the ability of organisations to understand the exchanged data in a similar way. Organisational interoperability facilitates the interoperable execution of administrative operations and procedures. The semantic interoperability of information systems is the ability of software systems to make adequate use of data received from other software systems.</p>
Term	<p>A verbal designation of a general concept in a specific subject field. [EVS-ISO 1087-1:2002 and EVS-ISO 5127 1.1.2.12]</p>
Transformation to HTML	<p>For the purposes of these instructions, a transfer of dataset in a machine-readable language to a human-readable form by means of IT (e.g. XSLT). E.g. from OWL or WSDL to HTML.</p>

UML (Unified Modelling Language)	A language for modelling and visual presentation of software systems and business domains. See also http://www.uml.org/ .
W3C (World Wide Web Consortium)	The main organisation developing web standards. See http://www.w3.org/ . W3C standards include XML, RDF and OWL.
Web service	A software system in a computer network allowing for interoperability between computers. [W3C] See also tutorials at http://www.w3schools.com/wsd/default.asp .
WSDL (Web Services Description Language)	An XML-based language for describing web services. WSDL 2.0 (http://www.w3.org/TR/wsd20-primer/) had the status of W3C Candidate Recommendation as at January 2007. See also http://www.w3schools.com/wsd/default.asp .
XMI (XML Metadata Interchange)	A standard allowing, among other things, exchange of UML models between parties in a standard way. XMI is one of OMG's standards. See also http://www.omg.org/technology/documents/formal/xmi.htm .