



INSPIRE Infrastructure for Spatial Information in Europe

D2.8.III.1 Data Specification on *Statistical Units* – Technical Guidelines

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Foreword

How to read the document?

This document describes the "*INSPIRE data specification on Statistical Units – Technical Guidelines*" version 3.0 as developed by the Thematic Working Group (TWG) SU-PD using both natural and a conceptual schema language.

The data specification is based on a common template^[1] used for all data specifications, which has been harmonised using the experience from the development of the Annex I, II and III data specifications.

This document provides guidelines for the implementation of the provisions laid down in the draft Implementing Rule for spatial data sets and services of the INSPIRE Directive. It also includes additional requirements and recommendations that, although not included in the Implementing Rule, are relevant to guarantee or to increase data interoperability.

Two executive summaries provide a quick overview of the INSPIRE data specification process in general, and the content of the data specification on *Statistical Units* in particular. We highly recommend that managers, decision makers, and all those new to the INSPIRE process and/or information modelling should read these executive summaries first.

The UML diagrams (in Chapter 5) offer a rapid way to see the main elements of the specifications and their relationships. The definition of the spatial object types, attributes, and relationships are included in the Feature Catalogue (also in Chapter 5). People having thematic expertise but not familiar with UML can fully understand the content of the data model focusing on the Feature Catalogue. Users might also find the Feature Catalogue especially useful to check if it contains the data necessary for the applications that they run. The technical details are expected to be of prime interest to those organisations that are responsible for implementing INSPIRE within the field of *Statistical Units*, but also to other stakeholders and users of the spatial data infrastructure.

The technical provisions and the underlying concepts are often illustrated by examples. Smaller examples are within the text of the specification, while longer explanatory examples and descriptions of selected use cases are attached in the annexes.

In order to distinguish the INSPIRE spatial data themes from the spatial object types, the INSPIRE spatial data themes are written in *italics*.

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Interoperability of Spatial Data Sets and Services – General Executive Summary

The challenges regarding the lack of availability, quality, organisation, accessibility, and sharing of spatial information are common to a large number of policies and activities and are experienced across the various levels of public authority in Europe. In order to solve these problems it is necessary to take measures of coordination between the users and providers of spatial information. The Directive 2007/2/EC of the European Parliament and of the Council adopted on 14 March 2007 aims at establishing an Infrastructure for Spatial Information in the European Community (INSPIRE) for environmental policies, or policies and activities that have an impact on the environment.

INSPIRE is based on the infrastructures for spatial information that are created and maintained by the Member States. To support the establishment of a European infrastructure, Implementing Rules addressing the following components of the infrastructure have been specified: metadata, interoperability of spatial data sets (as described in Annexes I, II, III of the Directive) and spatial data services, network services, data and service sharing, and monitoring and reporting procedures.

INSPIRE does not require collection of new data. However, after the period specified in the Directive^[2] Member States have to make their data available according to the Implementing Rules.

Interoperability in INSPIRE means the possibility to combine spatial data and services from different sources across the European Community in a consistent way without involving specific efforts of humans or machines. It is important to note that "interoperability" is understood as providing access to spatial data sets through network services, typically via Internet. Interoperability may be achieved by either changing (harmonising) and storing existing data sets or transforming them via services for publication in the INSPIRE infrastructure. It is expected that users will spend less time and efforts on understanding and integrating data when they build their applications based on data delivered in accordance with INSPIRE.

In order to benefit from the endeavours of international standardisation bodies and organisations established under international law their standards and technical means have been utilised and referenced, whenever possible.

To facilitate the implementation of INSPIRE, it is important that all stakeholders have the opportunity to participate in specification and development. For this reason, the Commission has put in place a consensus building process involving data users, and providers together with representatives of industry, research and government. These stakeholders, organised through Spatial Data Interest Communities (SDIC) and Legally Mandated Organisations (LMO)^[3], have provided reference materials, participated in the user requirement and technical^[4] surveys, proposed experts for the Data Specification Drafting Team^[5], the Thematic Working Groups^[6] and other ad-hoc cross-thematic technical groups and participated in the public stakeholder consultations on draft versions of the data specifications. These consultations covered expert reviews as well as feasibility and fitness-for-purpose testing of the data specifications^[7].

This open and participatory approach was successfully used during the development of the data specifications on Annex I, II and III data themes as well as during the preparation of the

Implementing Rule on Interoperability of Spatial Data Sets and Services^[8] for Annex I spatial data themes and of its amendment regarding the themes of Annex II and III.

The development framework elaborated by the Data Specification Drafting Team aims at keeping the data specifications of the different themes coherent. It summarises the methodology to be used for the development of the data specifications, providing a coherent set of requirements and recommendations to achieve interoperability. The pillars of the framework are the following technical documents^[9]:

- The *Definition of Annex Themes and Scope* describes in greater detail the spatial data themes defined in the Directive, and thus provides a sound starting point for the thematic aspects of the data specification development.
- The *Generic Conceptual Model* defines the elements necessary for interoperability and data harmonisation including cross-theme issues. It specifies requirements and recommendations with regard to data specification elements of common use, like the spatial and temporal schema, unique identifier management, object referencing, some common code lists, etc. Those requirements of the Generic Conceptual Model that are directly implementable are included in the Implementing Rule on Interoperability of Spatial Data Sets and Services.
- The *Methodology for the Development of Data Specifications* defines a repeatable methodology. It describes how to arrive from user requirements to a data specification through a number of steps including use-case development, initial specification development and analysis of analogies and gaps for further specification refinement.
- The *Guidelines for the Encoding of Spatial Data* defines how geographic information can be encoded to enable transfer processes between the systems of the data providers in the Member States. Even though it does not specify a mandatory encoding rule it sets GML (ISO 19136) as the default encoding for INSPIRE.
- The *Guidelines for the use of Observations & Measurements and Sensor Web Enablement-related standards in INSPIRE Annex II and III data specification development* provides guidelines on how the "Observations and Measurements" standard (ISO 19156) is to be used within INSPIRE.
- The *Common data models* are a set of documents that specify data models that are referenced by a number of different data specifications. These documents include generic data models for networks, coverages and activity complexes.

The structure of the data specifications is based on the "ISO 19131 Geographic information - Data product specifications" standard. They include the technical documentation of the application schema, the spatial object types with their properties, and other specifics of the spatial data themes using natural language as well as a formal conceptual schema language^[10].

A consolidated model repository, feature concept dictionary, and glossary are being maintained to support the consistent specification development and potential further reuse of specification elements. The consolidated model consists of the harmonised models of the relevant standards from the ISO 19100 series, the INSPIRE Generic Conceptual Model, and the application schemas^[11] developed for each spatial data theme. The multilingual INSPIRE Feature Concept Dictionary contains the definition and description of the INSPIRE themes together with the definition of the spatial object types present in the specification. The INSPIRE Glossary defines all the terms (beyond the spatial object types) necessary for understanding the INSPIRE documentation including the terminology of other components (metadata, network services, data sharing, and monitoring).

By listing a number of requirements and making the necessary recommendations, the data specifications enable full system interoperability across the Member States, within the scope of the application areas targeted by the Directive. The data specifications (in their version 3.0) are published as technical guidelines and provide the basis for the content of the Implementing Rule on Interoperability of Spatial Data Sets and Services^[12]. The content of the Implementing Rule is extracted from the data specifications, considering short- and medium-term feasibility as well as cost-benefit considerations. The requirements included in the Implementing Rule are legally binding for the Member States according to the timeline specified in the INSPIRE Directive.

In addition to providing a basis for the interoperability of spatial data in INSPIRE, the data specification development framework and the thematic data specifications can be reused in other environments at local, regional, national and global level contributing to improvements in the coherence and interoperability of data in spatial data infrastructures.

Statistical Units – Executive Summary

Statistical units are defined as "units for dissemination or use of statistical information". This document presents data specifications for statistical units. It is based on the following principles:

Separation between statistical data and statistical units

A statistical data is defined as "any numerical representation of a phenomenon". A statistical unit informs on the statistical data location. This document addresses only the statistical unit specification (the specification of statistical data is out of the scope). The principle is to provide stable and identified representations of the statistical units – and statistical data refers to these objects through their identifier. Some recommendations are provided on how to give stable identifiers to statistical unit and use these identifiers to attach statistical information on them. This is particularly important if the responsibility for geometry and statistical data are shared between different institutions e.g. mapping agency and statistical offices. Other INSPIRE data specifications such as Population Distribution use this referencing mechanism.

Linking statistical data to spatial object is not only linking a database object to another one. The challenge is to improve the interaction between the statistics and the GIS worlds. This document recommendations aim at improving the integration of spatial and statistical analyses.

Genericity

There are many different kinds of statistical units: Census districts, management zones, environmental reporting units, etc. This document does not intend to provide specifications for all these statistical units. Common characteristics have been extracted and represented into a generic data model.

Statistical units as vector geometries and grid cells

Statistical units are usually represented as:

- Vector geometries (points, lines, surfaces), mainly surfaces. Area statistical units usually compose a tessellation (a tessellation is a collection of surfaces that cover a part of the geographical space with no overlaps and no gaps, see definition in section 2.4)

- Grid cells.

This document provides recommendations for representation of these kinds of statistical units.

Hierarchical relations between statistical units

Some statistical units are organised into a hierarchical structure: Some statistical units compose other ones at a higher level. Recommendations are provided to represent such structures.

Multi scale representation

Statistical units have several representations at different scales. To disseminate statistical data at the European scale, simplified representations of the statistical units are required. To fulfil this requirement, this document specifies how different representations of statistical units can be specified.

Evolution of statistical units

There are specific requirements regarding the evolution of statistical units. Some units can be changed, deleted, created, aggregated or split. Many use cases of statistical units concern the evolution of statistical data across space and time. This document specifies how to represent different states and evolutions of statistical units.

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The Thematic Working Group on Statistical Units and Population Distribution (TWG-SU-PD) included:

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Contributors:

From Eurostat: Beatrice Eiselt, Ekkehard Petri and Daniele Rizzi

From CBS (NL): Niek van Leeuwen, Olav ten Bosch

Participants on GISCO / Geostat meetings:

Hugo Poelmann (DG Regio) – Requirements for Change Information

Ingrid Kaminger (Statistic Austria) – User Survey according Grids

Marjan van Herwijnen (ESPON-Coordination Unit) - Requirements for Change Information

Other contributors to the INSPIRE data specifications are the Drafting Team Data Specifications, the JRC Data Specifications Team and the INSPIRE stakeholders - Spatial Data Interested Communities (SDICs) and Legally Mandated Organisations (LMOs).

Contact information

Maria Vanda Nunes de Lima
European Commission Joint Research Centre
Institute for Environment and Sustainability
Unit H06: Digital Earth and Reference Data
TP262, Via Fermi 2749
I-21027 Ispra (VA)

ITALY

E-mail: vanda.lima@jrc.ec.europa.eu
Tel.: 39-0332-7865052
Fax: 39-0332-7866325
<http://ies.jrc.ec.europa.eu/>
<http://ec.europa.eu/dgs/jrc/>
<http://inspire.jrc.ec.europa.eu/>

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1. Scope

This document specifies a harmonised data specification for the spatial data theme *Statistical Units* as defined in Annex III of the INSPIRE Directive.

This data specification provides the basis for the drafting of Implementing Rules according to Article 7 (1) of the INSPIRE Directive [Directive 2007/2/EC]. The entire data specification is published as implementation guidelines accompanying these Implementing Rules.

2. Overview

2.1. Name

INSPIRE data specification for the theme *Statistical Units*.

2.2. Informal description

Definition:

Units for dissemination or use of statistical information. [Directive 2007/2/EC]

Description:

A Statistical Unit (SU) is a spatial feature (Polygon, Line, Point or Grid cell) that can be used to attach statistical information. Statistical information can be defined as "any numerical representation of a phenomenon" like for example human population. It must concern information about a certain population not restricted to human population.

Statistical information is not considered as part of the statistical unit. It is a non-spatial thematic information, whose harmonisation is out of the scope of this document. For this information we refer to the specification of the INSPIRE theme *Population Distribution*. This document only focus on the representation of the spatial features used to attach any kind of statistical data.

All INSPIRE features can be seen as a statistical unit. For example, road traffic data can be attached to *RoadLink* features of the *Road Transport Networks* theme, and population data can be attached to *Building* features of the *Building* theme. Statistical units theme addresses the units that are not already addressed by other themes and that are usually used only for dissemination of statistical data.

Important characteristics of statistical units are:

- They may have a hierarchical structure (like NUTS1, 2 and 3).
- Their spatial extent can go from sub-local (smaller than municipalities/communities) level to country level.
- Their temporal extent differs per country. They can change in time, which makes time comparisons difficult.
- In many cases they are derived from administrative units, but other sources are also possible.

Existing statistical units

NUTS

Since many years European regional statistics have been collected, compiled and disseminated on the basis of a common regional classification, called 'Nomenclature of territorial units for Statistics' (NUTS). At the top of the hierarchy there are the individual Member States of the EU and below the NUTS levels 1 to 3. In general, one or two NUTS levels match with existing national administrative

units. NUTS units are therefore an important type of statistical unit. Clear rules for this classification system have been fixed in a legal framework (Regulation (EC) No 1059/2003).

LAU and Urban Audit

The NUTS classification serves as a harmonised system for applications at European and regional level, while it does not preclude the existence of other subdivisions and classifications. At a more detailed level, there are the regional districts and municipalities used in European context. These are called Local Administrative Units (LAU) sometimes used in European legislation. Other examples of statistical units are the urban area's used in the Urban audit project, organized by Eurostat. Neither the LAU's nor the UA units are subject of the NUTS or any other European regulation; they are defined by gentlemen agreement.

Other local statistical units

Within most municipalities additional territorial subdivisions exist which are used for municipal administration, statistical surveys (e.g. census districts, neighbourhoods) and other thematic specific purposes (e.g. transportation cells) and for which statistical data are provided. All these units are not harmonised over Europe and not regulated at the European level.

Sector specific statistical units

Statistical units are also used for sector specific purposes (like for example civil security regions, jurisprudential areas or touristy regions). Such sector specific statistical units are considered out of scope as it may be an effort not worth while to harmonise all these sector specific statistical units on the European level. As the data model is generic it is possible to use it also for sector specific purposes, but there is no obligation to provide such statistical units according to this data specification.

Grids

In addition to these statistical units which are based on administrative or thematic lineation, abstract territorial division used as spatial reference for statistics, called grids, are also used. Grids are squares of different sizes oriented on the INSPIRE coordinate system, independent from any administrative or thematic boundaries.

Uses of statistical units

Statistical units are needed within local to national governments, settlement, urban and regional development, health and education planning, school enrolment planning, risks assessment, etc. They are of major importance to integrated analysis for sectors and regions. Statistical units are necessary as geographical features also in environmental and social assessments, e.g. on estimates on exposure to pressures and on availability of services. Statistical units can be used as the geographical base for the research on nearly any phenomena.

Statistical units can be used for collecting data as well as for aggregating or presenting data (at different scales for different purposes, for instance: at different statistical NUTS levels). Likewise administrative units the statistical units can be used to geo-reference data from different statistical fields, like demography and social statistics, economy, environment and natural resources. Statistical unit are also used for risk analysis (e.g. flood risk), mainly in connection with population

distribution.

Annex B describes some of these use cases.

Relations with other themes

The datasets addressed in this theme may also be covered in other INSPIRE themes, either as overlapping geometry/objects, or as a needed geometry for thematic presentations. Statistical units can be used as a basis for joining, aggregation and presentation of maps for nearly any theme or sector-specific issue. Statistical units have links to Administrative units, Population distribution/demography, Area management/restriction/regulation zones and reporting units, Geographical grids and Human health and safety.

Relation with Geographical Grid Systems theme

In this specification, Statistical Grids follow the principles laid down in sections 4 and 5 of the data specifications of the theme *Geographical Grid Systems* from Annex I. Due to extended requirements the statistical grid definition had to be more flexible, especially additional grid sizes are needed for geo-statistical analysis on large scales in regions or towns. INSPIRE statistical grids form a geo-referencing framework for the theme Population distribution / Demography and all other themes where grids with fixed and unambiguously defined location of equal-area grid cells are needed. The requirements and recommendations regarding statistical grids are harmonized with the requirements for Coordinate reference systems [INSPIRE-DS-CRS].

Technically, grids for statistical data are predefined spatial reference structures composed of cells regular in area. Cells are usually squares based on a given coordinate reference system (different shapes e.g. hexagons are not used in the statistical community, only in some research projects). Approximately equal area grids are required for statistical mapping and analytical work. The statistical grid specification takes as far as possible into account the recommendations of the "first Workshop on European Reference Grids in Ispra, 27-29 October 2003.

Definition:

Units for dissemination or use of statistical information.

Description:

Statistical unit informs on the location of statistical data and information. The principle of this theme is to provide stable and identified representations of the statistical units – and statistical data refers to these objects through their identifier. Recommendations are provided on how to give stable identifiers to statistical unit and use these identifiers to attach statistical information on them. This is particularly important if the responsibility for geometry and statistical data are shared between different institutions e.g. mapping agency and statistical offices. Other INSPIRE data specifications such as Population Distribution use this referencing mechanism.

Entry in the INSPIRE registry: <http://inspire.ec.europa.eu/theme/su/>

2.3. Normative References

[Directive 2007/2/EC] 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)

[ISO 19107] EN ISO 19107:2005, Geographic Information – Spatial Schema

[ISO 19113] EN ISO 19113:2005, Geographic Information – Quality principles

[ISO 19115] EN ISO 19115:2005, Geographic information – Metadata (ISO 19115:2003)

[ISO 19118] EN ISO 19118:2006, Geographic information – Encoding (ISO 19118:2005)

[ISO 19138] ISO/TS 19138:2006, Geographic Information – Data quality measures

[Regulation 1205/2008/EC] Regulation 1205/2008/EC implementing Directive 2007/2/EC of the European Parliament and of the Council as regards metadata

[ISO 3166-1] EN ISO 3166-1, English country names and code elements

[Regulation 1059/2003/EC] Regulation 1059/2003/EC on the establishment of a common classification of territorial units for statistics (NUTS)

[OGC 10-070r2] Georeferenced Table Joining Service Implementation Standard, OpenGIS standard

[OGC 09-110r3] Web Coverage Service 2.0 interface standard, OpenGIS standard

REGULATION (EC) No. 1059/2003 on the establishment of a common classification of territorial units for statistics (NUTS2003)

REGULATION (EC) No. 105/2007 Amending the Annexes to Regulation 1059/2007 (NUTS2006)

REGULATION (EC) No. 31/2011 Amending the Annexes to Regulation 1059/2007 (NUTS2010)

2.4. Terms and definitions

General terms and definitions helpful for understanding the INSPIRE data specification documents are defined in the INSPIRE Glossary^[13].

2.5. Symbols and abbreviations

ATS	Abstract Test Suite
EC	European Commission
EEA	European Environmental Agency
ETRS89	European Terrestrial Reference System 1989
ETRS89-LAEA	Lambert Azimuthal Equal Area
EU	European Union

EVRS	European Vertical Reference System
GCM	INSPIRE Generic Conceptual Model
GDAS	Geographic Data Attribute Set
GML	Geography Markup Language
INSPIRE	Infrastructure for Spatial Information in the European Community
IR	Implementing Rule
ISDSS	Interoperability of Spatial Data Sets and Services
ISO	International Organization for Standardization
ITRS	International Terrestrial Reference System
LAT	Lowest Astronomical Tide
LMO	Legally Mandated Organization
NUTS	Nomenclature of Territorial Units for Statistics
OGC	Open Geospatial Consortium
SDIC	Spatial Data Interest Community
SDMX	Statistical Data and Metadata eXchange
TG	Technical Guidance
TJS	Georeferenced Table Joining Service
UML	Unified Modelling Language
UTC	Coordinated Universal Time
WCS	Web Coverage Service
XML	EXtensible Markup Language

2.6. How the Technical Guidelines map to the Implementing Rules

The schematic diagram in Figure 1 gives an overview of the relationships between the INSPIRE legal acts (the INSPIRE Directive and Implementing Rules) and the INSPIRE Technical Guidelines. The INSPIRE Directive and Implementing Rules include legally binding requirements that describe, usually on an abstract level, *what* Member States must implement.

In contrast, the Technical Guidelines define *how* Member States might implement the requirements included in the INSPIRE Implementing Rules. As such, they may include non-binding technical requirements that must be satisfied if a Member State data provider chooses to conform to the Technical Guidelines. Implementing these Technical Guidelines will maximise the interoperability of INSPIRE spatial data sets.



Figure 1 - Relationship between INSPIRE Implementing Rules and Technical Guidelines

2.6.1. Requirements

The purpose of these Technical Guidelines (Data specifications on *Statistical Units*) is to provide practical guidance for implementation that is guided by, and satisfies, the (legally binding) requirements included for the spatial data theme *Statistical Units* in the Regulation (Implementing Rules) on interoperability of spatial data sets and services. These requirements are highlighted in this document as follows:

IR Requirement
Article / Annex / Section no.
Title / Heading



This style is used for requirements contained in the Implementing Rules on interoperability of spatial data sets and services (Commission Regulation (EU) No 1089/2010).

For each of these IR requirements, these Technical Guidelines contain additional explanations and examples.

NOTE The Abstract Test Suite (ATS) in Annex A contains conformance tests that directly check conformance with these IR requirements.

Furthermore, these Technical Guidelines may propose a specific technical implementation for satisfying an IR requirement. In such cases, these Technical Guidelines may contain additional technical requirements that need to be met in order to be conformant with the corresponding IR requirement *when using this proposed implementation*. These technical requirements are highlighted as follows:

TG Requirement X



This style is used for requirements for a specific technical solution proposed in these Technical Guidelines for an IR requirement.

NOTE 1 Conformance of a data set with the TG requirement(s) included in the ATS implies conformance with the corresponding IR requirement(s).

NOTE 2 In addition to the requirements included in the Implementing Rules on interoperability of spatial data sets and services, the INSPIRE Directive includes further legally binding obligations that put additional requirements on data providers. For example, Art. 10(2) requires that Member States shall, where appropriate, decide by mutual consent on the depiction and position of geographical features whose location spans the frontier between two or more Member States. General guidance for how to meet these obligations is provided in the INSPIRE framework documents.

2.6.2. Recommendations

In addition to IR and TG requirements, these Technical Guidelines may also include a number of recommendations for facilitating implementation or for further and coherent development of an interoperable infrastructure.



Recommendation X

Recommendations are shown using this style.

NOTE The implementation of recommendations is not mandatory. Compliance with these Technical Guidelines or the legal obligation does not depend on the fulfilment of the recommendations.

2.6.3. Conformance

Annex A includes the abstract test suite for checking conformance with the requirements included in these Technical Guidelines and the corresponding parts of the Implementing Rules (Commission Regulation (EU) No 1089/2010).

3. Specification scopes

This data specification does not distinguish different specification scopes, but just considers one general scope.

NOTE For more information on specification scopes, see [ISO 19131:2007], clause 8 and Annex D.

4. Identification information

These Technical Guidelines are identified by the following URI:

<http://inspire.ec.europa.eu/tg/su/3.0>

NOTE ISO 19131 suggests further identification information to be included in this section, e.g. the title, abstract or spatial representation type. The proposed items are already described in the document metadata, executive summary, overview description (section 2) and descriptions of the application schemas (section 5). In order to avoid redundancy, they are not repeated here.

5. Data content and structure

5.1. Application schemas – Overview

5.1.1. Application schemas included in the IRs

Articles 3, 4 and 5 of the Implementing Rules lay down the requirements for the content and structure of the data sets related to the INSPIRE Annex themes.

IR Requirement
Article 4
Types for the Exchange and Classification of Spatial Objects

- 1. For the exchange and classification of spatial objects from data sets meeting the conditions laid down in Article 4 of Directive 2007/2/EC, Member States shall use the spatial object types and associated data types, enumerations and code lists that are defined in Annexes II, III and IV for the themes the data sets relate to.
- 2. Spatial object types and data types shall comply with the definitions and constraints and include the attributes and association roles set out in the Annexes.
- 3. The enumerations and code lists used in attributes or association roles of spatial object types or data types shall comply with the definitions and include the values set out in Annex II. The enumeration and code list values are uniquely identified by language-neutral mnemonic codes for computers. The values may also include a language-specific name to be used for human interaction.



The types to be used for the exchange and classification of spatial objects from data sets related to the spatial data theme *Statistical Units* are defined in the *Statistical Units* application schema.

The application schemas specify requirements on the properties of each spatial object including its multiplicity, domain of valid values, constraints, etc.

NOTE The application schemas presented in this section contain some additional information that is not included in the Implementing Rules, in particular multiplicities of attributes and association roles.

TG Requirement 1



Spatial object types and data types shall comply with the multiplicities defined for the attributes and association roles in this section.

An application schema may include references (e.g. in attributes or inheritance relationships) to common types or types defined in other spatial data themes. These types can be found in a subsection called "Imported Types" at the end of each application schema section. The common types

referred to from application schemas included in the IRs are addressed in Article 3.

IR Requirement

Article 3

Common Types



Types that are common to several of the themes listed in Annexes I, II and III to Directive 2007/2/EC shall conform to the definitions and constraints and include the attributes and association roles set out in Annex I.

NOTE Since the IRs contain the types for all INSPIRE spatial data themes in one document, Article 3 does not explicitly refer to types defined in other spatial data themes, but only to types defined in external data models.

Common types are described in detail in the Generic Conceptual Model [DS-D2.7], in the relevant international standards (e.g. of the ISO 19100 series) or in the documents on the common INSPIRE models [DS-D2.10.x]. For detailed descriptions of types defined in other spatial data themes, see the corresponding Data Specification TG document [DS-D2.8.x].

5.2. Basic notions

This section explains some of the basic notions used in the INSPIRE application schemas. These explanations are based on the GCM [DS-D2.5].

5.2.1. Notation

5.2.1.1. Unified Modeling Language (UML)

The application schemas included in this section are specified in UML, version 2.1. The spatial object types, their properties and associated types are shown in UML class diagrams.

NOTE For an overview of the UML notation, see Annex D in [ISO 19103].

The use of a common conceptual schema language (i.e. UML) allows for an automated processing of application schemas and the encoding, querying and updating of data based on the application schema – across different themes and different levels of detail.

The following important rules related to class inheritance and abstract classes are included in the IRs.

IR Requirement

Article 5

Types



(...)

2. Types that are a sub-type of another type shall also include all this type's attributes and association roles.
3. Abstract types shall not be instantiated.

The use of UML conforms to ISO 19109 8.3 and ISO/TS 19103 with the exception that UML 2.1 instead of ISO/IEC 19501 is being used. The use of UML also conforms to ISO 19136 E.2.1.1.1-E.2.1.1.4.

NOTE ISO/TS 19103 and ISO 19109 specify a profile of UML to be used in conjunction with the ISO 19100 series. This includes in particular a list of stereotypes and basic types to be used in application schemas. ISO 19136 specifies a more restricted UML profile that allows for a direct encoding in XML Schema for data transfer purposes.

To model constraints on the spatial object types and their properties, in particular to express data/data set consistency rules, OCL (Object Constraint Language) is used as described in ISO/TS 19103, whenever possible. In addition, all constraints are described in the feature catalogue in English, too.

NOTE Since "void" is not a concept supported by OCL, OCL constraints cannot include expressions to test whether a value is a *void* value. Such constraints may only be expressed in natural language.

5.2.1.2. Stereotypes

In the application schemas in this section several stereotypes are used that have been defined as part of a UML profile for use in INSPIRE [DS-D2.5]. These are explained in Table 1 below.

Table 1 – Stereotypes (adapted from [DS-D2.5])

Stereotype	Model element	Description
applicationSchema	Package	An INSPIRE application schema according to ISO 19109 and the Generic Conceptual Model.
leaf	Package	A package that is not an application schema and contains no packages.
featureType	Class	A spatial object type.
type	Class	A type that is not directly instantiable, but is used as an abstract collection of operation, attribute and relation signatures. This stereotype should usually not be used in INSPIRE application schemas as these are on a different conceptual level than classifiers with this stereotype.
dataType	Class	A structured data type without identity.

Stereotype	Model element	Description
union	Class	A structured data type without identity where exactly one of the properties of the type is present in any instance.
enumeration	Class	An enumeration.
codeList	Class	A code list.
import	Dependency	The model elements of the supplier package are imported.
voidable	Attribute, association role	A voidable attribute or association role (see section 5.2.2).
lifeCycleInfo	Attribute, association role	If in an application schema a property is considered to be part of the life-cycle information of a spatial object type, the property shall receive this stereotype.
version	Association role	If in an application schema an association role ends at a spatial object type, this stereotype denotes that the value of the property is meant to be a specific version of the spatial object, not the spatial object in general.

5.2.2. Voidable characteristics

The «voidable» stereotype is used to characterise those properties of a spatial object that may not be present in some spatial data sets, even though they may be present or applicable in the real world. This does *not* mean that it is optional to provide a value for those properties.

For all properties defined for a spatial object, a value has to be provided – either the corresponding value (if available in the data set maintained by the data provider) or the value of *void*. A *void* value shall imply that no corresponding value is contained in the source spatial data set maintained by the data provider or no corresponding value can be derived from existing values at reasonable costs.

Recomendation 1



The reason for a *void* value should be provided where possible using a listed value from the VoidReasonValue code list to indicate the reason for the missing value.

The VoidReasonValue type is a code list, which includes the following pre-defined values:

- *Unpopulated*: The property is not part of the dataset maintained by the data provider. However, the characteristic may exist in the real world. For example when the "elevation of the water body above the sea level" has not been included in a dataset containing lake spatial objects, then the reason for a void value of this property would be 'Unpopulated'. The property receives this value for all spatial objects in the spatial data set.
- *Unknown*: The correct value for the specific spatial object is not known to, and not computable by the data provider. However, a correct value may exist. For example when the "elevation of the water body above the sea level" of a certain lake has not been measured, then the reason for a void value of this property would be 'Unknown'. This value is applied only to those spatial objects where the property in question is not known.
- *Withheld*: The characteristic may exist, but is confidential and not divulged by the data provider.

NOTE It is possible that additional reasons will be identified in the future, in particular to support reasons / special values in coverage ranges.

The «voidable» stereotype does not give any information on whether or not a characteristic exists in the real world. This is expressed using the multiplicity:

- If a characteristic may or may not exist in the real world, its minimum cardinality shall be defined as 0. For example, if an Address may or may not have a house number, the multiplicity of the corresponding property shall be 0..1.
- If at least one value for a certain characteristic exists in the real world, the minimum cardinality shall be defined as 1. For example, if an Administrative Unit always has at least one name, the multiplicity of the corresponding property shall be 1..*.

In both cases, the «voidable» stereotype can be applied. In cases where the minimum multiplicity is 0, the absence of a value indicates that it is known that no value exists, whereas a value of void indicates that it is not known whether a value exists or not.

EXAMPLE If an address does not have a house number, the corresponding Address object should not have any value for the «voidable» attribute house number. If the house number is simply not known or not populated in the data set, the Address object should receive a value of void (with the corresponding void reason) for the house number attribute.

5.2.3. Enumerations

Enumerations are modelled as classes in the application schemas. Their values are modelled as attributes of the enumeration class using the following modelling style:

- No initial value, but only the attribute name part, is used.
- The attribute name conforms to the rules for attributes names, i.e. is a lowerCamelCase name. Exceptions are words that consist of all uppercase letters (acronyms).

IR Requirement

Article 6

Code Lists and Enumerations



(...)

5. Attributes or association roles of spatial object types or data types that have an enumeration type may only take values from the lists specified for the enumeration type."

5.2.4. Code lists

Code lists are modelled as classes in the application schemas. Their values, however, are managed outside of the application schema.

5.2.4.1. Code list types

The IRs distinguish the following types of code lists.

IR Requirement
Article 6
Code Lists and Enumerations

1. Code lists shall be of one of the following types, as specified in the Annexes:
 - a. code lists whose allowed values comprise only the values specified in this Regulation;
 - b. code lists whose allowed values comprise the values specified in this Regulation and narrower values defined by data providers;
 - c. code lists whose allowed values comprise the values specified in this Regulation and additional values at any level defined by data providers;
 - d. code lists, whose allowed values comprise any values defined by data providers.



For the purposes of points (b), (c) and (d), in addition to the allowed values, data providers may use the values specified in the relevant INSPIRE Technical Guidance document available on the INSPIRE web site of the Joint Research Centre.

The type of code list is represented in the UML model through the tagged value *extensibility*, which can take the following values:

- *none*, representing code lists whose allowed values comprise only the values specified in the IRs (type a);
- *narrower*, representing code lists whose allowed values comprise the values specified in the IRs and narrower values defined by data providers (type b);
- *open*, representing code lists whose allowed values comprise the values specified in the IRs and additional values at any level defined by data providers (type c); and
- *any*, representing code lists, for which the IRs do not specify any allowed values, i.e. whose allowed values comprise any values defined by data providers (type d).



Recomendation 2

Additional values defined by data providers should not replace or redefine any value already specified in the IRs.

NOTE This data specification may specify recommended values for some of the code lists of type (b), (c) and (d) (see section 5.2.4.3). These recommended values are specified in a dedicated Annex.

In addition, code lists can be hierarchical, as explained in Article 6(2) of the IRs.

IR Requirement
Article 6
Code Lists and Enumerations

(...)

2. Code lists may be hierarchical. Values of hierarchical code lists may have a more generic parent value. Where the valid values of a hierarchical code list are specified in a table in this Regulation, the parent values are listed in the last column.

The type of code list and whether it is hierarchical or not is also indicated in the feature catalogues.

5.2.4.2. Obligations on data providers

IR Requirement
Article 6
Code Lists and Enumerations

(....)

3. Where, for an attribute whose type is a code list as referred to in points (b), (c) or (d) of paragraph 1, a data provider provides a value that is not specified in this Regulation, that value and its definition shall be made available in a register.
4. Attributes or association roles of spatial object types or data types whose type is a code list may only take values that are allowed according to the specification of the code list.

Article 6(4) obliges data providers to use only values that are allowed according to the specification of the code list. The "allowed values according to the specification of the code list" are the values explicitly defined in the IRs plus (in the case of code lists of type (b), (c) and (d)) additional values defined by data providers.

For attributes whose type is a code list of type (b), (c) or (d) data providers may use additional values that are not defined in the IRs. Article 6(3) requires that such additional values and their definition be made available in a register. This enables users of the data to look up the meaning of the additional values used in a data set, and also facilitates the re-use of additional values by other data providers (potentially across Member States).

NOTE Guidelines for setting up registers for additional values and how to register additional values

in these registers is still an open discussion point between Member States and the Commission.

5.2.4.3. Recommended code list values

For code lists of type (b), (c) and (d), this data specification may propose additional values as a recommendation (in a dedicated Annex). These values will be included in the INSPIRE code list register. This will facilitate and encourage the usage of the recommended values by data providers since the obligation to make additional values defined by data providers available in a register (see section 5.2.4.2) is already met.

Recomendation 3



Where these Technical Guidelines recommend values for a code list in addition to those specified in the IRs, these values should be used.

NOTE For some code lists of type (d), no values may be specified in these Technical Guidelines. In these cases, any additional value defined by data providers may be used.

5.2.4.4. Governance

The following two types of code lists are distinguished in INSPIRE:

- *Code lists that are governed by INSPIRE (INSPIRE-governed code lists).* These code lists will be managed centrally in the INSPIRE code list register. Change requests to these code lists (e.g. to add, deprecate or supersede values) are processed and decided upon using the INSPIRE code list register's maintenance workflows.

INSPIRE-governed code lists will be made available in the INSPIRE code list register at <http://inspire.ec.europa.eu/codelist/<CodeListName>>. They will be available in SKOS/RDF, XML and HTML. The maintenance will follow the procedures defined in ISO 19135. This means that the only allowed changes to a code list are the addition, deprecation or supersession of values, i.e. no value will ever be deleted, but only receive different statuses (valid, deprecated, superseded). Identifiers for values of INSPIRE-governed code lists are constructed using the pattern <http://inspire.ec.europa.eu/codelist/<CodeListName>/<value>>.

- *Code lists that are governed by an organisation outside of INSPIRE (externally governed code lists).* These code lists are managed by an organisation outside of INSPIRE, e.g. the World Meteorological Organization (WMO) or the World Health Organization (WHO). Change requests to these code lists follow the maintenance workflows defined by the maintaining organisations. Note that in some cases, no such workflows may be formally defined.

Since the updates of externally governed code lists is outside the control of INSPIRE, the IRs and these Technical Guidelines reference a specific version for such code lists.

The tables describing externally governed code lists in this section contain the following columns:

- The *Governance* column describes the external organisation that is responsible for maintaining the code list.
- The *Source* column specifies a citation for the authoritative source for the values of the code list. For code lists, whose values are mandated in the IRs, this citation should include the version of

the code list used in INSPIRE. The version can be specified using a version number or the publication date. For code list values recommended in these Technical Guidelines, the citation may refer to the "latest available version".

- In some cases, for INSPIRE only a subset of an externally governed code list is relevant. The subset is specified using the *Subset* column.
- The *Availability* column specifies from where (e.g. URL) the values of the externally governed code list are available, and in which formats. Formats can include machine-readable (e.g. SKOS/RDF, XML) or human-readable (e.g. HTML, PDF) ones.

Code list values are encoded using http URIs and labels. Rules for generating these URIs and labels are specified in a separate table.

Recomendation 4



The http URIs and labels used for encoding code list values should be taken from the INSPIRE code list registry for INSPIRE-governed code lists and generated according to the relevant rules specified for externally governed code lists.

NOTE Where practicable, the INSPIRE code list register could also provide http URIs and labels for externally governed code lists.

5.2.4.5. Vocabulary

For each code list, a tagged value called "vocabulary" is specified to define a URI identifying the values of the code list. For INSPIRE-governed code lists and externally governed code lists that do not have a persistent identifier, the URI is constructed following the pattern `<a href="http://inspire.ec.europa.eu/codelist/<UpperCamelCaseName>" class="bare">http://inspire.ec.europa.eu/codelist/<UpperCamelCaseName>;`.

If the value is missing or empty, this indicates an empty code list. If no sub-classes are defined for this empty code list, this means that any code list may be used that meets the given definition.

An empty code list may also be used as a super-class for a number of specific code lists whose values may be used to specify the attribute value. If the sub-classes specified in the model represent all valid extensions to the empty code list, the subtyping relationship is qualified with the standard UML constraint "`\{complete,disjoint\}`".

5.2.5. Identifier management

IR Requirement

Article 9

Identifier Management



1. The data type Identifier defined in Section 2.1 of Annex I shall be used as a type for the external object identifier of a spatial object.
2. The external object identifier for the unique identification of spatial objects shall not be changed during the life-cycle of a spatial object.

NOTE 1 An external object identifier is a unique object identifier which is published by the responsible body, which may be used by external applications to reference the spatial object. [DS-D2.5]

NOTE 2 Article 9(1) is implemented in each application schema by including the attribute *inspireId* of type Identifier.

NOTE 3 Article 9(2) is ensured if the *namespace* and *localId* attributes of the Identifier remains the same for different versions of a spatial object; the *version* attribute can of course change.

5.2.6. Geometry representation

IR Requirement
Article 12
Other Requirements & Rules



1. The value domain of spatial properties defined in this Regulation shall be restricted to the Simple Feature spatial schema as defined in Herring, John R. (ed.), OpenGIS® Implementation Standard for Geographic information – Simple feature access – Part 1: Common architecture, version 1.2.1, Open Geospatial Consortium, 2011, unless specified otherwise for a specific spatial data theme or type.

NOTE 1 The specification restricts the spatial schema to 0-, 1-, 2-, and 2.5-dimensional geometries where all curve interpolations are linear and surface interpolations are performed by triangles.

NOTE 2 The topological relations of two spatial objects based on their specific geometry and topology properties can in principle be investigated by invoking the operations of the types defined in ISO 19107 (or the methods specified in EN ISO 19125-1).

5.2.7. Temporality representation

The application schema(s) use(s) the derived attributes "beginLifespanVersion" and "endLifespanVersion" to record the lifespan of a spatial object.

The attributes "beginLifespanVersion" specifies the date and time at which this version of the spatial object was inserted or changed in the spatial data set. The attribute "endLifespanVersion" specifies the date and time at which this version of the spatial object was superseded or retired in the spatial data set.

NOTE 1 The attributes specify the beginning of the lifespan of the version in the spatial data set itself, which is different from the temporal characteristics of the real-world phenomenon described by the spatial object. This lifespan information, if available, supports mainly two requirements: First, knowledge about the spatial data set content at a specific time; second, knowledge about changes to a data set in a specific time frame. The lifespan information should be as detailed as in the data set (i.e., if the lifespan information in the data set includes seconds, the seconds should be represented in data published in INSPIRE) and include time zone information.

NOTE 2 Changes to the attribute "endLifespanVersion" does not trigger a change in the attribute

"beginLifespanVersion".

IR Requirement
Article 10
Life-cycle of Spatial Objects



(...)

3. Where the attributes beginLifespanVersion and endLifespanVersion are used, the value of endLifespanVersion shall not be before the value of beginLifespanVersion.

NOTE The requirement expressed in the IR Requirement above will be included as constraints in the UML data models of all themes.

Recomendation 5



If life-cycle information is not maintained as part of the spatial data set, all spatial objects belonging to this data set should provide a void value with a reason of "unpopulated".

5.2.7.1. Validity of the real-world phenomena

The application schema(s) use(s) the attributes "validFrom" and "validTo" to record the validity of the real-world phenomenon represented by a spatial object.

The attributes "validFrom" specifies the date and time at which the real-world phenomenon became valid in the real world. The attribute "validTo" specifies the date and time at which the real-world phenomenon is no longer valid in the real world.

Specific application schemas may give examples what "being valid" means for a specific real-world phenomenon represented by a spatial object.

IR Requirement
Article 12
Other Requirements & Rules



(...)

3. Where the attributes validFrom and validTo are used, the value of validTo shall not be before the value of validFrom.

NOTE The requirement expressed in the IR Requirement above will be included as constraints in the UML data models of all themes.

5.3. Application schema Statistical Units

5.3.1. Description

5.3.1.1. Narrative description

A statistical unit is defined as a unit used for dissemination or supporting the use of statistical information. According to this definition, all INSPIRE spatial objects can be considered as statistical units. Annex D.1 presents how to link statistical data to already existing units, using their identifier. This application schema provides objects that are not already covered by other INSPIRE themes, and that are usually used for spatial referencing of statistical data. The main characteristics of the INSPIRE statistical unit data model are the following:

Genericity

The data model does not intend to harmonise all existing specific statistical units, like census districts, management zones, environmental reporting units, etc. The philosophy is to provide an abstract model of statistical units that can then be specialised for specific statistical units (if needed). It is up to theme specific legislation to describe specialisation needs of this model. Annex D.2 explains how to make this specialisation. Annex E presents how this model is specialised for two existing models (NUTS and Urban Audit).

Grids, geometries, and tessellations

Statistical units as grid cells and vector geometries (point, line, and polygon) can be represented. A significant number of existing statistical units are area statistical units composing a tessellation (see glossary section 2.4 for definition). For pan-European applications, a recommended pan-European grid is described.

Multi scale representation

Vector statistical units can be represented by different geometries at different scales.

Hierarchical structure

Hierarchical structures of statistical units can be represented. Several levels can be defined; travelling between statistical units of successive levels is possible.

Temporal dimension

Vector statistical unit evolutions across time can be represented. It is possible to trace how these units have changed across time. The evolutions supported are creation, deletion, modification, aggregation and splitting. These evolutions can be represented explicitly. This is further described in section on temporality representation.

5.3.1.2. UML Overview

Figure 2 shows the package diagram of the *Statistical Units* application schema.

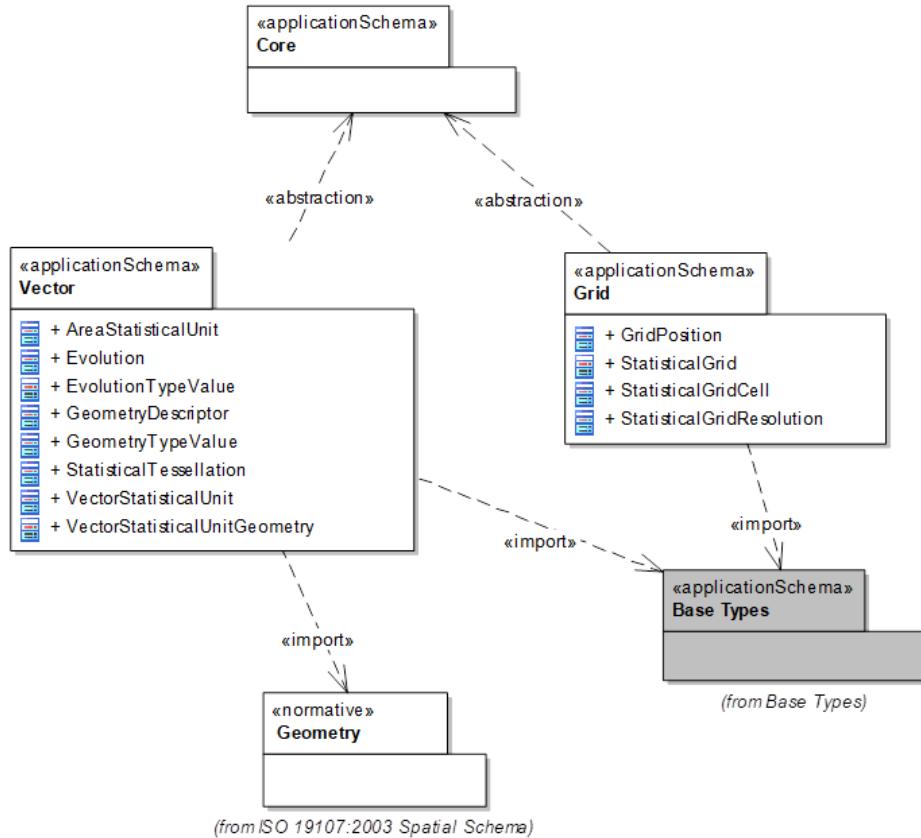


Figure 2 – UML package diagram the statistical units application schema

The application schema on statistical units is composed of different packages:

- **Base:** The base package.
- **Grid:** Classes to represent statistical grids.
- **Vector:** Classes to represent statistical unit having vector geometries (point, line, surfaces).

These packages import the following packages:

- The **base types** package defined in the INSPIRE generic conceptual model (document 2.5, see bibliography)
- **Geometry:** The ISO standard to represent geometries (ISO 19107).

These packages are described in the following sections.

5.3.1.2.1. *Base package*

This package contains the abstract class *StatisticalUnit* class (see Figure 3). A statistical unit is defined as a spatial feature used for dissemination or use of statistical information.

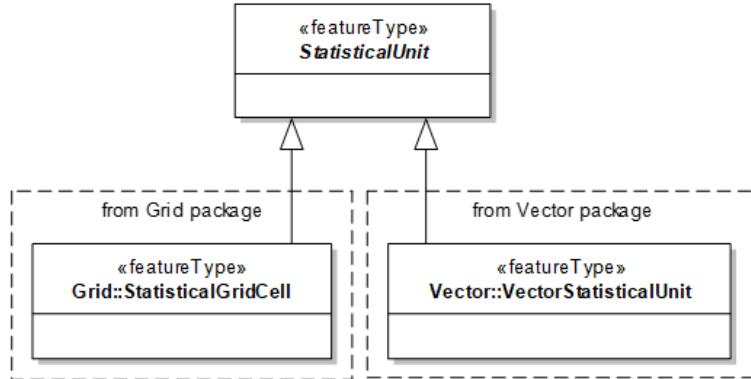


Figure 3 - Base package UML class diagram

Statistical units can be characterised by several statistical data. Recommendations on the modelling and encodings of statistical data to be linked to INSPIRE statistical units are given in annex D.1.

To ensure all statistical data can be linked to the unit they relate too, the following requirement is added:

IR Requirement
Annex IV, Section 1.5
Theme-specific Requirements



At least the geometry of statistical units, for which statistical data are made available under INSPIRE, shall be made available as well. This requirement applies to INSPIRE themes that refer to statistical units.

The INSPIRE data model provides two specialisations of the *StatisticalUnit* class: Statistical grid cells, described in the *Grid* package, and vector statistical units, described in the *Vector* package.

5.3.1.2.2. *Grid package*

This package (see Figure 4) contains classes to represent statistical grids (class *StatisticalGrid*) composed of statistical grid cells (class *StatisticalGridCell*).

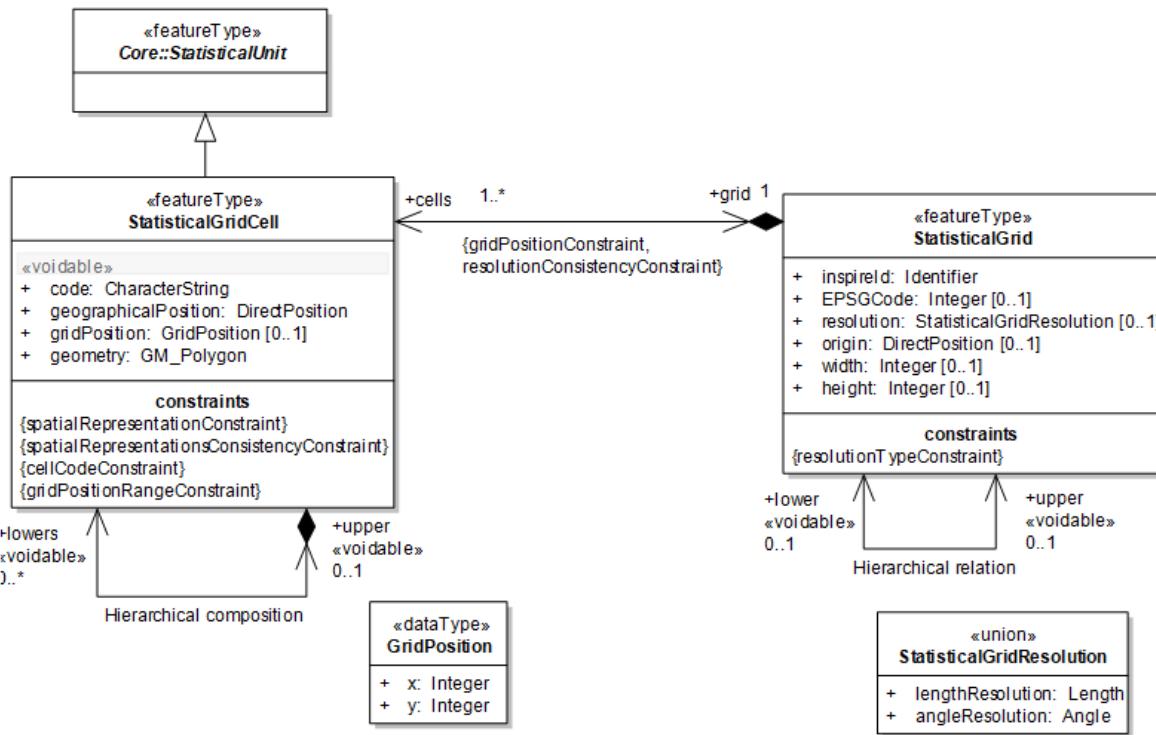


Figure 4 - UML class diagram of the Grid package

A statistical grid is identified by an INSPIRE identifier and characterised by a coordinate reference system (represented by its EPSG code). It is also characterised by a resolution, which can be a length (if the coordinate reference system is projected) or an angle (if the coordinate reference system is not projected). The choice between projected and non-projected coordinate reference systems should follow the following recommendation:

Recomendation 1



Because an important requirement of statistical grids is to be composed of equal area cells, grids based on non-projected coordinate reference systems should be used only on small spaces for which the cells keep comparable sizes.

Additionally, if a grid reference system is required, the grid can be characterised by an origin point. This origin point is the lower left point of the grid. The axes are parallel to the coordinate reference system axes, oriented from left to right and bottom to top. The pair (width, height) specifies the grid size.

A statistical grid is composed of statistical grid cells. Statistical grid cells are characterised by the following attributes:

A cell code: This code acts like an identifier. Its construction rules are described below.

A geographical position: This position is the position of the cell lower left corner within the grid coordinate reference system.

Recomendation 2



The reference point of a grid cell should be the lower left corner of the grid cell.

A grid position: The grid position is defined by the datatype *GridPosition*. It is the cell position in the grid reference system.

A geometry: This geometry is a square polygon representing the grid cell.

The cell code is built according to the following pattern:

```
CRS<EPSGcode>*RES*(<size>mN<northing>E<easting>)|(<d>-<m>-<s>dmsLON<d>-<m>-<s>LAT<d>-<m>-<s>)
```

This code is composed of:

1. A coordinate reference system part, represented by the word **CRS**, followed by the EPSG code.
2. A resolution and position part, which can be:
 - if the coordinate reference system is projected, the word **RES** followed by the grid resolution in meters and the letter **m**. Then, the letter **N** followed by the northing value in meters, and the letter **E** followed by the easting value in meters too,
 - if the coordinate reference system is not projected, the word **RES** followed by the grid resolution in degree-minute-second, followed by the word **dms**. Then the word **LON** followed by the longitude value in degree-minute-second, and word **LAT** followed by the latitude value in degree-minute-second.

For both cases, the given position is the position of the lower left cell corner.

EXAMPLES

CRS3035RES200mN1453400E1452800

CRS3035RES100000mN5400000E1200000

CRS4326RES0-10-0dmsLON45-20-0LAT4-50-0

Recommendation 3

The cell code should follow the following pattern: **CRS<EPSGcode>*RES*(<size>mN<northing>E<easting>)|(<d>-<m>-<s>dmsLON<d>-<m>-<s>LAT<d>-<m>-<s>)**. It is composed of the coordinate reference system represented by a EPSGCode, followed by a part giving the cell resolution and position of the lower left corner cell point. If the coordinate reference system is projected, the resolution is given in meters, and the northing and easting values too. If the coordinate reference system is not projected, the resolution is given in degree-minute-second, and the position longitude and latitude too.



There is an information redundancy among the attributes. Of course, all these different pieces of information should be consistent, and at least one of the attributes *code*, *geographicalPosition*, *gridPosition* should be provided.

The benefit of using this code allows to reconstruct the grid cell easily from it. The inclusion of the

EPSG code within the code enable to mix cells with different CRS in one dataset.

Recomendation 4



For a grid cell, the attribute values *code*, *geographicalPosition*, *gridPosition* and *geometry* should be consistent together, and also with the attributes of the grid.

TG Requirement 2



For a grid cell, at least one of the attributes *code*, *geographicalPosition* or *gridPosition* should be provided.

Hierarchical grids

Multi resolution grids are represented by a hierarchical structure through two associations. Each *StatisticalGrid* instance can be associated with a lower and/or an upper resolution grid through the *Hierarchical relation* association. A *StatisticalGridCell* belonging to a given *StatisticalGrid* is composed of the overlapping cells its grid's lower resolution grid, and composes the cell it overlaps in its grid's higher resolution grid. Lower and upper *StatisticalGridCells* are associated through the *Hierarchical composition*.

Recomendation 5



When required, multi resolution grids are represented through the *hierarchical composition* and *hierarchical relation* associations.

EXAMPLE 1 When each grid cell is linked to four grid cells of the lower level, this structure is a quad tree (see Figure 5).

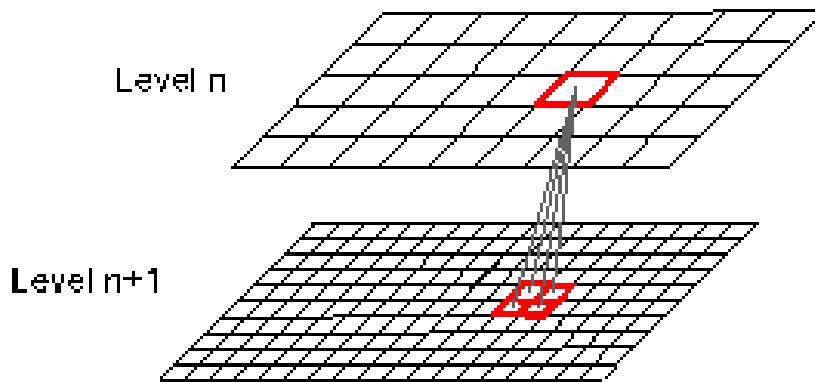


Figure 5 - Example of multi-resolution grid: A quad tree structure

EXAMPLE 2 Figure 6 shows an example of multi-resolution grid. Bigger cells (1 km resolution) are aggregations of 4*4 smaller cells (250m resolution).

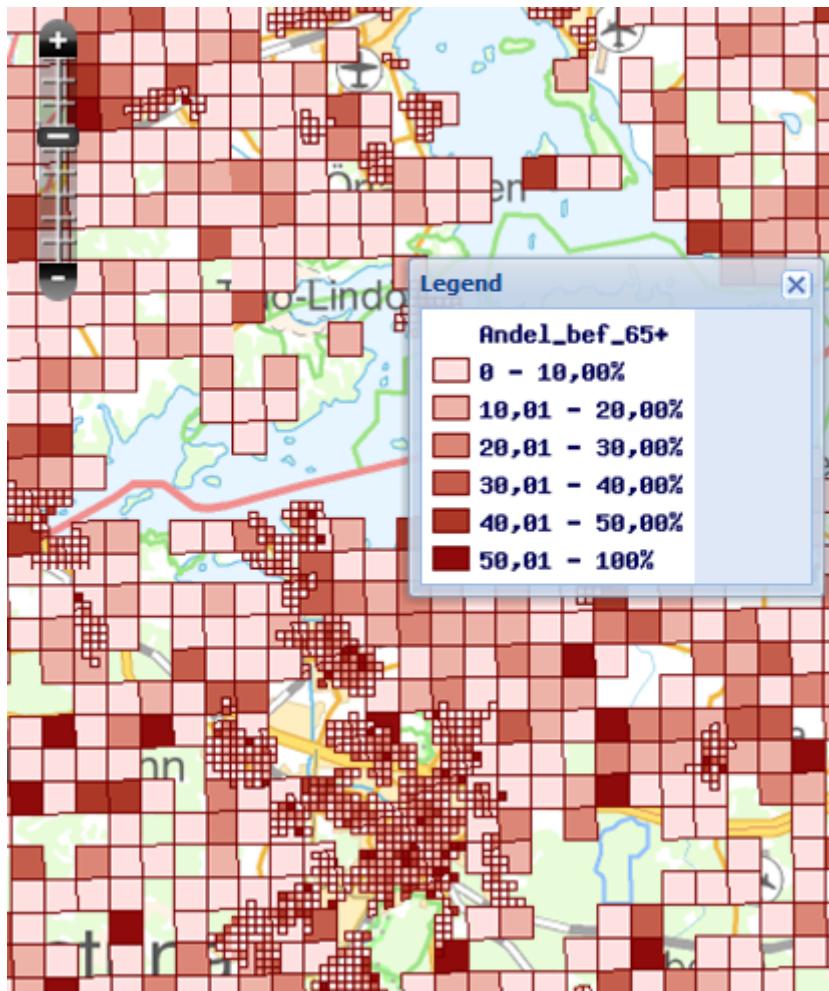


Figure 6 - Example of multi resolution grid: Display from the Swedish geoportal

A generic grid coverage model based on ISO 19123 is specified in the generic conceptual model (document 2.5, see bibliography). This model is not relevant for statistical grids because, compared to other grids, statistical grids are not used as coverages at this time. Statistical grid cells are used by statisticians as normal features for spatial referencing. Furthermore, the GCM grid model is multidimensional, while statistical grids are only simple two dimensional grids. However, if there is a need to represent statistical grids as coverages, the GCM model for RectifiedGridCoverage is recommended to be used.

Recomendation 6



To represent statistical grids coverages, the GCM model for RectifiedGridCoverage should be used.

Pan-European grid

For pan-European applications, there is a need to specify some common European grids. The recommended statistical grids follows the recommendation of the INSPIRE specification on geographical grid systems (document D2.8.I.2) as far as possible.



IR Requirement

Annex IV, Section 1.5

Theme-specific Requirements

For pan-European usage, the Equal Area Grid defined in Section 2.2.1 of Annex II shall be used.

5.3.1.2.3. Vector package

This package allows statistical units with point, line or surface geometries to be represented (see Figure 7). These vector statistical units are characterised by an INSPIRE identifier, at least one geometry, a country code, some potential geographical names, and have temporal attributes (see section on temporality representation).

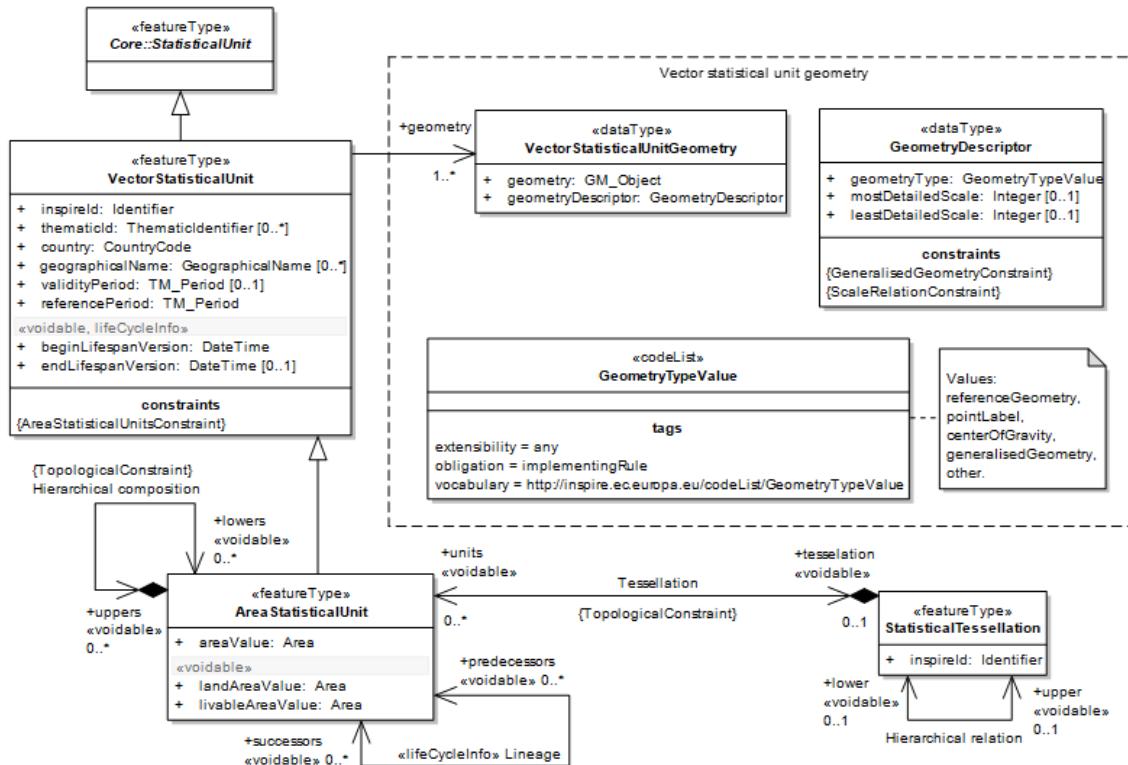


Figure 7 - UML class diagram of the Vector package

A vector statistical unit can have several geometries provided with the *geometries* association. These geometries are represented by the *VectorStatisticalUnitGeometry* datatype. A vector statistical unit geometry is characterized by:

- the vector geometry itself (*geometry* attribute). This attribute type is *GM_Object*, as described in ISO 19107 (see normative references). This standard is widely used in GIS to represent geometries such as points, lines, surfaces, solids, etc.
- and a geometry descriptor (*geometryDescriptor* attribute). The geometry descriptor has a *type* attribute, with values among the *GeometryType* codes. *mostDetailedScale* and *leastDetailedScale* fields must be provided only for geometry descriptors with a type *generalisedGeometry* (see Figure 8).

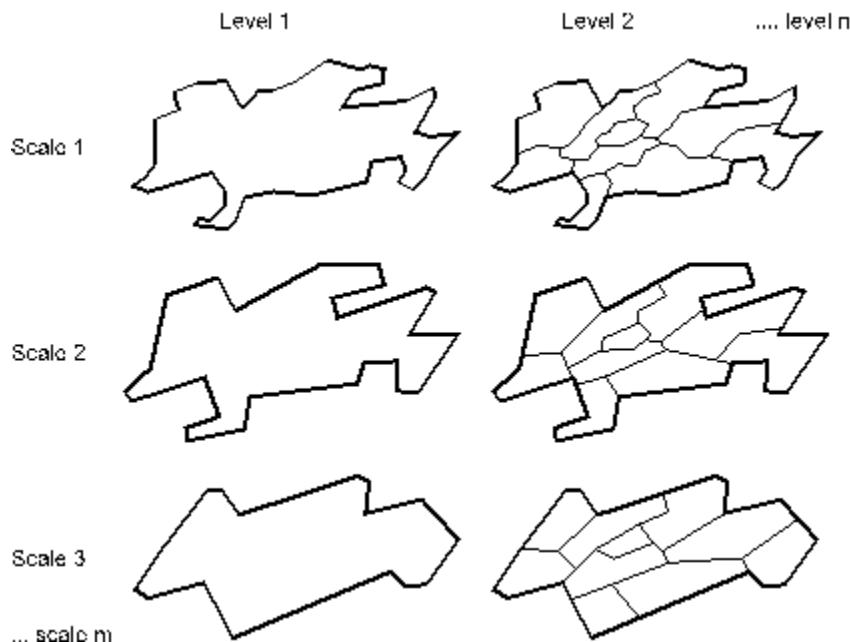


Figure 8 - Multiple generalised geometries of area statistical units.

Recomendation 7



When available, several geometrical representations of vector statistical units may be published.

The following constraints are added:

- Each vector statistical unit cannot have more than one geometry with a type *referenceGeometry*,
- Geometry descriptors with a *generalisedGeometry* type have to be instances of *GeneralisedGeometryDescriptor* class.
- Vector statistical units with a reference geometry instance of *GM_MultiSurface* must be instances of the specialised class *AreaStatisticalUnit*.

Recomendation 8



For each vector statistical unit, exactly one reference geometry has to be defined. This reference geometry is the "official" geometry of the statistical unit.

Recomendation 9



There is no obligation to publish the reference geometry: A data provider can publish only a generalised version. In this case, the source of the geometry should be specified in the metadata (as lineage element).

Area statistical units are usually organised into a hierarchical structure (see Figure 9). Area statistical units are composed of other area statistical unit. Such structure is represented through the *hierarchical composition* association: a given area statistical unit can be associated with the lower units it is composed of, and with the upper units it composes.

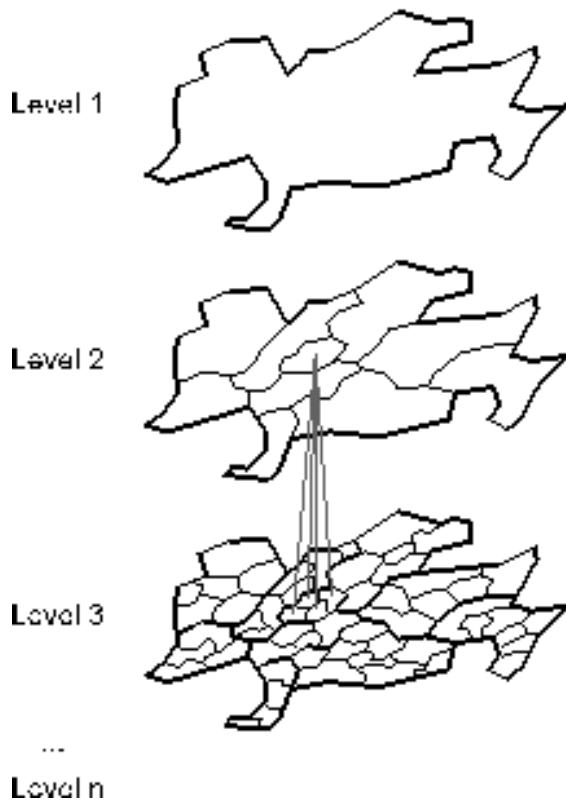


Figure 9 – A hierarchy of area statistical units

Recomendation 10



When available, the composition relations between statistical units should be given.

NOTE 1: A given area statistical unit can compose several different upper units as shown on Figure 10: The multiplicity of the *uppers* role is therefore 0..*.



Figure 10 - Each area statistical unit can compose several upper area statistical units

NOTE 2: There is no obligation to provide a geometry for upper statistical units: A statistical unit may be defined as a composition of other lower statistical units, and no geometry may be provided for this aggregated unit. Of course, in case a geometry is provided, this geometry should be an aggregation of the lower units.

In many statistical unit datasets, area statistical units cover the geographical space and compose a *tessellation* (see glossary section 2.4 for definition). Such tessellations are represented by instances of the class *StatisticalTessellation*. A statistical tessellation is not a statistical unit, but a collection of area statistical units with topological constraints (no overlaps and no gaps allowed between area statistical units composing a statistical tessellation).

Statistical tessellations may be organised into a hierarchy as shown on Figure 9. The *Hierarchical relation* association allows a linkage of upper and lower statistical tessellations. The hierarchical relations between statistical tessellations and their composing statistical units must be consistent.

Recomendation 11



For area statistical units composing a tessellation, an explicit object representing this tessellation should be provided. Existing hierarchical relations between these tessellations may be given.

Area statistical units are often built from administrative units. In order to retrieve from a given area statistical unit the administrative unit(s) it has been built from, there is an association toward the class administrative unit.

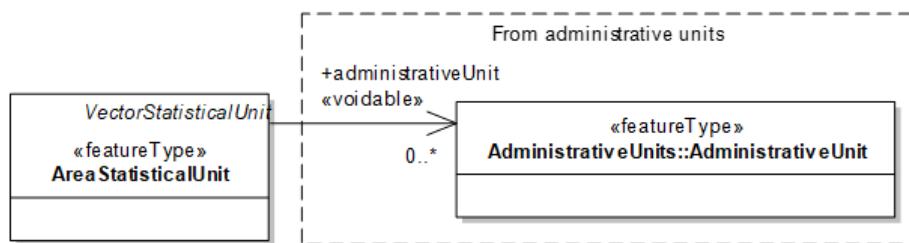


Figure 11 – Association between area statistical units and the administrative units it has been built from.

The attributes *beginLifespanVersion* and *endLifespanVersion* of the *VectorStatisticalUnit* class and the associations *Lineage* the *AreaStatisticalUnit* class are used to represent temporality of *VectorStatisticalUnit*. These components are further described in section the section on temporality representation.

5.3.1.3. Consistency between spatial data sets

Consistency between objects at different levels of detail

Vector statistical units with different levels of generalisation can be represented. These representations should respect the following constraints:

Recommendation 12



The topological relations between vector statistical units should be preserved as much as possible whatever their representation scale.

EXAMPLE If two area statistical units touch, all their representations should touch.

Area statistical units are often used for mapping purposes. In order not to give a deformed view of the reality, it should be important to preserve the area value of each statistical unit.

Recommendation 13



All area statistical unit geometries should have an area as close as possible to the reference geometry's one.

Consistency across borders

In order to ensure the consistency of statistical unit data across country borders, the following recommendations are given:

Recomendation 14



Edge-matching between vector statistical units in adjacent datasets should be performed.

Recomendation 15



The level of generalisation of adjacent datasets should be consistent.

In order to make the previous recommendations possible, it is necessary that member states use the same scale range for the multi-scale representation of their vector statistical units. For this reason, the following recommendation is added:

Recommendation 16



When needed for cross border use cases, it is recommended to use the following scales for the vector statistical geometry representations: 1:100k, 1:500k, 1:1M, 1:3M, 1:10M, 1:20M, 1:60M (where k=1000 and M=1 000 000).

NOTE These scales are compatible with the ones used for the last version of the NUTS dataset published in 2011 by Eurostat.

These recommendations related to cross border consistency cannot be solved at member state level. The same issue exist for cross border grid cell: The calculation of statistical data on grid cells shared by several countries cannot be performed by individual member states (this is a general issue to all INSPIRE theme using grids). For this reason, the following recommendation is added:

Recommendation 17



Cross border consistency should be ensured at the European level with the active support of European bodies.

NOTE Eurostat and the Geostat project are suitable European bodies to support the implementation of the previous recommendations related to cross border consistency.

Consistency with other themes

Vector statistical unit mainly share topological relations with other objects of other themes (like administrative units).

Recomendation 18



When a vector statistical unit share topological relations with other objects, their geometrical representations should be consistent with these topological relations as much as possible.

Recomendation 19



When a vector statistical unit is defined from another named spatial object (like an administrative unit), their geographical names should be consistent.

5.3.1.4. Identifier management

Vector statistical units, statistical tessellations and statistical grids are identified by an INSPIRE identifier. Additionally, statistical grid cells are identified by a code and vector statistical units can be identified with alternative thematic identifiers.

5.3.1.5. Modelling of object references

As described in annex D.1, the statistical unit identifiers are essential to the linkage of statistical data on statistical units.

5.3.1.6. Geometry representation

The Statistical units application schema enable to attach different geometrical representations to an instance of the class *VectorStatisticalUnit*. All these geometrical representations are described by a geometry descriptor as detailed in the UML overview section.

5.3.1.7. Temporality representation

Both statistical data and statistical units change over time. The change of statistical data is out of the scope of this document: Statistical data attached to a statistical unit are supposed to have their own temporality representation using, for example, a timestamp that represents the period in which these data are considered through in the real world. Only statistical unit changes are considered.

Statistical grid cells and statistical grids do not change across time (it is one of the advantages of their use). No temporality representation is required for them.

For vector statistical units, a traditional method to represent changes is to adopt a "snapshot" model. In this model, a version number is attached to the whole dataset with a timestamp, and a new version is published regularly or every time a change needs to be released. There is no explicit link between the different versions of a same spatial object. Changes are not managed at the object level, but at the dataset level. We propose here to explicitly represented evolutions at the object level. The following evolutions are represented:

- Creation (see Figure 12 a.)

- Deletion (see Figure 12 b.)
- Change (see Figure 12 c.) (Both geometrical and attribute changes are considered).

These changes are represented through the attributes *validityPeriod*, *beginLifespanVersion* and *endLifespanVersion*.

Recomendation 20



Creation, changes and deletions should be represented using the attributes *validityPeriod*, *beginLifespanVersion* and *endLifespanVersion*.

Furthermore, the following recommendation is added:

Recomendation 21



In case only one version is published, it should be the most updated one.

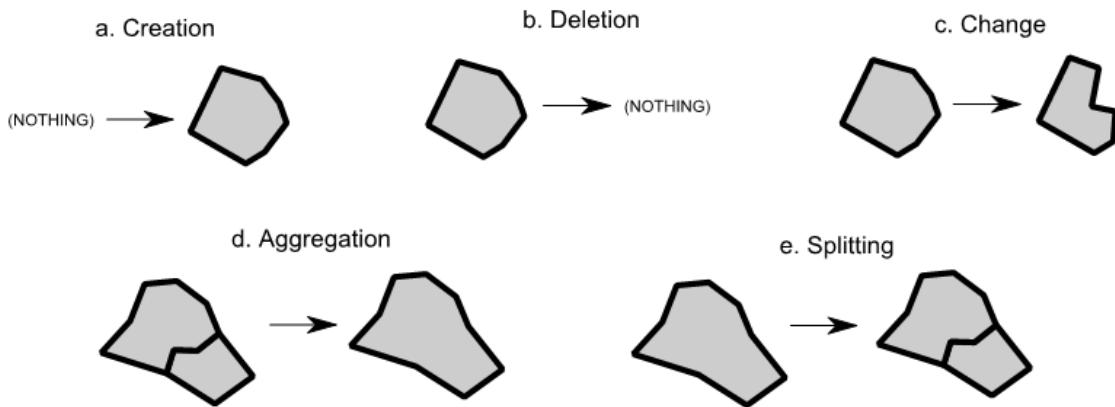


Figure 12 - Typical statistical unit changes

For area statistical units, two additional evolutions can be represented:

- Aggregation (see Figure 12 d.), when several area statistical units are aggregated into another one.
- Splitting (see Figure 12 e.), when one area statistical units splits into several.

Aggregated and split objects are linked through the *Lineage* association.

Recommendation 22



The lineage of aggregated and split area statistical units should be represented using a *Lineage* association with the *successors* and *predecessors* roles.

Annex F presents some examples on how these changes (creation, deletion, change, aggregation and splitting) are represented.

Representation of evolutions

The previous elements enable to represent the different versions of vector statistical units at

different times. An additional class, called *Evolution* (see Figure 13), is also provided in order to explicitly represent the evolutions that led from one version to another one.

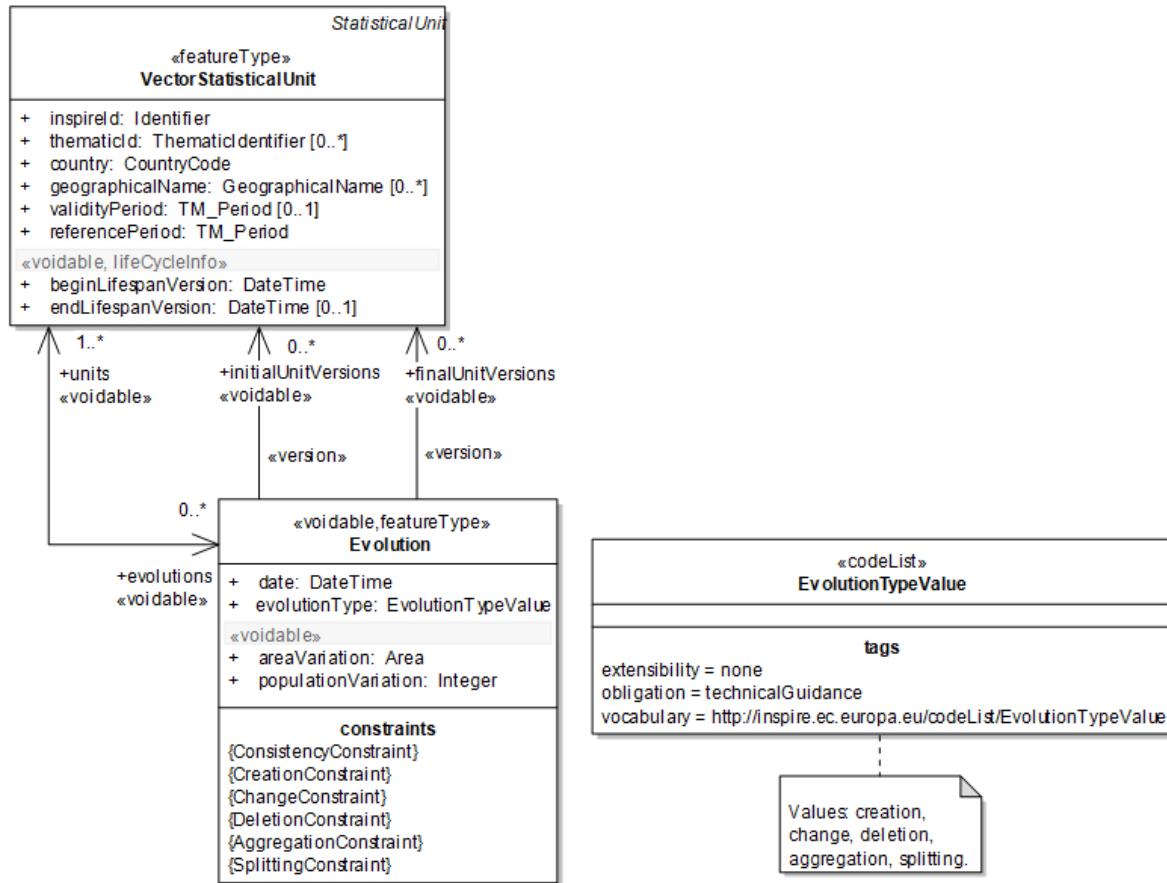


Figure 13 - Evolutions

A vector statistical unit is associated to its evolution objects. The evolution instances of a vector statistical unit represent the flow of events that occurred during his life cycle. An evolution is characterised by a date, a type value, among the code list *EvolutionType*, and two attributes on the area and population variation during the evolution. Finally, an evolution points toward the different versions it concerns, the initial and the final (through the associations *initialUnitVersions* and *finalUnitVersions*). Of course, these roles have the following constraints depending on the type of evolution:

- An evolution of type *creation* should not have any initial unit versions, and only one final one.
- An evolution of type *change* should have one initial unit version, and one final one.
- An evolution of type *deletion* should have one initial unit versions, and no final one.
- An evolution of type *aggregation* should have at least two initial unit versions (the units to be aggregated) and a single final one (the resulting aggregation).
- An evolution of type *splitting* should have a single final unit version (the unit to split), and at least two final ones (the units resulting from the splitting).

Because the evolution object represents redundant information already implicitly represented by the different object versions, there is a need for consistency control of these objects.



Evolution representations should be consistent with the versions of the concerned objects.

EXAMPLE If a change instance represents an object deletion at a given time, the last version of the object should have its *validityPeriod.end* attribute value set to this time.

5.3.2. Base package Feature catalogue

Feature catalogue metadata

Application Schema	INSPIRE Application Schema <i>Statistical Units</i> Base
Version number	3.0

Types defined in the feature catalogue

Type	Package	Stereotypes
StatisticalUnit	<i>Statistical Units</i> Base	«featureType»

5.3.2.1. Spatial object types

5.3.2.1.1. StatisticalUnit

StatisticalUnit (abstract)	
Name:	Statistical unit
Definition:	Unit for dissemination or use of statistical information.
Description:	<p>SOURCE [INSPIRE Directive:2007].</p> <p>EXAMPLE grid cell, point, line, polygon.</p> <p>NOTE Spatial features of any INSPIRE application schema can be considered as a statistical unit, because all can be used as spatial reference. This class is provided to represent features that are used only to disseminate statistical information and that are not included in another INSPIRE application schema.</p>
Stereotypes:	«featureType»

Association role:

Value type:	AggregatedEnergy
Multiplicity:	0..*

Imported types (informative)

This section lists definitions for feature types, data types and enumerations and code lists that are defined in other application schemas. The section is purely informative and should help the reader understand the feature catalogue presented in the previous sections. For the normative documentation of these types, see the given references.

5.3.2.1.2. AggregatedEnergy

AggregatedEnergy (abstract)	
Package:	Energy Statistics
Reference:	INSPIRE Data specification on Energy Resources [DS-D2.8.III.20]
Definition:	Abstract class intended to aggregate values on energy statistics (energy products, consumption, supply, etc...) and energy resources (fossil fuels, renewables and waste).

5.3.3. Grid package Feature catalogue

Feature catalogue metadata

Application Schema	INSPIRE Application Schema Statistical Units Grid
Version number	3.0

Types defined in the feature catalogue

Type	Package
Stereotypes	GridPosition
Statistical Units Grid	«dataType»
StatisticalGrid	Statistical Units Grid
«featureType»	StatisticalGridCell
Statistical Units Grid	«featureType»
StatisticalGridResolution	Statistical Units Grid

5.3.3.1. Spatial object types

5.3.3.1.1. StatisticalGrid

StatisticalGrid

Name:	Statistical grid
Definition:	A grid composed of statistical cells.
Description:	<p>Such grid is associated with an upper grid, that has a bigger resolution, and a lower grid that has a lower resolution. Some statistical grids are organised into a hierarchy of grids with different resolutions. The cells composing two linked grids have to satisfy some topological constraints: each cell of the upper grid should be the aggregation of cells of the lower grid.</p> <p>EXAMPLE The hierarchical structure is a quadtree if the grids are composed of quadrilateral cells and each cell is composed of less than four cells of the lower level.</p>
Stereotypes:	«featureType»

Attribute: inspireId

Name:	INSPIRE identifier
Value type:	Identifier
Definition:	External object identifier of the spatial object.
Description:	An external object identifier is a unique object identifier published by the responsible body, which may be used by external applications to reference the spatial object. The identifier is an identifier of the spatial object, not an identifier of the real-world phenomenon.
Multiplicity:	1

Attribute: EPSGCode

Name:	EPSGCode
Value type:	Integer
Definition:	The EPSG code to identify the grid Coordinate Referencing System.
Description:	This information is relevant only if all cells of the grid have the same CRS.
Multiplicity:	0..1

StatisticalGrid

Attribute: resolution

Name:	Resolution
Value type:	StatisticalGridResolution
Definition:	The grid resolution.
Description:	This information is relevant only if all cells of the grid have the same resolution.
Multiplicity:	0..1

Attribute: origin

Name:	Origin
Value type:	DirectPosition
Definition:	The position of the origin point of the grid in the specified coordinate reference system (if defined).
Description:	The origin point is the lower left grid point.
Multiplicity:	0..1

Attribute: width

Name:	Width
Value type:	Integer
Definition:	The grid width, in cell number (if defined).
Multiplicity:	0..1

Attribute: height

Name:	Height
Value type:	Integer
Definition:	The grid height, in cell number (if defined).
Multiplicity:	0..1

Association role: cells

Value type:	StatisticalGridCell
Definition:	The cells composing a grid.
Multiplicity:	1..*

StatisticalGrid

Association role: lower

Value type:	StatisticalGrid
Definition:	The immediately lower statistical grid.
Multiplicity:	0..1
Stereotypes:	«voidable»

Association role: upper

Value type:	StatisticalGrid
Definition:	The immediately upper statistical grid.
Multiplicity:	0..1
Stereotypes:	«voidable»

Constraint: resolutionTypeConstraint

Natural language:	If the coordinate reference system is a projected one, the resolution shall be a length. Otherwise, it shall be an angle.
OCL:	

5.3.3.1.2. StatisticalGridCell

StatisticalGridCell

Name:	Statistical grid cell
Subtype of:	StatisticalUnit
Definition:	Unit for dissemination or use of statistical information that is represented as a grid cell.
Description:	A statistical grid cell is associated with: - the unique statistical grid cell of its upper level (if any) it is covered by, - the statistical grid cells of its lower level (if any) it covers. NB Statistical grid cells are squares.
	EXAMPLE In a quadtree structure, some cells are associated with the four cells they are decomposed into.
Stereotypes:	«featureType»

StatisticalGridCell

Attribute: code

Name:	Code
Value type:	CharacterString
Definition:	A cell code.
Description:	<p>This code is composed of:</p> <ol style="list-style-type: none">1. A coordinate reference system part, represented by the word CRS, followed by the EPSG code.2. A resolution and position part:<ul style="list-style-type: none">- If the coordinate reference system is projected, the word RES followed by the grid resolution in meters and the letter m. Then, the letter N followed by the northing value in meters, and the letter E followed by the easting value in meters too.- If the coordinate reference system is not projected, the word RES followed by the grid resolution in degree-minute-second, followed by the word dms. Then the word LON followed by the longitude value in degree-minute-second, and word LAT followed by the latitude value in degree-minute-second. <p>For both cases, the given position is the position of the lower left cell corner.</p> <p>NOTE This code acts like an identifier.</p>
Multiplicity:	1
Stereotypes:	«voidable»

Attribute: geographicalPosition

Name:	Geographical position
Value type:	DirectPosition
Definition:	The grid cell lower left corner geographical position.
Multiplicity:	1
Stereotypes:	«voidable»

StatisticalGridCell

Attribute: gridPosition

Name:	Grid position
Value type:	GridPosition
Definition:	The grid cell position within the grid based on the grid coordinates.
Multiplicity:	0..1
Stereotypes:	«voidable»

Attribute: geometry

Name:	Geometry
Value type:	GM_Polygon
Definition:	The grid cell geometry.
Multiplicity:	1
Stereotypes:	«voidable»

Association role: lowers

Value type:	StatisticalGridCell
Definition:	The immediately lower statistical grid cells.
Multiplicity:	0..*
Stereotypes:	«voidable»

Association role: upper

Value type:	StatisticalGridCell
Definition:	The immediately upper statistical grid cell.
Multiplicity:	0..1
Stereotypes:	«voidable»

Association role: grid

Value type:	StatisticalGrid
Definition:	The grid made up of cells.
Multiplicity:	1

StatisticalGridCell

Constraint: cellCodeConstraint

Natural language:	The code shall be composed of: (1) A coordinate reference system part, represented by the word CRS, followed by the EPSG code. (2) A resolution and position part: – If the coordinate reference system is projected, the word RES followed by the grid resolution in meters and the letter m. Then, the letter N followed by the northing value in meters, and the letter E followed by the easting value in meters. – If the coordinate reference system is not projected, the word RES followed by the grid resolution in degree-minute-second, followed by the word dms. Then the word LON followed by the longitude value in degree-minute-second, and word LAT followed by the latitude value in degree-minute-second. For both cases, the given position shall be the position of the lower left cell corner.
OCL:	

Constraint: gridPositionRangeConstraint

Natural language:	The cell position should be within the grid, according to its width and height
OCL:	

Constraint: spatialRepresentationConstraint

Natural language:	At least one of the attributes code, geographicalPosition, gridPosition or geometry shall be provided
OCL:	

Constraint: spatialRepresentationsConsistencyConstraint

Natural language:	Where several spatial representations are provided (code, geographicalPosition, gridPosition and geometry), they shall be consistent
OCL:	

5.3.3.2. Data types

5.3.3.2.1. *GridPosition*

GridPosition	
Name:	Grid position
Definition:	A grid cell position within a grid.
Stereotypes:	«dataType»

Attribute: x

Name:	x-axis value
Value type:	Integer
Definition:	The position of the cell on the horizontal axis, starting from the left side, toward the right, from 0 to the grid width -1.
Multiplicity:	1

Attribute: y

Name:	y-axis value
Value type:	Integer
Definition:	The position of the cell on the vertical axis, starting from the bottom toward the top, from 0 to the grid height -1.
Multiplicity:	1

5.3.3.2.2. *StatisticalGridResolution*

StatisticalGridResolution	
Name:	Statistical grid resolution
Definition:	A statistical unit resolution value. — The resolution can be a distance or an angle.
Stereotypes:	«union»

Attribute: lengthResolution

Name:	Length resolution
Value type:	Length
Definition:	A distance resolution.
Multiplicity:	1

StatisticalGridResolution

Attribute: angleResolution

Name:	Angle resolution
Value type:	Angle
Definition:	An angle resolution.
Multiplicity:	1

5.3.3.3. Imported types (informative)

This section lists definitions for feature types, data types and enumerations and code lists that are defined in other application schemas. The section is purely informative and should help the reader understand the feature catalogue presented in the previous sections. For the normative documentation of these types, see the given references.

5.3.3.3.1. Angle

Angle

Package:	Units of Measure
Reference:	Geographic information — Conceptual schema language [ISO/TS 19103:2005]

5.3.3.3.2. CharacterString

CharacterString

Package:	Text
Reference:	Geographic information — Conceptual schema language [ISO/TS 19103:2005]

5.3.3.3.3. DirectPosition

DirectPosition

Package:	Coordinate geometry
Reference:	Geographic information — Spatial schema [ISO 19107:2003]

5.3.3.3.4. GM_Polygon

GM_Polygon

Package:	Coordinate geometry
Reference:	Geographic information — Spatial schema [ISO 19107:2003]

5.3.3.3.5. *Identifier*

Identifier	
Package:	Base Types
Reference:	INSPIRE Generic Conceptual Model, version 3.4 [DS-D2.5]
Definition:	External unique object identifier published by the responsible body, which may be used by external applications to reference the spatial object.
Description:	<p>NOTE1 External object identifiers are distinct from thematic object identifiers.</p> <p>NOTE 2 The voidable version identifier attribute is not part of the unique identifier of a spatial object and may be used to distinguish two versions of the same spatial object.</p> <p>NOTE 3 The unique identifier will not change during the life-time of a spatial object.</p>

5.3.3.3.6. *Integer*

Integer	
Package:	Numerics
Reference:	Geographic information — Conceptual schema language [ISO/TS 19103:2005]

5.3.3.3.7. *Length*

Length	
Package:	Units of Measure
Reference:	Geographic information — Conceptual schema language [ISO/TS 19103:2005]

5.3.3.3.8. *StatisticalUnit*

StatisticalUnit (abstract)	
Package:	Statistical Units Base
Reference:	INSPIRE Data specification on Statistical Units [DS-D2.8.III.1]
Definition:	Unit for dissemination or use of statistical information.
Description:	<p>SOURCE [INSPIRE Directive:2007].</p> <p>EXAMPLE grid cell, point, line, polygon.</p> <p>NOTE Spatial features of any INSPIRE application schema can be considered as a statistical unit, because all can be used as spatial reference. This class is provided to represent features that are used only to disseminate statistical information and that are not included in another INSPIRE application schema.</p>

5.3.4. Vector package Feature catalogue

Feature catalogue metadata

Application Schema	INSPIRE Application Schema Statistical Units Vector
Version number	3.0

Types defined in the feature catalogue

Type	Package	Stereotypes
AreaStatisticalUnit	Statistical Units Vector	«featureType»
Evolution	Statistical Units Vector	«voidable,featureType»
EvolutionTypeValue	Statistical Units Vector	«codelist»
GeometryDescriptor	Statistical Units Vector	«dataType»
GeometryTypeValue	Statistical Units Vector	«codelist»
StatisticalTessellation	Statistical Units Vector	«featureType»
VectorStatisticalUnit	Statistical Units Vector	«featureType»
VectorStatisticalUnitGeometry	Statistical Units Vector	«dataType»

5.3.4.1. Spatial object types

5.3.4.1.1. AreaStatisticalUnit

AreaStatisticalUnit	
Name:	Area statistical unit
Subtype of:	VectorStatisticalUnit
Definition:	Vector statistical unit with a surfacic reference geometry.
Description:	<p>Such object can be composed of other area statistical unit.</p> <p>EXAMPLE A country area, an administrative unit, a NUTS region.</p>
Stereotypes:	«featureType»

Attribute: areaValue

Name:	Area value
Value type:	Area
Definition:	The area of the reference geometry.
Multiplicity:	1

Attribute: landAreaValue

Name:	Land area value
Value type:	Area
Definition:	The area of the above-water part.
Multiplicity:	1
Stereotypes:	«voidable»

Attribute: livableAreaValue

Name:	Livable area value
Value type:	Area
Definition:	The area of the livable part.
Multiplicity:	1
Stereotypes:	«voidable»

AreaStatisticalUnit

Association role: lowers

Value type:	AreaStatisticalUnit
Definition:	The area statistical units of the next lower level.
Multiplicity:	0..*
Stereotypes:	«voidable»

Association role: successors

Value type:	AreaStatisticalUnit
Definition:	Successors of the area statistical unit.
Multiplicity:	0..*
Stereotypes:	«voidable»

Association role: administrativeUnit

Value type:	AdministrativeUnit
Definition:	Administrative units used to build the area statistical unit.
Multiplicity:	0..*
Stereotypes:	«voidable»

Association role: uppers

Value type:	AreaStatisticalUnit
Definition:	The area statistical units of the next upper level.
Multiplicity:	0..*
Stereotypes:	«voidable»

Association role: predecessors

Value type:	AreaStatisticalUnit
Definition:	Predecessors of the area statistical unit.
Multiplicity:	0..*
Stereotypes:	«voidable»

AreaStatisticalUnit

Association role: tessellation

Value type:	StatisticalTessellation
Definition:	The tessellation composed of units.
Multiplicity:	0..1
Stereotypes:	«voidable»

5.3.4.1.2. Evolution

Evolution

Name:	Evolution
Definition:	Representation of vector statistical unit evolution.
Stereotypes:	«voidable,featureType»

Attribute: date

Name:	Date
Value type:	DateTime
Definition:	The date when the change occurred.
Multiplicity:	1

Attribute: evolutionType

Name:	Evolution type
Value type:	EvolutionTypeValue
Definition:	The type of evolution.
Multiplicity:	1

Attribute: areaVariation

Name:	Area variation
Value type:	Area
Definition:	The area variation during the evolution. This attribute has to be populated only if the type is "change".
Multiplicity:	1
Stereotypes:	«voidable»

Evolution

Attribute: populationVariation

Name:	Population variation
Value type:	Integer
Definition:	The population variation during the evolution. This attribute has to be populated only if the type is "change".
Multiplicity:	1
Stereotypes:	«voidable»

Association role: finalUnitVersions

Value type:	VectorStatisticalUnit
Definition:	All the final unit versions concerned by the evolution.
Multiplicity:	0..*
Stereotypes:	«voidable»

Association role: units

Value type:	VectorStatisticalUnit
Definition:	All the units concerned by the evolution.
Multiplicity:	1..*
Stereotypes:	«voidable»

Association role: initialUnitVersions

Value type:	VectorStatisticalUnit
Definition:	All the initial unit versions concerned by the evolution.
Multiplicity:	0..*
Stereotypes:	«voidable»

Constraint: AggregationConstraint

Natural language:	An evolution with a typeValue "aggregation" shall have at least two initial unit versions (the units to be aggregated) and a single final one (the resulting aggregation).
OCL:	

Evolution

Constraint: ChangeConstraint

Natural language:	An evolution with a typeValue "change" shall have one initial unit version and one final one.
OCL:	

Constraint: ConsistencyConstraint

Natural language:	Evolution representations shall be consistent with the versions of the concerned objects.
OCL:	

Constraint: CreationConstraint

Natural language:	An evolution with a typeValue "creation" shall not have any initial unit versions and only one final one.
OCL:	

Constraint: DeletionConstraint

Natural language:	An evolution with a typeValue "deletion" shall have one initial unit version and no final one.
OCL:	

Constraint: SplittingConstraint

Natural language:	An evolution with a typeValue "splitting" shall have a single initial unit version (the unit to split), and at least two final ones (the units resulting from the splitting).
OCL:	

5.3.4.1.3. StatisticalTessellation

StatisticalTessellation

Name:	Statistical tessellation
Definition:	A tessellation composed of area statistical units.
Description:	EXAMPLE A NUTS regions coverage.
Stereotypes:	«featureType»

StatisticalTessellation

Attribute: inspireId

Name:	INSPIRE identifier
Value type:	Identifier
Definition:	External object identifier of the spatial object.
Description:	An external object identifier is a unique object identifier published by the responsible body, which may be used by external applications to reference the spatial object. The identifier is an identifier of the spatial object, not an identifier of the real-world phenomenon.
Multiplicity:	1

Association role: units

Value type:	AreaStatisticalUnit
Definition:	The units composing a tessellation.
Multiplicity:	0..*
Stereotypes:	«voidable»

Association role: lower

Value type:	StatisticalTessellation
Definition:	The immediately lower statistical tessellation.
Multiplicity:	0..1
Stereotypes:	«voidable»

Association role: upper

Value type:	StatisticalTessellation
Definition:	The immediately upper statistical tessellation.
Multiplicity:	0..1
Stereotypes:	«voidable»

5.3.4.1.4. *VectorStatisticalUnit*

VectorStatisticalUnit

Name:	Vector statistical unit
Subtype of:	StatisticalUnit
Definition:	Statistical unit represented as a vector geometry (point, line or surface).
Stereotypes:	«featureType»

Attribute: inspireId

Name:	INSPIRE identifier
Value type:	Identifier
Definition:	External object identifier of the spatial object.
Description:	An external object identifier is a unique object identifier published by the responsible body, which may be used by external applications to reference the spatial object. The identifier is an identifier of the spatial object, not an identifier of the real-world phenomenon.
Multiplicity:	1

Attribute: thematicId

Name:	Thematic identifier
Value type:	ThematicIdentifier
Definition:	Descriptive unique object identifier applied to spatial objects in a defined information theme.
Description:	Some statistical units may be assigned multiple thematic identifiers. EXAMPLE: NUTS codes are thematic identifiers.
Multiplicity:	0..*

Attribute: country

Name:	Country
Value type:	CountryCode
Definition:	The code of the country the object belongs to.
Multiplicity:	1

VectorStatisticalUnit

Attribute: geographicalName

Name:	Geographical name
Value type:	GeographicalName
Definition:	Possible geographical names of the object.
Multiplicity:	0..*

Attribute: beginLifespanVersion

Name:	Begin lifespan version
Value type:	DateTime
Definition:	Date and time at which this version of the spatial object was inserted or changed in the spatial data set.
Multiplicity:	1
Stereotypes:	«voidable,lifeCycleInfo»

Attribute: endLifespanVersion

Name:	End lifespan version
Value type:	DateTime
Definition:	Date and time at which this version of the spatial object was superseded or retired in the spatial data set.
Multiplicity:	0..1
Stereotypes:	«voidable,lifeCycleInfo»

Attribute: validityPeriod

Name:	Validity period
Value type:	TM_Period
Definition:	The period when the statistical unit is supposed to be preferably used and not.
Multiplicity:	0..1

VectorStatisticalUnit

Attribute: referencePeriod

Name:	Reference period
Value type:	TM_Period
Definition:	The period when the data is supposed to give a picture of the territorial division in statistical units.
Multiplicity:	1

Association role: evolutions

Value type:	Evolution
Definition:	All the evolutions the statistical unit has encountered.
Multiplicity:	0..*
Stereotypes:	«voidable»

Association role: statisticalMeasure

Value type:	AggregatedEnergy
Multiplicity:	0..*

Association role: geometry

Name:	Geometries
Value type:	VectorStatisticalUnitGeometry
Definition:	Geometrical representations of the vector statistical unit.
Multiplicity:	1..*

Constraint: AreaStatisticalUnitsConstraint

Natural language:	Vector statistical units with a reference geometry instance of <i>GM_MultiSurface</i> must be instances of the specialised class <i>AreaStatisticalUnit</i> .
OCL:	

5.3.4.2. Data types

5.3.4.2.1. *GeometryDescriptor*

GeometryDescriptor

Name:	Geometry descriptor
Definition:	A descriptor for vector statistical unit geometry.
Stereotypes:	«dataType»

Attribute: geometryType

Name:	Geometry type
Value type:	GeometryTypeValue
Definition:	The geometry type.
Multiplicity:	1

Attribute: mostDetailedScale

Name:	Most detailed scale
Value type:	Integer
Definition:	The most detailed scale the generalised geometry is supposed to be suitable for (expressed as the inverse of an indicative scale).
Multiplicity:	0..1

Attribute: leastDetailedScale

Name:	Least detailed scale
Value type:	Integer
Definition:	The least detailed scale the generalised geometry is supposed to be suitable for (expressed as the inverse of an indicative scale).
Multiplicity:	0..1

Constraint: GeneralisedGeometryConstraint

Natural language:	The <i>mostDetailedScale</i> and <i>leastDetailedScale</i> fields shall be provided only for geometry descriptors with a type <i>generalisedGeometry</i>
OCL:	

Constraint: ScaleRelationConstraint

Natural language:	If provided, <i>mostDetailedScale</i> shall be smaller than <i>leastDetailedScale</i>
OCL:	

5.3.4.2.2. VectorStatisticalUnitGeometry

VectorStatisticalUnitGeometry	
Name:	Vector statistical unit geometry
Definition:	A geometrical representation for vector statistical units.
Description:	<p>Vector statistical units can have several representations depending on the context they are used for. It is advised to produce at least one reference geometry.</p> <p>EXAMPLE1: A vector statistical units may be represented both by an area and a point geometry. Such point can be the center of gravity or a label location.</p> <p>EXAMPLE2: For mapping, different generalised representations of vector statistical units are required. These geometries depend on the visualisation scale.</p>
Stereotypes:	«dataType»

Attribute: geometry

Name:	Geometry
Value type:	GM_Object
Definition:	The geometry.
Multiplicity:	1

Attribute: geometryDescriptor

Name:	Geometry descriptor
Value type:	GeometryDescriptor
Definition:	The statistical unit geometry descriptor.
Multiplicity:	1

5.3.4.3. Code lists

5.3.4.3.1. EvolutionTypeValue

EvolutionTypeValue

Name:	Evolution type value
Definition:	The code values for evolution types.
Extensibility:	any
Identifier:	http://inspire.ec.europa.eu/codelist/EvolutionTypeValue
Values:	The allowed values for this code list comprise any values defined by data providers. Annex C includes recommended values that may be used by data providers.

5.3.4.3.2. GeometryTypeValue

GeometryTypeValue

Name:	Geometry type value
Definition:	The code values for the geometry types.
Extensibility:	open
Identifier:	http://inspire.ec.europa.eu/codelist/GeometryTypeValue
Values:	The allowed values for this code list comprise the values specified in Annex C and additional values at any level defined by data providers.

5.3.4.4. Imported types (informative)

This section lists definitions for feature types, data types and enumerations and code lists that are defined in other application schemas. The section is purely informative and should help the reader understand the feature catalogue presented in the previous sections. For the normative documentation of these types, see the given references.

5.3.4.4.1. AdministrativeUnit

AdministrativeUnit

Package:	AdministrativeUnits
Reference:	INSPIRE Data specification on Administrative Units [DS-D2.8.I.4]
Definition:	Unit of administration where a Member State has and/or exercises jurisdictional rights, for local, regional and national governance.

5.3.4.4.2. AggregatedEnergy

AggregatedEnergy (abstract)	
Package:	Energy Statistics
Reference:	INSPIRE Data specification on Energy Resources [DS-D2.8.III.20]
Definition:	Abstract class intended to aggregate values on energy statistics (energy products, consumption, supply, etc...) and energy resources (fossil fuels, renewables and waste).

5.3.4.4.3. Area

Area	
Package:	Units of Measure
Reference:	Geographic information — Conceptual schema language [ISO/TS 19103:2005]

5.3.4.4.4. CountryCode

CountryCode	
Package:	Base Types 2
Reference:	INSPIRE Generic Conceptual Model, version 3.4 [DS-D2.5]

5.3.4.4.5. DateTime

DateTime	
Package:	Date and Time
Reference:	Geographic information — Conceptual schema language [ISO/TS 19103:2005]

5.3.4.4.6. GM_Object

GM_Object (abstract)	
Package:	Geometry root
Reference:	Geographic information — Spatial schema [ISO 19107:2003]

5.3.4.4.7. GeographicalName

GeographicalName

Package:	Geographical Names
Reference:	INSPIRE Data specification on Geographical Names [DS-D2.8.I.3]
Definition:	Proper noun applied to a real world entity.

5.3.4.4.8. Identifier

Identifier

Package:	Base Types
Reference:	INSPIRE Generic Conceptual Model, version 3.4 [DS-D2.5]
Definition:	External unique object identifier published by the responsible body, which may be used by external applications to reference the spatial object.
Description:	<p>NOTE1 External object identifiers are distinct from thematic object identifiers.</p> <p>NOTE 2 The voidable version identifier attribute is not part of the unique identifier of a spatial object and may be used to distinguish two versions of the same spatial object.</p> <p>NOTE 3 The unique identifier will not change during the life-time of a spatial object.</p>

5.3.4.4.9. Integer

Integer

Package:	Numerics
Reference:	Geographic information — Conceptual schema language [ISO/TS 19103:2005]

5.3.4.4.10. StatisticalUnit

StatisticalUnit (abstract)

Package:	Statistical Units Base
Reference:	INSPIRE Data specification on <i>Statistical Units</i> [DS-D2.8.III.1]
Definition:	Unit for dissemination or use of statistical information.
Description:	<p>SOURCE [INSPIRE Directive:2007].</p> <p>EXAMPLE grid cell, point, line, polygon.</p> <p>NOTE Spatial features of any INSPIRE application schema can be considered as a statistical unit, because all can be used as spatial reference. This class is provided to represent features that are used only to disseminate statistical information and that are not included in another INSPIRE application schema.</p>

5.3.4.4.11. TM_Period

TM_Period

Package:	Temporal Objects
Reference:	Geographic information — Temporal schema [ISO 19108:2002/Cor 1:2006]

5.3.4.4.12. ThematicIdentifier

ThematicIdentifier

Package:	Base Types 2
Reference:	INSPIRE Generic Conceptual Model, version 3.4 [DS-D2.5]
Definition:	Thematic identifier to uniquely identify the spatial object.
Description:	<p>Some spatial objects may be assigned multiple unique identifiers.</p> <p>These may have been established to meet data exchange requirements of different reporting obligations at International, European or national levels and/or internal data maintenance requirements.</p>

6. Reference systems, units of measure and grids

6.1. Default reference systems, units of measure and grid

The reference systems, units of measure and geographic grid systems included in this sub-section are the defaults to be used for all INSPIRE data sets, unless theme-specific exceptions and/or additional requirements are defined in section 6.2.

6.1.1. Coordinate reference systems

6.1.1.1. Datum

IR Requirement

Annex II, Section 1.2

Datum for three-dimensional and two-dimensional coordinate reference systems

For the three-dimensional and two-dimensional coordinate reference systems and the horizontal component of compound coordinate reference systems used for making spatial data sets available, the datum shall be the datum of the European Terrestrial Reference System 1989 (ETRS89) in areas within its geographical scope, or the datum of the International Terrestrial Reference System (ITRS) or other geodetic coordinate reference systems compliant with ITRS in areas that are outside the geographical scope of ETRS89. Compliant with the ITRS means that the system definition is based on the definition of the ITRS and there is a well documented relationship between both systems, according to EN ISO 19111.



6.1.1.2. Coordinate reference systems

IR Requirement

Annex II, Section 1.3

Coordinate Reference Systems

Spatial data sets shall be made available using at least one of the coordinate reference systems specified in sections 1.3.1, 1.3.2 and 1.3.3, unless one of the conditions specified in section 1.3.4 holds.



1.3.1. Three-dimensional Coordinate Reference Systems

- Three-dimensional Cartesian coordinates based on a datum specified in 1.2 and using the parameters of the Geodetic Reference System 1980 (GRS80) ellipsoid.
- Three-dimensional geodetic coordinates (latitude, longitude and ellipsoidal height) based on a datum specified in 1.2 and using the parameters of the

GRS80 ellipsoid.

1.3.2. Two-dimensional Coordinate Reference Systems

- Two-dimensional geodetic coordinates (latitude and longitude) based on a datum specified in 1.2 and using the parameters of the GRS80 ellipsoid.
- Plane coordinates using the ETRS89 Lambert Azimuthal Equal Area coordinate reference system.
- Plane coordinates using the ETRS89 Lambert Conformal Conic coordinate reference system.
- Plane coordinates using the ETRS89 Transverse Mercator coordinate reference system.

1.3.3. Compound Coordinate Reference Systems

1. For the horizontal component of the compound coordinate reference system, one of the coordinate reference systems specified in section 1.3.2 shall be used.
2. For the vertical component, one of the following coordinate reference systems shall be used:
 - For the vertical component on land, the European Vertical Reference System (EVRS) shall be used to express gravity-related heights within its geographical scope. Other vertical reference systems related to the Earth gravity field shall be used to express gravity-related heights in areas that are outside the geographical scope of EVRS.
 - For the vertical component in the free atmosphere, barometric pressure, converted to height using ISO 2533:1975 International Standard Atmosphere, or other linear or parametric reference systems shall be used. Where other parametric reference systems are used, these shall be described in an accessible reference using EN ISO 19111-2:2012.
 - For the vertical component in marine areas where there is an appreciable tidal range (tidal waters), the Lowest Astronomical Tide (LAT) shall be used as the reference surface.
 - For the vertical component in marine areas without an appreciable tidal range, in open oceans and effectively in waters that are deeper than 200 meters, the Mean Sea Level (MSL) or a well-defined reference level close to the MSL shall be used as the reference surface.

1.3.4. Other Coordinate Reference Systems

Exceptions, where other coordinate reference systems than those listed in 1.3.1, 1.3.2 or 1.3.3 may be used, are:

1. Other coordinate reference systems may be specified for specific spatial data themes in this Annex.
2. For regions outside of continental Europe, Member States may define suitable

coordinate reference systems.

The geodetic codes and parameters needed to describe these coordinate reference systems and to allow conversion and transformation operations shall be documented and an identifier shall be created, according to EN ISO 19111 and ISO 19127.

6.1.1.3. Display

IR Requirement

Annex II, Section 1.4

Coordinate Reference Systems used in the View Network Service



For the display of spatial data sets with the view network service as specified in Regulation No 976/2009, at least the coordinate reference systems for two-dimensional geodetic coordinates (latitude, longitude) shall be available.

6.1.1.4. Identifiers for coordinate reference systems

IR Requirement

Annex II, Section 1.4

Coordinate Reference Systems used in the View Network Service



1. Coordinate reference system parameters and identifiers shall be managed in one or several common registers for coordinate reference systems.
2. Only identifiers contained in a common register shall be used for referring to the coordinate reference systems listed in this Section.

These Technical Guidelines propose to use the http URIs provided by the Open Geospatial Consortium as coordinate reference system identifiers (see identifiers for the default CRSS below). These are based on and redirect to the definition in the EPSG Geodetic Parameter Registry (<http://www.epsg-registry.org/>).

TG Requirement 3



The identifiers listed in Table 2 shall be used for referring to the coordinate reference systems used in a data set.

NOTE CRS identifiers may be used e.g. in:

- data encoding,
- data set and service metadata, and
- requests to INSPIRE network services.

Table 2. http URIs for the default coordinate reference systems

Coordinate reference system	Short name	http URI identifier
3D Cartesian in ETRS89	ETRS89-XYZ	http://www.opengis.net/def/crs/EPSG/0/4936
3D geodetic in ETRS89 on GRS80	ETRS89-GRS80h	http://www.opengis.net/def/crs/EPSG/0/4937
2D geodetic in ETRS89 on GRS80	ETRS89-GRS80	http://www.opengis.net/def/crs/EPSG/0/4258
2D LAEA projection in ETRS89 on GRS80	ETRS89-LAEA	http://www.opengis.net/def/crs/EPSG/0/3035
2D LCC projection in ETRS89 on GRS80	ETRS89-LCC	http://www.opengis.net/def/crs/EPSG/0/3034
2D TM projection in ETRS89 on GRS80, zone 26N (30°W to 24°W)	ETRS89-TM26N	http://www.opengis.net/def/crs/EPSG/0/3038
2D TM projection in ETRS89 on GRS80, zone 27N (24°W to 18°W)	ETRS89-TM27N	http://www.opengis.net/def/crs/EPSG/0/3039
2D TM projection in ETRS89 on GRS80, zone 28N (18°W to 12°W)	ETRS89-TM28N	http://www.opengis.net/def/crs/EPSG/0/3040
2D TM projection in ETRS89 on GRS80, zone 29N (12°W to 6°W)	ETRS89-TM29N	http://www.opengis.net/def/crs/EPSG/0/3041
2D TM projection in ETRS89 on GRS80, zone 30N (6°W to 0°)	ETRS89-TM30N	http://www.opengis.net/def/crs/EPSG/0/3042
2D TM projection in ETRS89 on GRS80, zone 31N (0° to 6°E)	ETRS89-TM31N	http://www.opengis.net/def/crs/EPSG/0/3043
2D TM projection in ETRS89 on GRS80, zone 32N (6°E to 12°E)	ETRS89-TM32N	http://www.opengis.net/def/crs/EPSG/0/3044
2D TM projection in ETRS89 on GRS80, zone 33N (12°E to 18°E)	ETRS89-TM33N	http://www.opengis.net/def/crs/EPSG/0/3045
2D TM projection in ETRS89 on GRS80, zone 34N (18°E to 24°E)	ETRS89-TM34N	http://www.opengis.net/def/crs/EPSG/0/3046
2D TM projection in ETRS89 on GRS80, zone 35N (24°E to 30°E)	ETRS89-TM35N	http://www.opengis.net/def/crs/EPSG/0/3047
2D TM projection in ETRS89 on GRS80, zone 36N (30°E to 36°E)	ETRS89-TM36N	http://www.opengis.net/def/crs/EPSG/0/3048
2D TM projection in ETRS89 on GRS80, zone 37N (36°E to 42°E)	ETRS89-TM37N	http://www.opengis.net/def/crs/EPSG/0/3049
2D TM projection in ETRS89 on GRS80, zone 38N (42°E to 48°E)	ETRS89-TM38N	http://www.opengis.net/def/crs/EPSG/0/3050

Coordinate reference system	Short name	http URI identifier
2D TM projection in ETRS89 on GRS80, zone 39N (48°E to 54°E)	ETRS89-TM39N	http://www.opengis.net/def/crs/EPSG/0/3051
Height in EVRS	EVRS	http://www.opengis.net/def/crs/EPSG/0/5730
3D compound: 2D geodetic in ETRS89 on GRS80, and EVRS height	ETRS89-GRS80-EVRS	http://www.opengis.net/def/crs/EPSG/0/7409

6.1.2. Temporal reference system

IR Requirement

Article 11

Temporal Reference Systems



1. The default temporal reference system referred to in point 5 of part B of the Annex to Commission Regulation (EC) No 1205/2008 (^[14]) shall be used, unless other temporal reference systems are specified for a specific spatial data theme in Annex II.

NOTE 1 Point 5 of part B of the Annex to Commission Regulation (EC) No 1205/2008 (the INSPIRE Metadata IRs) states that the default reference system shall be the Gregorian calendar, with dates expressed in accordance with ISO 8601.

NOTE 2 ISO 8601 *Data elements and interchange formats – Information interchange – Representation of dates and times* is an international standard covering the exchange of date and time-related data. The purpose of this standard is to provide an unambiguous and well-defined method of representing dates and times, so as to avoid misinterpretation of numeric representations of dates and times, particularly when data is transferred between countries with different conventions for writing numeric dates and times. The standard organizes the data so the largest temporal term (the year) appears first in the data string and progresses to the smallest term (the second). It also provides for a standardized method of communicating time-based information across time zones by attaching an offset to Coordinated Universal Time (UTC).

EXAMPLE 1997 (the year 1997), 1997-07-16 (16th July 1997), 1997-07-16T19:20:3001:00 (16th July 1997, 19h 20' 30", time zone: UTC1)

6.1.3. Units of measure

IR Requirement

Article 12

Other Requirements & Rules



(...)

1. All measurement values shall be expressed using SI units or non-SI units accepted for use with the International System of Units, unless specified

otherwise for a specific spatial data theme or type.

6.1.4. Grids

IR Requirement
Annex II, Section 2.2
Grids

Either of the grids with fixed and unambiguously defined locations defined in Sections 2.2.1 and 2.2.2 shall be used as a geo-referencing framework to make gridded data available in INSPIRE, unless one of the following conditions holds:

1. Other grids may be specified for specific spatial data themes in Annexes II-IV. In this case, data exchanged using such a theme-specific grid shall use standards in which the grid definition is either included with the data, or linked by reference.
2. For grid referencing in regions outside of continental Europe Member States may define their own grid based on a geodetic coordinate reference system compliant with ITRS and a Lambert Azimuthal Equal Area projection, following the same principles as laid down for the grid specified in Section 2.2.1. In this case, an identifier for the coordinate reference system shall be created.

2.2 Equal Area Grid



The grid is based on the ETRS89 Lambert Azimuthal Equal Area (ETRS89-LAEA) coordinate reference system with the centre of the projection at the point 52° N, 10° E and false easting: $x_0 = 4321000$ m, false northing: $y_0 = 3210000$ m.

The origin of the grid coincides with the false origin of the ETRS89-LAEA coordinate reference system ($x=0, y=0$).

Grid points of grids based on ETRS89-LAEA shall coincide with grid points of the grid.

The grid is hierarchical, with resolutions of 1m, 10m, 100m, 1000m, 10000m and 100000m.

The grid orientation is south-north, west-east.

The grid is designated as Grid_ETRS89-LAEA. For identification of an individual resolution level the cell size in metres is appended.

For the unambiguous referencing and identification of a grid cell, the cell code composed of the size of the cell and the coordinates of the lower left cell corner in ETRS89-LAEA shall be used. The cell size shall be denoted in metres ("m") for cell sizes up to 100m or kilometres ("km") for cell sizes of 1000m and above. Values for northing and easting shall be divided by 10^n , where n is the number of trailing zeros in the cell size value.

6.2. Theme-specific requirements and recommendations

Because statistical maps based on grids require all the cells to have the same size, the following recommendation is added:



Recomendation 24

For the visualisation of statistical grids, equal-area projections should be used.

7. Data quality

This chapter includes a description of the data quality elements and sub-elements as well as the corresponding data quality measures that should be used to evaluate and document data quality for data sets related to the spatial data theme *Statistical Units* (section 7.1).

It may also define requirements or recommendations about the targeted data quality results applicable for data sets related to the spatial data theme *Statistical Units* (sections 7.2 and 7.3).

In particular, the data quality elements, sub-elements and measures specified in section 7.1 should be used for

- evaluating and documenting data quality properties and constraints of spatial objects, where such properties or constraints are defined as part of the application schema(s) (see section 5);
- evaluating and documenting data quality metadata elements of spatial data sets (see section 8); and/or
- specifying requirements or recommendations about the targeted data quality results applicable for data sets related to the spatial data theme *Statistical Units* (see sections 7.2 and 7.3).

The descriptions of the elements and measures are based on Annex D of ISO/DIS 19157 Geographic information – Data quality.

7.1. Data quality elements

Table 3 lists all data quality elements and sub-elements that are being used in this specification. Data quality information can be evaluated at level of spatial object, spatial object type, dataset or dataset series. The level at which the evaluation is performed is given in the "Evaluation Scope" column.

The measures to be used for each of the listed data quality sub-elements are defined in the following sub-sections.

Table 3 – Data quality elements used in the spatial data theme *Statistical Units*

Section	Data quality element	Data quality sub-element	Definition	Evaluation Scope
7.1.1	Completeness	Commission	excess data present in the dataset, as described by the scope	dataset
7.1.2	Completeness	Omission	data absent from the dataset, as described by the scope	dataset

Section	Data quality element	Data quality sub-element	Definition	Evaluation Scope
0	Logical consistency	Topological consistency	correctness of the explicitly encoded topological characteristics of the dataset, as described by the scope	dataset
7.1.4	Positional accuracy	Absolute or external accuracy	closeness of reported coordinate values to values accepted as or being true	dataset
7.1.5	Thematic accuracy	Classification correctness	comparison of the classes assigned to features or their attributes to a universe of discourse	dataset
7.1.6	Temporal quality	Temporal validity	validity of data specified by the scope with respect to time	dataset

Recomendation 6



Where it is impossible to express the evaluation of a data quality element in a quantitative way, the evaluation of the element should be expressed with a textual statement as a data quality descriptive result.

7.1.1. Completeness – Commission

Recomendation 25



Commission should be evaluated and documented using **Rate of excess items** as specified in the tables below.

Name	Rate of excess items
Alternative name	–
Data quality element	Completeness
Data quality sub-element	Commission
Data quality basic measure	Error rate

Definition	Number of excess items in the dataset in relation to the number of items that should have been present.
Description	–
Evaluation scope	data set
Reporting scope	data set
Parameter	–
Data quality value type	Real, percentage, ratio (example: 0,0189 ; 98,11% ; 11:582)
Data quality value structure	–
Source reference	–
Example	–
Measure identifier	3 (ISO 19138)

7.1.2. Completeness – Omission

Recomendation 26



Omission should be evaluated and documented using **Rate of missing items** as specified in the tables below.

Name	Rate of missing items
Alternative name	–
Data quality element	Completeness
Data quality sub-element	Omission
Data quality basic measure	Error rate
Definition	Number of missing items in the dataset in relation to the number of items that should have been present.
Description	–
Evaluation scope	data set
Reporting scope	data set
Parameter	–
Data quality value type	Real, percentage, ratio (example: 0,0189 ; 98,11% ; 11:582)
Data quality value structure	–
Source reference	–
Example	–

7.1.3. Logical Consistency – Topological consistency

Recomendation 27



Topological consistency should be evaluated and documented using **Slivers** as specified in the tables below.

Name	Slivers
Alternative name	Slivers
Data quality element	Logical consistency
Data quality sub-element	Topological consistency
Data quality basic measure	Error rate
Definition	A sliver is an unintended area that occurs when adjacent surfaces are not digitized properly. The borders of the adjacent surfaces may unintentionally gap or overlap by small amounts to cause a topological error.
Description	<p>This data quality measure has 2 parameters:</p> <ul style="list-style-type: none"> • maximum sliver area size • thickness quotient <p>The thickness quotient shall be a real number between 0 and 1. This quotient is determined by the following formula:</p> <p>T is defined as: $T=4\pi \text{ area}/\text{perimeter}^2$</p> <p>T values are within [0,1]. 1 correspond a circle, and 0 to a line segment.</p> <p>The thickness quotient is independent of the size of the surface, and the closer the value is to 0, the thinner the selected sliver surfaces shall be. The maximum area determines the upper limit of a sliver. This is to prevent surfaces with sinuous perimeters and large areas from being mistaken as slivers.</p>
Evaluation scope	data set
Reporting scope	data set
Parameter	-
Data quality value type	Integer

Data quality value structure	-
Source reference	Environmental Systems Research Institute, Inc. (ESRI) GIS Data ReViewer 4.2 User Guide
Example	image::/media/image17.png[image,width=400,height=485, align=center]
Measure identifier	25

7.1.4. Positional accuracy – Absolute or external accuracy

Recomendation 28



Absolute or external accuracy should be evaluated and documented using **Positional accuracy** as specified in the tables below.

Name	Positional accuracy
Alternative name	-
Data quality element	Positional accuracy
Data quality sub-element	Absolute or external accuracy
Data quality basic measure	Not applicable
Definition	mean value of the positional uncertainties for a set of positions where the positional uncertainties are defined as the distance between a measured position and what is considered as the corresponding true position
Evaluation scope	data set
Reporting scope	data set

Description	<p>For a number of points (N), the measured positions are given as x_{mi}, y_{mi} and z_{mi} coordinates depending on the dimension in which the position of the point is measured. A corresponding set of coordinates, x_{ti}, y_{ti} and z_{ti}, are considered to represent the true positions. The errors are calculated as:</p> $1D: e_i = x_{mi} - x_{ti} $ $2D: e_i = \sqrt{(x_{mi} - x_{ti})^2 + (y_{mi} - y_{ti})^2}$ $3D: e_i = \sqrt{(x_{mi} - x_{ti})^2 + (y_{mi} - y_{ti})^2 + (z_{mi} - z_{ti})^2}$ <p>The mean positional uncertainties of the horizontal absolute or external positions are then calculated as</p> $\bar{e} = \frac{1}{N} \sum_{i=1}^N e_i$ <p>A criterion for the establishing of correspondence should also be stated (e.g. allowing for correspondence to the closest position, correspondence on vertices or along lines). The criterion/criteria for finding the corresponding points shall be reported with the data quality evaluation result. This data quality measure is different from the standard deviation.</p>
Parameter	-
Data quality value type	Measure
Data quality value structure	-
Source reference	-
Example	-
Measure identifier	28

7.1.5. Thematic accuracy – Classification correctness

Recomendation 29



Classification correctness should be evaluated and documented using **Thematic accuracy** as specified in the tables below.

Name	Thematic accuracy
------	-------------------

Alternative name	-
Data quality element	Thematic accuracy
Data quality sub-element	Classification correctness
Data quality basic measure	Error rate
Definition	Number of incorrectly classified features in relation to the number of features that are supposed to be there
Description	-
Evaluation scope	data set
Reporting scope	data set
Parameter	-
Data quality value type	real, percentage, ratio
Data quality value structure	-
Source reference	-
Example	-
Measure identifier	61

7.1.6. Temporal quality – Temporal validity

Recomendation 30



Temporal validity should be evaluated and documented using **Temporal accuracy** as specified in the tables below.

Name	Temporal accuracy
Alternative name	-
Data quality element	Temporal accuracy
Data quality sub-element	Temporal validity
Data quality basic measure	Correctness indicator
Definition	Indication of if an item is conforming to its value domain
Description	-
Evaluation scope	data set
Reporting scope	data set
Parameter	-
Data quality value type	Boolean (true indicates that an item is conforming to its value domain)

Data quality value structure	-
Source reference	-
Example	-
Measure identifier	15

7.2. Minimum data quality requirements

No minimum data quality requirements are defined for the spatial data theme *Statistical Units*.

7.3. Recommendation on data quality

No minimum data quality recommendations are defined.

8. Dataset-level metadata

This section specifies dataset-level metadata elements, which should be used for documenting metadata for a complete dataset or dataset series.

NOTE Metadata can also be reported for each individual spatial object (spatial object-level metadata). Spatial object-level metadata is fully described in the application schema(s) (section 5).

For some dataset-level metadata elements, in particular those for reporting data quality and maintenance, a more specific scope can be specified. This allows the definition of metadata at sub-dataset level, e.g. separately for each spatial object type (see instructions for the relevant metadata element).

8.1. Metadata elements defined in INSPIRE Metadata Regulation

Table 4 gives an overview of the metadata elements specified in Regulation 1205/2008/EC (implementing Directive 2007/2/EC of the European Parliament and of the Council as regards metadata).

The table contains the following information:

- The first column provides a reference to the relevant section in the Metadata Regulation, which contains a more detailed description.
- The second column specifies the name of the metadata element.
- The third column specifies the multiplicity.
- The fourth column specifies the condition, under which the given element becomes mandatory.

Table 4 – Metadata for spatial datasets and spatial dataset series specified in Regulation 1205/2008/EC

Metadata Regulation Section	Metadata element	Multiplicity	Condition
1.1	Resource title	1	
1.2	Resource abstract	1	
1.3	Resource type	1	
1.4	Resource locator	0..*	Mandatory if a URL is available to obtain more information on the resource, and/or access related services.
1.5	Unique resource identifier	1..*	

1.7	Resource language	0..*	Mandatory if the resource includes textual information.
2.1	Topic category	1..*	
3	Keyword	1..*	
4.1	Geographic bounding box	1..*	
5	Temporal reference	1..*	
6.1	Lineage	1	
6.2	Spatial resolution	0..*	Mandatory for data sets and data set series if an equivalent scale or a resolution distance can be specified.
7	Conformity	1..*	
8.1	Conditions for access and use	1..*	
8.2	Limitations on public access	1..*	
9	Responsible organisation	1..*	
10.1	Metadata point of contact	1..*	
10.2	Metadata date	1	
10.3	Metadata language	1	

Generic guidelines for implementing these elements using ISO 19115 and 19119 are available at <http://inspire.jrc.ec.europa.eu/index.cfm/pageid/101>. The following sections describe additional theme-specific recommendations and requirements for implementing these elements.

8.1.1. Conformity

The *Conformity* metadata element defined in Regulation 1205/2008/EC requires to report the conformance with the Implementing Rule for interoperability of spatial data sets and services. In addition, it may be used also to document the conformance to another specification.

Recomendation 7



Dataset metadata should include a statement on the overall conformance of the dataset with this data specification (i.e. conformance with all requirements).

Recomendation 8



The *Conformity* metadata element should be used to document conformance with this data specification (as a whole), with a specific conformance class defined in the Abstract Test Suite in Annex A and/or with another specification.

The *Conformity* element includes two sub-elements, the *Specification* (a citation of the Implementing Rule for interoperability of spatial data sets and services or other specification), and the *Degree* of conformance. The *Degree* can be *Conformant* (if the dataset is fully conformant with the cited specification), *Not Conformant* (if the dataset does not conform to the cited specification) or *Not Evaluated* (if the conformance has not been evaluated).

Recomendation 9



If a dataset is not yet conformant with all requirements of this data specification, it is recommended to include information on the conformance with the individual conformance classes specified in the Abstract Test Suite in Annex A.

Recomendation 10



If a dataset is produced or transformed according to an external specification that includes specific quality assurance procedures, the conformity with this specification should be documented using the *Conformity* metadata element.

Recomendation 11



If minimum data quality recommendations are defined then the statement on the conformity with these requirements should be included using the *Conformity* metadata element and referring to the relevant data quality conformance class in the Abstract Test Suite.

NOTE Currently no minimum data quality requirements are included in the IRs. The recommendation above should be included as a requirement in the IRs if minimum data quality requirements are defined at some point in the future.

Recomendation 12

When documenting conformance with this data specification or one of the conformance classes defined in the Abstract Test Suite, the *Specification* sub-element should be given using the http URI identifier of the conformance class or using a citation including the following elements:



- title: "INSPIRE Data Specification on *Statistical Units* – Draft Guidelines – <name of the conformance class>"
- date:
 - dateType: publication
 - date: 2013-04-10

EXAMPLE 1: The XML snippets below show how to fill the *Specification* sub-element for

documenting conformance with the whole data specification on Addresses v3.0.1.

```
<gmd:DQ_ConformanceResult>
  <gmd:specification href="http://inspire.ec.europa.eu/conformanceClass/ad/3.0.1/tg"
/>
  <gmd:explanation> (...)</gmd:explanation>
  <gmd:pass> (...)</gmd:pass>
</gmd:DQ_ConformanceResult>
```

or (using a citation):

```
<gmd:DQ_ConformanceResult>
  <gmd:specification>
    <gmd:CI_Citation>
      <gmd:title>
        <gco:CharacterString>INSPIRE Data Specification on Statistical Units □
Draft Guidelines</gco:CharacterString>
      </gmd:title>
      <gmd:date>
        <gmd:date>
          <gco:Date>2013-04-10</gco:Date>
        </gmd:date>
        <gmd:dateType>
          <gmd:CI_DateTypeCode
codeList="http://standards.iso.org/ittf/PubliclyAvailableStandards/ISO_19139_Schemas/r
esou
rces/Codelist/ML_gmxCodelists.xml#CI_DateTypeCode"
codeListValue="publication">publication</gmd:CI_DateTypeCode>
        </gmd:dateType>
      </gmd:date>
      </gmd:CI_Citation>
    </gmd:specification>
    <gmd:explanation> (...)</gmd:explanation>
    <gmd:pass> (...)</gmd:pass>
  </gmd:DQ_ConformanceResult>
```

EXAMPLE 2: The XML snippets below show how to fill the *Specification* sub-element for documenting conformance with the CRS conformance class of the data specification on Addresses v3.0.1.

```
<gmd:DQ_ConformanceResult>
  <gmd:specification
  href="http://inspire.ec.europa.eu/conformanceClass/ad/3.0.1/crs" />
  <gmd:explanation> (...)</gmd:explanation>
  <gmd:pass> (...)</gmd:pass>
</gmd:DQ_ConformanceResult>
```

or (using a citation):

```
<gmd:DQ_ConformanceResult>
  <gmd:specification>
    <gmd:CI_Citation>
      <gmd:title>
        <gco:CharacterString>INSPIRE Data Specification on Statistical Units □
Draft Guidelines □ CRS</gco:CharacterString>
      </gmd:title>
      <gmd:date>
        <gmd:date>
          <gco:Date>2013-04-10</gco:Date>
        </gmd:date>
        <gmd:dateType>
          <gmd:CI_DateTypeCode
codeList="http://standards.iso.org/ittf/PubliclyAvailableStandards/ISO_19139_Schemas/r
esou
rces/Codelist/ML_gmxCodeLists.xml#CI_DateTypeCode"
codeListValue="publication">publication</gmd:CI_DateTypeCode>
        </gmd:dateType>
      </gmd:date>
      </gmd:CI_Citation>
    </gmd:specification>
    <gmd:explanation> (...) </gmd:explanation>
    <gmd:pass> (...) </gmd:pass>
  </gmd:DQ_ConformanceResult>
```

8.1.2. Lineage

Recomendation 13



Following the ISO/DIS 19157 Quality principles, if a data provider has a procedure for the quality management of their spatial data sets then the appropriate data quality elements and measures defined in ISO/DIS 19157 should be used to evaluate and report (in the metadata) the results. If not, the *Lineage* metadata element (defined in Regulation 1205/2008/EC) should be used to describe the overall quality of a spatial data set.

According to Regulation 1205/2008/EC, lineage "is a statement on process history and/or overall quality of the spatial data set. Where appropriate it may include a statement whether the data set has been validated or quality assured, whether it is the official version (if multiple versions exist), and whether it has legal validity. The value domain of this metadata element is free text".

The Metadata Technical Guidelines based on EN ISO 19115 and EN ISO 19119 specifies that the statement sub-element of LI_Lineage (EN ISO 19115) should be used to implement the lineage metadata element.



Recomendation 14

To describe the transformation steps and related source data, it is recommended to use the following sub-elements of LI_Lineage:

- For the description of the transformation process of the local to the common INSPIRE data structures, the LI_ProcessStep sub-element should be used.
- For the description of the source data the LI_Source sub-element should be used.

NOTE 1 In order to improve the interoperability, domain templates and instructions for using these free text elements (descriptive statements) may be specified here and/or in an Annex of this data specification.

8.1.3. Temporal reference

According to Regulation 1205/2008/EC, at least one of the following temporal reference metadata sub-elements shall be provided: temporal extent, date of publication, date of last revision, date of creation.

Recomendation 15



It is recommended that at least the date of the last revision of a spatial data set should be reported using the *Date of last revision* metadata sub-element.

8.2. Metadata elements for interoperability

IR Requirement

Article 13

Metadata required for Interoperability

The metadata describing a spatial data set shall include the following metadata elements required for interoperability:

1. Coordinate Reference System: Description of the coordinate reference system(s) used in the data set.
2. Temporal Reference System: Description of the temporal reference system(s) used in the data set.



This element is mandatory only if the spatial data set contains temporal information that does not refer to the default temporal reference system.

3. Encoding: Description of the computer language construct(s) specifying the representation of data objects in a record, file, message, storage device or transmission channel.
4. Topological Consistency: Correctness of the explicitly encoded topological characteristics of the data set as described by the scope.

This element is mandatory only if the data set includes types from the Generic

Network Model and does not assure centreline topology (connectivity of centrelines) for the network.

5. Character Encoding: The character encoding used in the data set.

This element is mandatory only if an encoding is used that is not based on UTF-8.

6. Spatial Representation Type: The method used to spatially represent geographic information.

These Technical Guidelines propose to implement the required metadata elements based on ISO 19115 and ISO/TS 19139.

The following TG requirements need to be met in order to be conformant with the proposed encoding.

TG Requirement 4



Metadata instance (XML) documents shall validate without error against the used ISO 19139 XML schema.

NOTE Section 2.1.2 of the Metadata Technical Guidelines discusses the different ISO 19139 XML schemas that are currently available.

TG Requirement 5



Metadata instance (XML) documents shall contain the elements and meet the INSPIRE multiplicity specified in the sections below.

TG Requirement 6



The elements specified below shall be available in the specified ISO/TS 19139 path.

Recomendation 16



The metadata elements for interoperability should be made available together with the metadata elements defined in the Metadata Regulation through an INSPIRE discovery service.

NOTE While this is not explicitly required by any of the INSPIRE Implementing Rules, making all metadata of a data set available together and through one service simplifies implementation and usability.

8.2.1. Coordinate Reference System

Metadata element name	Coordinate Reference System
Definition	Description of the coordinate reference system used in the dataset.
ISO 19115 number and name	13. referenceSystemInfo
ISO/TS 19139 path	referenceSystemInfo
INSPIRE obligation / condition	mandatory
INSPIRE multiplicity	1..*
Data type(and ISO 19115 no.)	186. MD_ReferenceSystem
Domain	<p>To identify the reference system, the referenceSystemIdentifier (RS_Identifier) shall be provided.</p> <p>NOTE More specific instructions, in particular on pre-defined values for filling the referenceSystemIdentifier attribute should be agreed among Member States during the implementation phase to support interoperability.</p>
Implementing instructions	
Example	<p>referenceSystemIdentifier:</p> <p>code: ETRS_89</p> <p>codeSpace: INSPIRE RS registry</p>
Example XML encoding	<pre> <gmd:referenceSystemInfo> <gmd:MD_ReferenceSystem> <gmd:referenceSystemIdentifier> <gmd:RS_Identifier> <gmd:code> <gco:CharacterString>ETRS89 </gco:CharacterString> </gmd:code> <gmd:codeSpace> <gco:CharacterString>INSPIRE RS registry</gco:CharacterString> </gmd:codeSpace> </gmd:RS_Identifier> </gmd:referenceSystemIdentifier> </gmd:MD_ReferenceSystem> </gmd:referenceSystemInfo> </pre>

Metadata element name	Coordinate Reference System
Comments	

8.2.2. Temporal Reference System

Metadata element name	Temporal Reference System
Definition	Description of the temporal reference systems used in the dataset.
ISO 19115 number and name	13. referenceSystemInfo
ISO/TS 19139 path	referenceSystemInfo
INSPIRE obligation / condition	Mandatory, if the spatial data set or one of its feature types contains temporal information that does not refer to the Gregorian Calendar or the Coordinated Universal Time.
INSPIRE multiplicity	0..*
Data type(and ISO 19115 no.)	186. MD_ReferenceSystem
Domain	No specific type is defined in ISO 19115 for temporal reference systems. Thus, the generic MD_ReferenceSystem element and its reference SystemIdentifier (RS_Identifier) property shall be provided. NOTE More specific instructions, in particular on pre-defined values for filling the referenceSystemIdentifier attribute should be agreed among Member States during the implementation phase to support interoperability.
Implementing instructions	
Example	referenceSystemIdentifier: code: GregorianCalendar codeSpace: INSPIRE RS registry

Metadata element name	Temporal Reference System
Example XML encoding	<pre> <gmd:referenceSystemInfo> <gmd:MD_ReferenceSystem> <gmd:referenceSystemIdentifier> <gmd:RS_Identifier> <gmd:code></pre> <p style="margin-left: 40px;"><code><gco:CharacterString>GregorianCalendar</gco:CharacterString></gmd:code><gmd:codeSpace></code></p> <p style="margin-left: 40px;"><code><gco:CharacterString>INSPIRE RS registry</gco:CharacterString></gmd:codeSpace></gmd:RS_Identifier></gmd:referenceSystemIdentifier></gmd:MD_ReferenceSystem></code></p> <pre></gmd:referenceSystemInfo></pre>
Comments	

8.2.3. Encoding

Metadata element name	Encoding
Definition	Description of the computer language construct that specifies the representation of data objects in a record, file, message, storage device or transmission channel
ISO 19115 number and name	271. distributionFormat
ISO/TS 19139 path	distributionInfo/MD_Distribution/distributionFormat
INSPIRE obligation / condition	mandatory
INSPIRE multiplicity	1
Data type (and ISO 19115 no.)	284. MD_Format
Domain	See B.2.10.4. The property values (name, version, specification) specified in section 5 shall be used to document the default and alternative encodings.
Implementing instructions	

Metadata element name	Encoding
Example	<p>name: <Application schema name> GML application schema</p> <p>version: version 3.0</p> <p>specification: D2.8.III.1 Data Specification on <i>Statistical Units</i> – Technical Guidelines</p>
Example XML encoding	<pre><gmd:MD_Format> <gmd:name> <gco:CharacterString>SomeApplicationSche ma GML application schema</gco:CharacterString> </gmd:name> <gmd:version> <gco:CharacterString>3.0</gco:CharacterS tring> </gmd:version> <gmd:specification> <gco:CharacterString>D2.8.III.1 Data Specification on Statistical Units Technical Guidelines</gco:CharacterString> </gmd:specification> </gmd:MD_Format></pre>
Comments	

8.2.4. Character Encoding

Metadata element name	Character Encoding
Definition	The character encoding used in the data set.
ISO 19115 number and name	
ISO/TS 19139 path	
INSPIRE obligation / condition	Mandatory, if an encoding is used that is not based on UTF-8.
INSPIRE multiplicity	0..*
Data type (and ISO 19115 no.)	
Domain	
Implementing instructions	
Example	-

Metadata element name	Character Encoding
Example XML encoding	<pre><gmd:characterSet> <gmd:MD_CharacterSetCode codeListValue="8859part2" codeList="http://standards.iso.org/ittf/ PubliclyAvailableStandards/ISO_19139_Sch emas/resources/Codelist/ML_gmxCodeLists. xml#CharacterSetCode">8859- 2</gmd:MD_CharacterSetCode> </gmd:characterSet></pre>
Comments	

8.2.5. Spatial representation type

Metadata element name	Spatial representation type
Definition	The method used to spatially represent geographic information.
ISO 19115 number and name	37. spatialRepresentationType
ISO/TS 19139 path	
INSPIRE obligation / condition	Mandatory
INSPIRE multiplicity	1..*
Data type (and ISO 19115 no.)	B.5.26 MD_SpatialRepresentationTypeCode
Domain	
Implementing instructions	<p>Of the values included in the code list in ISO 19115 (vector, grid, textTable, tin, stereoModel, video), only vector, grid and tin should be used.</p> <p>NOTE Additional code list values may be defined based on feedback from implementation.</p>
Example	-
Example XML encoding	
Comments	

8.2.6. Data Quality – Logical Consistency – Topological Consistency

See section 8.3.2 for instructions on how to implement metadata elements for reporting data quality.

8.3. Recommended theme-specific metadata elements



The metadata describing a spatial data set or a spatial data set series related to the theme *Statistical Units* should comprise the theme-specific metadata elements specified in Table 5.

The table contains the following information:

- The first column provides a reference to a more detailed description.
- The second column specifies the name of the metadata element.
- The third column specifies the multiplicity.

Table 5 – Optional theme-specific metadata elements for the theme *Statistical Units*

Section	Metadata element	Multiplicity
8.3.1	Maintenance Information	0..1
8.3.2	Logical Consistency – Conceptual Consistency	0..*
8.3.2	Logical Consistency – Domain Consistency	0..*
8.3.2	Completeness – Commission	0..1
8.3.2	Completeness – Omission	0..1
8.3.2	Logical consistency - Topological consistency	0..1
8.3.2	Positional accuracy - Absolute or external accuracy	0..1
8.3.2	Thematic accuracy - Classification correctness	0..1
8.3.2	Temporal quality - Temporal validity	0..1

Recomendation 18



For implementing the metadata elements included in this section using ISO 19115, ISO/DIS 19157 and ISO/TS 19139, the instructions included in the relevant sub-sections should be followed.

8.3.1. Maintenance Information

Metadata element name	Maintenance information
Definition	Information about the scope and frequency of updating
ISO 19115 number and name	30. resourceMaintenance

Metadata element name	Maintenance information
ISO/TS 19139 path	identificationInfo/MD_Identification/resourceMaintenance
INSPIRE obligation / condition	optional
INSPIRE multiplicity	0..1
Data type(and ISO 19115 no.)	142. MD_MaintenanceInformation
Domain	<p>This is a complex type (lines 143-148 from ISO 19115).</p> <p>At least the following elements should be used (the multiplicity according to ISO 19115 is shown in parentheses):</p> <ul style="list-style-type: none"> • maintenanceAndUpdateFrequency [1]: frequency with which changes and additions are made to the resource after the initial resource is completed / domain value: MD_MaintenanceFrequencyCode: • updateScope [0..*]: scope of data to which maintenance is applied / domain value: MD_ScopeCode • maintenanceNote [0..*]: information regarding specific requirements for maintaining the resource / domain value: free text
Implementing instructions	
Example	
Example XML encoding	
Comments	

8.3.2. Metadata elements for reporting data quality

Recomendation 19



For reporting the results of the data quality evaluation, the data quality elements, sub-elements and (for quantitative evaluation) measures defined in chapter 7 should be used.

Recomendation 20



The metadata elements specified in the following sections should be used to report the results of the data quality evaluation. At least the information included in the row "Implementation instructions" should be provided.

The first section applies to reporting quantitative results (using the element DQ_QuantitativeResult), while the second section applies to reporting non-quantitative results (using the element DQ_DescriptiveResult).

Recomendation 21



If a dataset does not pass the tests of the Application schema conformance class (defined in Annex A), the results of each test should be reported using one of the options described in sections 8.3.2.1 and 8.3.2.2.

NOTE 1 If using non-quantitative description, the results of several tests do not have to be reported separately, but may be combined into one descriptive statement.

NOTE 2 The sections 8.3.2.1 and 8.3.2.2 may need to be updated once the XML schemas for ISO 19157 have been finalised.

The scope for reporting may be different from the scope for evaluating data quality (see section 7). If data quality is reported at the data set or spatial object type level, the results are usually derived or aggregated.

Recomendation 22

The scope element (of type DQ_Scope) of the DQ_DataQuality subtype should be used to encode the reporting scope.



Only the following values should be used for the level element of DQ_Scope: Series, Dataset, featureType.

If the level is featureType the levelDescription/MDScopeDescription/features element (of type Set< GF_FeatureType>) shall be used to list the feature type names.

NOTE In the level element of DQ_Scope, the value featureType is used to denote spatial object type.

8.3.2.1. Guidelines for reporting quantitative results of the data quality evaluation

Metadata element name	See chapter 7
Definition	See chapter 7
ISO/DIS 19157 number and name	3. report
ISO/TS 19139 path	dataQualityInfo/*/report
INSPIRE obligation / condition	optional
INSPIRE multiplicity	0..*
Data type (and ISO/DIS 19157 no.)	Corresponding DQ_xxx subelement from ISO/DIS 19157, e.g. 12. DQ_CompletenessCommission

Metadata element name	See chapter 7
Domain	<p>Lines 7-9 from ISO/DIS 19157</p> <p>7. DQ_MeasureReference (C.2.1.3)</p> <p>8. DQ_EvaluationMethod (C.2.1.4.)</p> <p>9. DQ_Result (C2.1.5.)</p>
Implementing instructions	<p>39. nameOfMeasure</p> <p>NOTE This should be the name as defined in Chapter 7.</p> <p>42. evaluationMethodType</p> <p>43. evaluationMethodDescription</p> <p>NOTE If the reported data quality results are derived or aggregated (i.e. the scope levels for evaluation and reporting are different), the derivation or aggregation should also be specified using this property.</p> <p>46. dateTime</p> <p>NOTE This should be data or range of dates on which the data quality measure was applied.</p> <p>63. DQ_QuantitativeResult / 64. value</p> <p>NOTE The DQ_Result type should be DQ_QuantitativeResult and the value(s) represent(s) the application of the data quality measure (39.) using the specified evaluation method (42-43.)</p>
Example	See Table E.12 — Reporting commission as metadata (ISO/DIS 19157)
Example XML encoding	

8.3.2.2. Guidelines for reporting descriptive results of the Data Quality evaluation

Metadata element name	See chapter 7
Definition	See chapter 7
ISO/DIS 19157 number and name	3. report
ISO/TS 19139 path	dataQualityInfo/*/report
INSPIRE obligation / condition	optional
INSPIRE multiplicity	0..*

Metadata element name	See chapter 7
Data type (and ISO/DIS 19157 no.)	Corresponding DQ_xxx subelement from ISO/DIS 19157, e.g. 12. DQ_CompletenessCommission
Domain	Line 9 from ISO/DIS 19157 9. DQ_Result (C2.1.5.)
Implementing instructions	67. DQ_DescriptiveResult / 68. statement NOTE The DQ_Result type should be DQ_DescriptiveResult and in the statement (68.) the evaluation of the selected DQ sub-element should be expressed in a narrative way.
Example	See Table E.15 — Reporting descriptive result as metadata (ISO/DIS 19157)
Example XML encoding	

9. Delivery

9.1. Updates

IR Requirement

Article 8

Updates



1. Member States shall make available updates of data on a regular basis.
2. All updates shall be made available at the latest 6 months after the change was applied in the source data set, unless a different period is specified for a specific spatial data theme in Annex II.

NOTE In this data specification, no exception is specified, so all updates shall be made available at the latest 6 months after the change was applied in the source data set.

9.2. Delivery medium

According to Article 11(1) of the INSPIRE Directive, Member States shall establish and operate a network of services for INSPIRE spatial data sets and services. The relevant network service types for making spatial data available are:

- *view services* making it possible, as a minimum, to display, navigate, zoom in/out, pan, or overlay viewable spatial data sets and to display legend information and any relevant content of metadata;
- *download services*, enabling copies of spatial data sets, or parts of such sets, to be downloaded and, where practicable, accessed directly;

- *transformation services*, enabling spatial data sets to be transformed with a view to achieving interoperability.

NOTE For the relevant requirements and recommendations for network services, see the relevant Implementing Rules and Technical Guidelines^[15].

EXAMPLE 1 Through the Get Spatial Objects function, a download service can either download a pre-defined data set or pre-defined part of a data set (non-direct access download service), or give direct access to the spatial objects contained in the data set, and download selections of spatial objects based upon a query (direct access download service). To execute such a request, some of the following information might be required:

- the list of spatial object types and/or predefined data sets that are offered by the download service (to be provided through the Get Download Service Metadata operation),
- and the query capabilities section advertising the types of predicates that may be used to form a query expression (to be provided through the Get Download Service Metadata operation, where applicable),
- a description of spatial object types offered by a download service instance (to be provided through the Describe Spatial Object Types operation).

EXAMPLE 2 Through the Transform function, a transformation service carries out data content transformations from native data forms to the INSPIRE-compliant form and vice versa. If this operation is directly called by an application to transform source data (e.g. obtained through a download service) that is not yet conformant with this data specification, the following parameters are required:

Input data (mandatory). The data set to be transformed.

- Source model (mandatory, if cannot be determined from the input data). The model in which the input data is provided.
- Target model (mandatory). The model in which the results are expected.
- Model mapping (mandatory, unless a default exists). Detailed description of how the transformation is to be carried out.

9.3. Encodings

The IRs contain the following two requirements for the encoding to be used to make data available.

IR Requirement

Article 7

Encoding



1. Every encoding rule used to encode spatial data shall conform to EN ISO 19118. In particular, it shall specify schema conversion rules for all spatial object types and all attributes and association roles and the output data structure used.
2. Every encoding rule used to encode spatial data shall be made available.

NOTE ISO 19118:2011 specifies the requirements for defining encoding rules used for interchange of geographic data within the set of International Standards known as the "ISO 19100 series". An encoding rule allows geographic information defined by application schemas and standardized schemas to be coded into a system-independent data structure suitable for transport and storage. The encoding rule specifies the types of data being coded and the syntax, structure and coding schemes used in the resulting data structure. Specifically, ISO 19118:2011 includes

- requirements for creating encoding rules based on UML schemas,
- requirements for creating encoding services, and
- requirements for XML-based encoding rules for neutral interchange of data.

While the IRs do not oblige the usage of a specific encoding, these Technical Guidelines propose to make data related to the spatial data theme *Statistical Units* available at least in the default encoding(s) specified in section 0. In this section, a number of TG requirements are listed that need to be met in order to be conformant with the default encoding(s).

The proposed default encoding(s) meet the requirements in Article 7 of the IRs, i.e. they are conformant with ISO 19118 and (since they are included in this specification) publicly available.

9.3.1. Default Encoding(s)

9.3.1.1. Specific requirements for GML encoding

This data specification proposes the use of GML as the default encoding, as recommended in sections 7.2 and 7.3 of [DS-D2.7]. GML is an XML encoding in compliance with ISO 19118, as required in Article 7(1). For details, see [ISO 19136], and in particular Annex E (UML-to-GML application schema encoding rules).

The following TG requirements need to be met in order to be conformant with GML encodings.



TG Requirement 7

Data instance (XML) documents shall validate without error against the provided XML schema.

NOTE 1 Not all constraints defined in the application schemas can be mapped to XML. Therefore, the following requirement is necessary.

NOTE 2 The obligation to use only the allowed code list values specified for attributes and most of the constraints defined in the application schemas cannot be mapped to the XML sch. They can therefore not be enforced through schema validation. It may be possible to express some of these constraints using other schema or rule languages (e.g. Schematron), in order to enable automatic validation.

9.3.1.2. Default encoding(s) for application schema StatisticalUnits

Name: StatisticalUnits GML Application Schema

Version: version 3.0,

Character set: UTF-8

The xml schemata document are available on the INSPIRE websites

<http://inspire.jrc.ec.europa.eu/schemas/su-core/>

<http://inspire.jrc.ec.europa.eu/schemas/su-grid/>

<http://inspire.jrc.ec.europa.eu/schemas/su-nuts/>

<http://inspire.jrc.ec.europa.eu/schemas/su-ua/>

<http://inspire.jrc.ec.europa.eu/schemas/su-vector/>

9.3.2. Recommended Encoding(s)

Recomendation 23



It is recommended that also the encodings specified in this section be provided for the relevant application schemas.

9.3.2.1. Alternative encoding for application schema StatisticalUnits

Grids encoding

For statistical data disseminated on grids, the following encodings are recommended:

Recomendation 31



The recommended encodings for statistical data disseminated on grids are: GeoTIFF, netCDF, GRIB, BUFR and JPEG2000.

Statistical data encoding

Even if the encoding of statistical data to be linked to statistical units is out of the scope of this document, some recommendations on this topic are given in annex D.1.

Association encoding

Recomendation 32



Associations and references toward a statistical unit should be encoded using either its INSPIRE identifier or a thematic identifier.

EXAMPLE: The area statistical units composing a statistical tessellation (see the role *units* of the *Tesselation* association) may be represented as a list of their thematic identifiers.

NOTE This recommendation is consistent with the recommendations provided in annex D regarding the linking from statistical data to statistical units.

10. Data Capture

There is no specific guidance required with respect to data capture.

11. Portrayal

This clause defines the rules for layers and styles to be used for portrayal of the spatial object types defined for this theme. Portrayal is regulated in Article 14 of the IRs.

IR Requirement

Article 14

Portrayal

1. For the portrayal of spatial data sets using a view network service as specified in Commission Regulation No 976/2009 (^[16]), the following shall be available:
 - a. the layers specified in Annex II for the theme or themes the data set is related to;
 - b. for each layer at least a default portrayal style, with as a minimum an associated title and a unique identifier.
2. For each layer, Annex II defines the following:
 - a. a human readable title of the layer to be used for display in user interface;
 - b. the spatial object type(s), or sub-set thereof, that constitute(s) the content of the layer.



In section 11.1, the *types* of layers are defined that are to be used for the portrayal of the spatial object types defined in this specification. A view service may offer several layers of the same type, one for each dataset that it offers data on a specific topic.

NOTE The layer specification in the IRs only contains the name, a human readable title and the (subset(s) of) spatial object type(s), that constitute(s) the content of the layer. In addition, this TG documents suggests keywords for describing the layer.

Recomendation 24



It is recommended to use the keywords specified in section 11.1 in the *Layers Metadata parameters* of the INSPIRE View service (see Annex III, Part A, section 2.2.4 in Commission Regulation (EC) No 976/2009).

Section 11.2 specifies one style for each of these layers. It is proposed that INSPIRE view services support this style as the default style required by Article 14(1b).

TG Requirement 8



For each layer specified in this section, the styles defined in section 11.2 shall be available.

NOTE The default style should be used for portrayal by the view network service if no user-defined style is specified in a portrayal request for a specific layer.

In section 11.2.1, further styles can be specified that represent examples of styles typically used in a thematic domain. It is recommended that also these styles should be supported by INSPIRE view services, where applicable.

Recomendation 25



In addition, it is recommended that, where applicable, INSPIRE view services also support the styles defined in section 11.2.1.

Where XML fragments are used in the following sections, the following namespace prefixes apply:

- sld="http://www.opengis.net/sld" (WMS/SLD 1.1)
- se="http://www.opengis.net/se" (SE 1.1)
- ogc="http://www.opengis.net/ogc" (FE 1.1)

11.1. Layers to be provided by INSPIRE view services

Layer Name	Layer Title	Spatial object type(s)	Keywords
SU.VectorStatisticalUnit	Vector statistical units	VectorStatisticalUnit	
SU.StatisticalGridCell	Statistical grid cells	StatisticalGridCell	

NOTE The table above contains several layers for some spatial object types, which can be further classified using a code list-valued attribute. Such sets of layers are specified as described in Article 14(3) of the IRs.

IR Requirement
Article 14
Portrayal

(...)



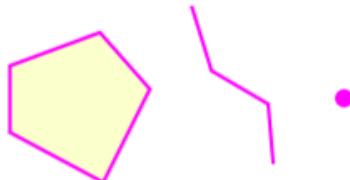
3. For spatial object types whose objects can be further classified using a code list-valued attribute, several layers may be defined. Each of these layers shall include the spatial objects corresponding to one specific code list value. In the definition of such sets of layers in Annexes II-IV,
 - a. the placeholder <CodeListValue> shall represent the values of the relevant code list, with the first letter in upper case,
 - b. the placeholder <human-readable name> shall represent the human-readable name of the code list values;
 - c. the spatial object type shall include the relevant attribute and code list, in parentheses;
 - d. one example of a layer shall be given.

11.1.1. Layers organisation

None.

11.2. Styles required to be supported by INSPIRE view services

11.2.1. Styles for the layer SU.VectorStatisticalUnits

Style Name	SU.VectorStatisticalUnits
Default Style	Yes
Style Title	Vector statistical units default style.
Style Abstract	<p>The default style for vector statistical units draws the statistical unit reference geometry with a style depending on the geometry type.</p> <p>For surface geometries:</p> <p>Fill colour: light yellow, transparency 0.2 (RGBA 228 255 0 51)</p> <p>Outline colour: solid, magenta (RGB 255 0 255)</p> <p>Outline width: 3pt</p> <p>For linear geometries:</p> <p>Colour: solid, magenta (RGB 255 0 255)</p> <p>Outline width: 3pt</p> <p>For punctual geometries:</p> <p>Style: circle</p> <p>Fill colour: solid, magenta (RGB 255 0 255)</p> <p>Width: 3pt</p> <p>Examples:</p> 

Style Name Symbology	SU.VectorStatisticalUnits <pre> <sld:NamedLayer> <se:Name>SU.VectorStatisticalUnits</se:Name> <sld:UserStyle> <se:Name>SU.VectorStatisticalUnits.Default</se:Name> <sld:IsDefault>1</sld:IsDefault> <se:FeatureTypeStyle version="1.1.0"> <se:Description> <se:Title>Vector statistical units default Style</se:Title> <se:Abstract></se:Abstract> </se:Description> <se:FeatureTypeName>SU.VectorStatistical Units</se:FeatureTypeName> </pre> <pre> <Rule> <se:Filter> <se:And> <se:PropertyIsEqualTo> <se:Function name="in2"> <se:Function name="geometryType"> <se:PropertyName>geometries.geometry</se:PropertyName> </se:Function> <se:Literal>Polygon</se:Literal> <se:Literal>MultiPolygon</se:Literal> </se:Function> <se:Literal>true</se:Literal> </se:PropertyIsEqualTo> <se:PropertyIsEqualTo> <se:ValueReference> geometries.geometryDescriptor.geometryType</se:ValueReference> <se:Literal>referenceGeometry</se:Literal> </se:PropertyIsEqualTo> </se:And> </se:Filter> <se:PolygonSymbolizer> <se:Geometry></pre>
---------------------------------------	---

Style Name	SU.VectorStatisticalUnits
Minimum & maximum scales	No scale limits.

11.2.2. Styles for the layer SU.StatisticalGridCell

Style Name	SU.StatisticalGridCell
Default Style	Yes
Style Title	Statistical grid cell default style.
Style Abstract	<p>The default style for Statistical grid cells draws the grid cell polygonal geometry with a light yellow transparent fill.</p> <p>For surface geometries:</p> <p>Fill colour: light yellow, transparency 0.2 (RGBA 228 255 0 51)</p> <p>Examples:</p> 

Style Name	SU.StatisticalGridCell
Symbology	<pre> <sld:NamedLayer> <se:Name>SU.StatisticalGridCell</se:Name> <sld:UserStyle> <se:Name>SU.StatisticalGridCell.Default</se:Name> <sld:IsDefault>1</sld:IsDefault> <se:FeatureTypeStyle version="1.1.0"> <se:Description> <se:Title>Statistical grid cell default Style</se:Title> <se:Abstract></se:Abstract> </se:Description> <se:FeatureTypeName>SU.StatisticalGridCell </se:FeatureTypeName> <Rule> <se:PolygonSymbolizer> <se:Geometry> <ogc:PropertyName>geometry</ogc:PropertyName> </se:Geometry> <se:Fill> <se:SvgParameter name="fill">#e4ff00</se:SvgParameter> <se:SvgParameter name="fill-opacity"> <se:Literal>0.2</se:Literal> </se:SvgParameter> </se:Fill> </se:PolygonSymbolizer> </Rule> </se:FeatureTypeStyle> </sld:UserStyle> </sld:NamedLayer> </pre>
Minimum & maximum scales	No scale limits.

11.3. Styles recommended to be supported by INSPIRE view services

11.3.1. Styles for the layer SU.VectorStatisticalUnits

Style Name	SU.VectorStatisticalUnits.X
Style Title	Vector statistical units style.
Style Abstract	Vector statistical unit can have several geometrical representations. Each geometrical representation can be described according to the scale range it is suitable for. This style consists in displaying the suitable geometrical representation according to the visualisation scale.
Symbolology	-
Minimum & maximum scales	Depending on the scale range specified in the <i>GeneralisedGeometryDescriptor</i> .

11.3.2. Styles for the layer SU.StatisticalGridCell

Style Name	SU.StatisticalGridCell.X
Style Title	Statistical grid cell style.
Style Abstract	Statistical grids are organised into multi-resolution hierarchical structures. This style consists in displaying the suitable grid according to the visualisation scale: High resolution grids should be displayed for more detailed scales, while low resolution should be for less detailed scales.
Symbolology	-
Minimum & maximum scales	A grid cell should be displayed if its resolution is comparable to the display screen resolution.

Bibliography

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[DS-D2.5] INSPIRE DS-D2.5, Generic Conceptual Model, v3.3, http://inspire.jrc.ec.europa.eu/documents/Data_Specifications/D2.5_v3_3.pdf

[DS-D2.6] INSPIRE DS-D2.6, Methodology for the development of data specifications, v3.0, http://inspire.jrc.ec.europa.eu/reports/ImplementingRules/DataSpecifications/D2.6_v3.0.pdf

[DS-D2.7] INSPIRE DS-D2.7, Guidelines for the encoding of spatial data, v3.2, http://inspire.jrc.ec.europa.eu/documents/Data_Specifications/D2.7_v3.2.pdf

Norwegian feature catalogue including a UML application schema for administrative and statistical units. <http://www.statkart.no/sosi/UMLfullmodell/ABAS/abas.htm>

Regulation (EC) No 1059/2003 of the European Parliament and of the Council of 16 May 2003 on the establishment of a common classification system of territorial units for statistics (NUTS), OJ L 154, 21.06.2003, p.1

SDMX (Statistical Data and Metadata Exchange)

<http://sdmx.org/>

SIGMA-TER project (Italy): DBTI (DataBase Territoriale Integrato): modello dati.

<http://www.sigmater.it/>

Tandem project

<http://www.tandemproject.com/>

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Toward an approach of time series data issue: from empirical methods to applications. Technical report of ESPON project, 31 pages. <http://www.espon.eu/>

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Georeferenced Table Joining Service Implementation Standard, OpenGIS standard 10-070r2

Annex A: Abstract Test Suite - (normative)

Disclaimer

While this Annex refers to the Commission Regulation (EU) No 1089/2010 of 23 November 2010 implementing Directive 2007/2/EC of the European Parliament and of the Council as regards interoperability of spatial data sets and services, it does not replace the legal act or any part of it.

The objective of the Abstract Test Suite (ATS) included in this Annex is to help the conformance testing process. It includes a set of tests to be applied on a data set to evaluate whether it fulfils the requirements included in this data specification and the corresponding parts of Commission Regulation No 1089/2010 (implementing rule as regards interoperability of spatial datasets and services, further referred to as ISDSS Regulation). This is to help data providers in declaring the conformity of a data set to the "degree of conformity, with implementing rules adopted under Article 7(1) of Directive 2007/2/EC", which is required to be provided in the data set metadata according to Commission Regulation (EC) No 2008/1205 (the Metadata Regulation).

Part 1 of this ATS includes tests that provide **input for assessing conformity with the ISDSS regulation**. In order to make visible which requirements are addressed by a specific test, references to the corresponding articles of the legal act are given. The way how the cited requirements apply to su specification is described under the testing method.

In addition to the requirements included in ISDSS Regulation this Technical guideline contains TG requirements too. TG requirements are technical provisions that need to be fulfilled in order to be conformant with the corresponding IR requirement when the specific technical implementation proposed in this document is used. Such requirements relate for example to the default encoding described in section 9. **Part 2** of the ATS presents tests necessary for assessing the **conformity with TG requirements**.

NOTE Conformance of a data set with the TG requirement(s) included in this ATS implies conformance with the corresponding IR requirement(s).

The **ATS is applicable to the data sets that have been transformed** to be made available through INSPIRE download services (i.e. the data returned as a response to the mandatory "Get Spatial Dataset" operation) rather than the original "source" data sets.

The requirements to be tested are grouped in several *conformance classes*. Each of these classes covers a specific aspect: one conformance class contains tests reflecting the requirements on the application schema, another on the reference systems, etc. **Each conformance class is identified by a URI** (uniform resource identifier) according to the following pattern:

<http://inspire.ec.europa.eu/conformance-class/ir/su/<conformance class identifier>>

EXAMPLE 1 The URI <http://inspire.ec.europa.eu/conformance-class/ir/ef/rs> identifies the Reference Systems ISDSS conformance class of the Environmental Monitoring Facilities (EF) data theme.

The results of the tests should be published referring to the relevant conformance class (using its URI).

When an INSPIRE data specification contains **more than one application schema**, the

requirements tested in a conformance class may differ depending on the application schema used as a target for the transformation of the data set. This will always be the case for the application schema conformance class. However, also other conformance classes could have different requirements for different application schemas. In such cases, a separate conformance class is defined for each application schema, and they are distinguished by specific URIs according to the following pattern:

<http://inspire.ec.europa.eu/conformance-class/ir/su/<conformance class identifier>/<application schema namespace prefix>>

EXAMPLE 2 The URI <http://inspire.ec.europa.eu/conformance-class/ir/el/as/el-vec> identifies the conformity with the application schema (as) conformance class for the Elevation Vector Elements (*el-vec*) application schema.

An overview of the conformance classes and the associated tests is given in the table below.

A.1 Application Schema Conformance Class
A.1.1 Schema element denomination test
A.1.2 Value test
A.1.3 Attributes/associations completeness test
A.1.4 Abstract spatial object test
A.1.5 Constraints test
A.1.6 Geometry representation test
A.2 Reference Systems Conformance Class
A.2.1 Datum test
A.2.2 Coordinate reference system test
A.2.3 Grid test
A.2.4 View service coordinate reference system test
A.2.5 Temporal reference system test
A.2.6 Units of measurements test
A.3 Data Consistency Conformance Class
A.3.1 Unique identifier persistency test
A.3.2 Version consistency test
A.3.3 Life cycle time sequence test
A.3.4 Validity time sequence test
A.3.5 Update frequency test
A.4 Metadata IR Conformance Class
A.4.1 Metadata for interoperability test

A.5 Information Accessibility Conformance Class

A.5.1 Code list publication test

A.5.2 CRS publication test

A.5.3 CRS identification test

A.5.4 Grid identification test

A.6 Data Delivery Conformance Class

A.6.1 Encoding compliance test

A.7 Portrayal Conformance Class

A.7.1 Layer designation test

A.8 Technical Guideline Conformance Class

A.8.1 Multiplicity test

A.8.2 CRS http URI test

A.8.3 Metadata encoding schema validation test

A.8.4 Metadata occurrence test

A.8.5 Metadata consistency test

A.8.6 Encoding schema validation test

A.8.7 Style test

In order to be conformant to a conformance class, a data set has to pass **all** tests defined for that conformance class.

In order to be conformant with the ISDSS regulation the inspected data set needs to be conformant to **all** conformance classes in Part 1. The conformance class for overall conformity with the ISDSS regulation is identified by the URI <http://inspire.ec.europa.eu/conformance-class/ir/su/>.

In order to be conformant with the Technical Guidelines, the dataset under inspection needs to be conformant to all conformance classes included both in Part 1 and 2. Chapter 8 describes in detail how to publish the result of testing regarding overall conformity and conformity with the conformance classes as metadata. The conformance class for overall conformity with the Technical Guidelines is identified by the URI <http://inspire.ec.europa.eu/conformance-class/tg/su/3.0>.

It should be noted that data providers are not obliged to integrate / decompose the original structure of the source data sets when they deliver them for INSPIRE. It means that a conformant dataset can contain less or more spatial object / data types than specified in the ISDSS Regulation.

A dataset that contains less spatial object and/or data types can be regarded conformant when the corresponding types of the source datasets after the necessary transformations fulfil the requirements set out in the ISDSS Regulation.

A dataset that contain more spatial object and/or data types may be regarded as conformant when

- all the spatial object / data types that have corresponding types in the source dataset after the necessary transformations fulfil the requirements set out in the ISDSS Regulation and
- all additional elements of the source model (spatial object types, data types, attributes, constraints, code lists and enumerations together with their values) do not conflict with any rule defined in the interoperability target specifications defined for any theme within INSPIRE.

Open issue 1: Even though the last condition can be derived from Art. 8(4) of the Directive, the ISDSS Regulation does not contain requirements concerning the above issue. Therefore, no specific tests have been included in this abstract suit for testing conformity of extended application schemas. Annex F of the Generic Conceptual Model (D2.5) provides an example how to extend INSPIRE application schemas in a compliant way.

The ATS contains a detailed list of abstract tests. It should be noted that some tests in the Application schema conformance class can be automated by utilising **xml schema validation tools**. It should be noted that failing such validation test does not necessarily reflect non-compliance to the application schema; it may be the results of erroneous encoding.

Each test in this suit follows the same structure:

- Requirement: citation from the legal texts (ISDSS requirements) or the Technical Guidelines (TG requirements);
- Purpose: definition of the scope of the test;
- Reference: link to any material that may be useful during the test;
- Test method: description of the testing procedure.

According to ISO 19105:2000 all tests in this ATS are basic tests. Therefore, this statement is not repeated each time.

Part 1 - (normative)

- Conformity with Commission Regulation No 1089/2010*

A.1. Application Schema Conformance Class

Conformance class:

<http://inspire.ec.europa.eu/conformance-class/ir/su/as/StatisticalUnits>

A.1.1. Schema element denomination test

- Purpose:** Verification whether each element of the dataset under inspection carries a name specified in the target application schema(s).
- Reference:** Art. 3 and Art.4 of Commission Regulation No 1089/2010
- Test method:** Examine whether the corresponding elements of the source schema (spatial object types, data types, attributes, association roles, code lists, and enumerations) are mapped to the target schema with the correct designation of mnemonic names.

NOTE Further technical information is in the Feature catalogue and UML diagram of the application schema(s) in section 5.2.

A.1.2. Value test

- Purpose:** Verify whether all attributes or association roles whose value type is a code list or enumeration take the values set out therein.
- Reference:** Art.4 (3) of Commission Regulation No 1089/2010.
- Test method:** When an attribute / association role has an enumeration or code list as its type, compare the values of each instance with those provided in the application schema. To pass this tests any instance of an attribute / association role
 - shall not take any other value than defined in the enumeration table when its type is an enumeration.
 - shall take only values explicitly specified in the code list when the code list's extensibility is "none".
 - shall take only a value explicitly specified in the code list or shall take a value that is narrower (i.e. more specific) than those explicitly specified in the application schema when the code list's extensibility is "narrower".

NOTE 1 This test is not applicable to code lists with extensibility "open" or "any".

NOTE 2 When a data provider only uses code lists with narrower (more specific values) this test can be fully performed based on internal information.

A.1.3. Attributes/associations completeness test

- a) Purpose: Verification whether each instance of spatial object type and data types include all attributes and association roles as defined in the target application schema.
- b) Reference: Art. 3, Art.4(1), Art.4(2), and Art.5(2) of Commission Regulation No 1089/2010.
- c) Test method: Examine whether all attributes and association roles defined for a spatial object type or data type are present for each instance in the dataset.

NOTE 1 Further technical information is in the Feature catalogue and UML diagram of the application schema(s) in section 5.2.

NOTE 2 For all properties defined for a spatial object, a value has to be provided if it exists in or applies to the real world entity – either the corresponding value (if available in the data set maintained by the data provider) or the value of *void*. If the characteristic described by the attribute or association role does not exist in or apply to the real world entity, the attribute or association role does not need to be present in the data set.

A.1.4. Abstract spatial object test

- a) Purpose: Verification whether the dataset does NOT contain abstract spatial object / data types defined in the target application schema(s).
- b) Reference: Art.5(3) of Commission Regulation No 1089/2010
- c) Test method: Examine that there are NO instances of abstract spatial object / data types in the dataset provided.

NOTE Further technical information is in the Feature catalogue and UML diagram of the application schema(s) in section 5.2.

A.1.5. Constraints test

- a) Purpose: Verification whether the instances of spatial object and/or data types provided in the dataset adhere to the constraints specified in the target application schema(s).
- b) Reference: Art. 3, Art.4(1), and Art.4(2) of Commission Regulation No 1089/2010.
- c) Test method: Examine all instances of data for the constraints specified for the corresponding spatial object / data type. Each instance shall adhere to all constraints specified in the target application schema(s).

NOTE Further technical information is in the Feature catalogue and UML diagram of the application schema(s) in section 5.2.

A.1.6. Geometry representation test

- a) Purpose: Verification whether the value domain of spatial properties is restricted as specified in the Commission Regulation No 1089/2010.

b) Reference: Art.12(1), Annex IV Section 1 of Commission Regulation No 1089/2010

c) Test Method: Check whether all spatial properties only use 0, 1 and 2-dimensional geometric objects that exist in the right 2-, 3- or 4-dimensional coordinate space, and where all curve interpolations respect the rules specified in the reference documents.

NOTE Further technical information is in OGC Simple Feature spatial schema v1.2.1 [06-103r4].

A.2. Reference Systems Conformance Class

Conformance class:

<http://inspire.ec.europa.eu/conformance-class/ir/su/rs>

A.2.1. Datum test

a) Purpose: Verify whether each instance of a spatial object type is given with reference to one of the (geodetic) datums specified in the target specification.

b) Reference: Annex II Section 1.2 of Commission Regulation No 1089/2010

c) Test method: Check whether each instance of a spatial object type specified in the application schema(s) in section 5 has been expressed using:

- the European Terrestrial Reference System 1989 (ETRS89) within its geographical scope; or
- the International Terrestrial Reference System (ITRS) for areas beyond the ETRS89 geographical scope; or
- other geodetic coordinate reference systems compliant with the ITRS. Compliant with the ITRS means that the system definition is based on the definition of ITRS and there is a well-established and described relationship between both systems, according to the EN ISO 19111.

NOTE Further technical information is given in Section 6 of this document.

A.2.2. Coordinate reference system test

a) Purpose: Verify whether the two- and three-dimensional coordinate reference systems are used as defined in section 6.

b) Reference: Section 6 of Commission Regulation 1089/2010.

c) Test method: Inspect whether the horizontal and vertical components of coordinates one of the corresponding coordinate reference system has been:

- Three-dimensional Cartesian coordinates based on a datum specified in 1.2 and using the parameters of the Geodetic Reference System 1980 (GRS80) ellipsoid.
- Three-dimensional geodetic coordinates (latitude, longitude and ellipsoidal height) based on a datum specified in 1.2 and using the parameters of the GRS80 ellipsoid.
- Two-dimensional geodetic coordinates (latitude and longitude) based on a datum specified in

1.2 and using the parameters of the GRS80 ellipsoid.

- Plane coordinates using the ETRS89 Lambert Azimuthal Equal Area coordinate reference system.
- Plane coordinates using the ETRS89 Lambert Conformal Conic coordinate reference system.
- Plane coordinates using the ETRS89 Transverse Mercator coordinate reference system.
- For the vertical component on land, the European Vertical Reference System (EVRS) shall be used to express gravity-related heights within its geographical scope. Other vertical reference systems related to the Earth gravity field shall be used to express gravity-related heights in areas that are outside the geographical scope of EVRS.
- For the vertical component in marine areas where there is an appreciable tidal range (tidal waters), the Lowest Astronomical Tide (LAT) shall be used as the reference surface.
- For the vertical component in marine areas without an appreciable tidal range, in open oceans and effectively in waters that are deeper than 200 meters, the Mean Sea Level (MSL) or a well-defined reference level close to the MSL shall be used as the reference surface."
- For the vertical component in the free atmosphere, barometric pressure, converted to height using ISO 2533:1975 International Standard Atmosphere, or other linear or parametric reference systems shall be used. Where other parametric reference systems are used, these shall be described in an accessible reference using EN ISO 19111-2:2012.

NOTE Further technical information is given in Section 6 of this document.

A.2.3. Grid test

a) Purpose: Verify that gridded data related are available using the grid compatible with one of the coordinate reference systems defined in Commission Regulation No 1089/2010

b) Reference: Annex II Section 2.1 and 2.2 of Commission Regulation 1089/2010.

c) Test method: Check whether the dataset defined as a grid is compatible with one of the coordinate reference.

- Grid_ETRS89_GRS80 based on two-dimensional geodetic coordinates using the parameters of the GRS80 ellipsoid
- Grid_ETRS89_GRS80zn based on two-dimensional geodetic coordinates with zoning,
- Plane coordinates using the Lambert Azimuthal Equal Area projection and the parameters of the GRS80 ellipsoid (ETRS89-LAEA)
- Plane coordinates using the Lambert Conformal Conic projection and the parameters of the GRS80 ellipsoid (ETRS89-LCC)
- Plane coordinates using the Transverse Mercator projection and the parameters of the GRS80 ellipsoid (ETRS89-TMzn)

NOTE Further technical information is given in Section 6 of this document.

A.2.4. View service coordinate reference system test

- a) Purpose: Verify whether the spatial data set is available in the two dimensional geodetic coordinate system for their display with the INSPIRE View Service.
- b) Reference: Annex II Section 1.4 of Commission Regulation 1089/2010
- c) Test method: Check that each instance of a spatial object types specified in the application schema(s) in section 5 is available in the two-dimensional geodetic coordinate system

NOTE Further technical information is given in Section 6 of this document.

A.2.5. Temporal reference system test

- a) Purpose: Verify whether date and time values are given as specified in Commission Regulation No 1089/2010.
- b) Reference: Art.11(1) of Commission Regulation 1089/2010
- c) Test method: Check whether:
 - the Gregorian calendar is used as a reference system for date values;
 - the Universal Time Coordinated (UTC) or the local time including the time zone as an offset from UTC are used as a reference system for time values.

NOTE Further technical information is given in Section 6 of this document.

A.2.6. Units of measurements test

- a) Purpose: Verify whether all measurements are expressed as specified in Commission Regulation No 1089/2010.
- b) Reference: Art.12(2) of Commission Regulation 1089/2010
- c) Test method: Check whether all measurements are expressed in SI units or non-SI units accepted for use with the International System of Units.

NOTE 1 Further technical information is given in ISO 80000-1:2009.

NOTE 2 Degrees, minutes and seconds are non-SI units accepted for use with the International System of Units for expressing measurements of angles.

A.3. Data Consistency Conformance Class

Conformance class:

<http://inspire.ec.europa.eu/conformance-class/ir/su/dc>

A.3.1. Unique identifier persistency test

- a) Purpose: Verify whether the namespace and localId attributes of the external object identifier remain the same for different versions of a spatial object.
- b) Reference: Art. 9 of Commission Regulation 1089/2010.
- c) Test method: Compare the namespace and localId attributes of the external object identifiers in the previous version(s) of the dataset with the namespace and localId attributes of the external object identifiers of current version for the same instances of spatial object / data types; To pass the test, neither the namespace, nor the localId shall be changed during the life-cycle of a spatial object.

NOTE 1 This test can be performed exclusively on the basis of the information available in the database of the data providers.

NOTE 2 When using URI this test includes the verification whether no part of the construct has been changed during the life cycle of the instances of spatial object / data types.

NOTE 3 Further technical information is given in section 14.2 of the INSPIRE Generic Conceptual Model.

A.3.2. Version consistency test

- a) Purpose: Verify whether different versions of the same spatial object / data type instance belong to the same type.
- b) Reference: Art. 9 of Commission Regulation 1089/2010.
- c) Test method: Compare the types of different versions for each instance of spatial object / data type

NOTE 1 This test can be performed exclusively on the basis of the information available in the database of the data providers.

A.3.3. Life cycle time sequence test

- a) Purpose: Verification whether the value of the attribute beginLifespanVersion refers to an earlier moment of time than the value of the attribute endLifespanVersion for every spatial object / object type where this property is specified.
- b) Reference: Art.10(3) of Commission Regulation 1089/2010.
- c) Test method: Compare the value of the attribute beginLifespanVersion with attribute endLifespanVersion. The test is passed when the beginLifespanVersion value is before endLifespanVersion value for each instance of all spatial object/data types for which this attribute has been defined.

NOTE 1 This test can be performed exclusively on the basis of the information available in the database of the data providers.

A.3.4. Validity time sequence test

- a) Purpose: Verification whether the value of the attribute validFrom refers to an earlier moment of time than the value of the attribute validTo for every spatial object / object type where this property is specified.
- b) Reference: Art.12(3) of Commission Regulation 1089/2010.
- c) Test method: Compare the value of the attribute validFrom with attribute validTo. The test is passed when the validFrom value is before validTo value for each instance of all spatial object/data types for which this attribute has been defined.

NOTE 1 This test can be performed exclusively on the basis of the information available in the database of the data providers.

A.3.5. Update frequency test

- a) Purpose: Verify whether all the updates in the source dataset(s) have been transmitted to the dataset(s) which can be retrieved for the SU data theme using INSPIRE download services.
- b) Reference: Art.8 (2) of Commission Regulation 1089/2010.
- c) Test method: Compare the values of beginning of life cycle information in the source and the target datasets for each instance of corresponding spatial object / object types. The test is passed when the difference between the corresponding values is less than 6 months.

NOTE 1 This test can be performed exclusively on the basis of the information available in the database of the data providers.

A.4. Metadata IR Conformance Class

Conformance class:

<http://inspire.ec.europa.eu/conformance-class/ir/su/md>

A.4.1. Metadata for interoperability test

- a) Purpose: Verify whether the metadata for interoperability of spatial data sets and services described in 1089/2010 Commission Regulation have been created and published for each dataset related to the SU data theme.
- b) Reference: Art.13 of Commission Regulation 1089/2010
- c) Test method: Inspect whether metadata describing the coordinate reference systems, encoding, topological consistency and spatial representation type have been created and published. If the spatial data set contains temporal information that does not refer to the default temporal reference system, inspect whether metadata describing the temporal reference system have been created and published. If an encoding is used that is not based on UTF-8, inspect whether metadata describing the character encoding have been created.

NOTE Further technical information is given in section 8 of this document.

A.5. Information Accessibility Conformance Class

Conformance class:

<http://inspire.ec.europa.eu/conformance-class/ir/su/ia>

A.5.1. Code list publication test

- a) Purpose: Verify whether all additional values used in the data sets for attributes, for which narrower values or any other value than specified in Commission Regulation 1089/2010 are allowed, are published in a register.
- b) Reference: Art.6(3), Annex IV Section 1.
- c) Test method: For each additional value used in the data sets for code list-valued attributes, check whether it is published in a register.

NOTE Further technical information is given in section 5 of this document.

A.5.2. CRS publication test

- a) Purpose: Verify whether the identifiers and the parameters of coordinate reference system are published in common registers.
- b) Reference: Annex II Section 1.5
- c) Test method: Check whether the identifier and the parameter of the CRS used for the dataset are included in a register.

NOTE Further technical information is given in section 6 of this document.

A.5.3. CRS identification test

- a) Purpose: Verify whether identifiers for other coordinate reference systems than specified in Commission Regulation 1089/2010 have been created and their parameters have been described according to EN ISO 19111 and ISO 19127.
- b) Reference: Annex II Section 1.3.4
- c) Test method: Check whether the register with the identifiers of the coordinate reference systems is accessible.

NOTE Further technical information is given in section 6 of this document.

A.5.4. Grid identification test

- a) Purpose: Verify whether identifiers for other geographic grid systems than specified in Commission Regulation 1089/2010 have been created and their definitions have been either

described with the data or referenced.

b) Reference: Annex II Section 2.1 and 2.2

c) Test method: Check whether the identifiers for grids have been created. Inspect the dataset and/or the metadata for inclusion of grid definition.

NOTE Further technical information is given in section 6 of this document.

A.6. Data Delivery Conformance Class

Conformance class:

<http://inspire.ec.europa.eu/conformance-class/ir/su/de>

A.6.1. Encoding compliance test

a) Purpose: Verify whether the encoding used to deliver the dataset comply with EN ISO 19118.

b) Reference: Art.7 (1) of Commission Regulation 1089/2010.

c) Test method: Follow the steps of the Abstract Test Suit provided in EN ISO 19118.

NOTE 1 Datasets using the default encoding specified in Section 9 fulfil this requirement.

NOTE 2 Further technical information is given in Section 9 of this document.

A.7. Portrayal Conformance Class

Conformance class:

<http://inspire.ec.europa.eu/conformance-class/ir/su/po>

A.7.1. Layer designation test

a) Purpose: verify whether each spatial object type has been assigned to the layer designated according to Commission Regulation 1089/2010.

b) Reference: Art. 14(1), Art14(2) and Annex IV Section 1.

c) Test method: Check whether data is made available for the view network service using the specified layers respectively:

- SU.VectorStatisticalUnit
- SU.StatisticalGridCell

NOTE Further technical information is given in section 11 of this document.

Part 2 - (informative)

Conformity with the technical guideline (TG) Requirements

A.8. Technical Guideline Conformance Class

Conformance class:

<http://inspire.ec.europa.eu/conformance-class/tg/su/3.0>

A.8.1. Multiplicity test

- a) Purpose: Verify whether each instance of an attribute or association role specified in the application schema(s) does not include fewer or more occurrences than specified in section 5.
- b) Reference: Feature catalogue and UML diagram of the application schema(s) in section 5 of this guideline.
- c) Test method: Examine that the number of occurrences of each attribute and/or association role for each instance of a spatial object type or data type provided in the dataset corresponds to the number of occurrences of the attribute / association role that is specified in the application schema(s) in section 5.

A.8.2. CRS http URI test

- a) Purpose: Verify whether the coordinate reference system used to deliver data for INSPIRE network services has been identified by URIs according to the EPSG register.
- b) Reference: Table 2 in Section 6 of this technical guideline
- c) Test method: Compare the URI of the dataset with the URIs in the table.

NOTE 1 Passing this test implies the fulfilment of test A6.2

NOTE 2 Further reference please see <http://www.epsg.org/geodetic.html>

A.8.3. Metadata encoding schema validation test

- a) Purpose: Verify whether the metadata follows an XML schema specified in ISO/TS 19139.
- b) Reference: Section 8 of this technical guideline, ISO/TS 19139
- c) Test method: Inspect whether provided XML schema is conformant to the encoding specified in ISO 19139 for each metadata instance.

NOTE 1 Section 2.1.2 of the Metadata Technical Guidelines discusses the different ISO 19139 XML schemas that are currently available.

A.8.4. Metadata occurrence test

- a) Purpose: Verify whether the occurrence of each metadata element corresponds to those specified in section 8.
- b) Reference: Section 8 of this technical guideline
- c) Test method: Examine the number of occurrences for each metadata element. The number of occurrences shall be compared with its occurrence specified in Section 8:

NOTE 1 Section 2.1.2 of the Metadata Technical Guidelines discusses the different ISO 19139 XML schema

A.8.5. Metadata consistency test

- a) Purpose: Verify whether the metadata elements follow the path specified in ISO/TS 19139.
- b) Reference: Section 8 of this technical guideline, ISO/TS 19139
- c) Test method: Compare the XML schema of each metadata element with the path provide in ISO/TS 19137.

NOTE 1 This test does not apply to the metadata elements that are not included in ISO/TS 19139.

A.8.6. Encoding schema validation test

- a) Purpose: Verify whether the provided dataset follows the rules of default encoding specified in section 9 of this document
- b) Reference: section 9 of this technical guideline
- c) Test method: Inspect whether provided encoding(s) is conformant to the encoding(s) for the relevant application schema(s) as defined in section 9:

NOTE 1 Applying this test to the default encoding schema described in section 9 facilitates testing conformity with the application schema specified in section 5. In such cases running this test with positive result may replace tests from A1.1 to A1.4 provided in this abstract test suite.

NOTE 2 Using Schematron or other schema validation tool may significantly improve the validation process, because some complex constraints of the schema cannot be validated using the simple XSD validation process. On the contrary to XSDs Schematron rules are not delivered together with the INSPIRE data specifications. Automating the process of validation (e.g. creation of Schematron rules) is therefore a task and an opportunity for data providers.

A.8.7. Style test

- a) Purpose: Verify whether the styles defined in section 11.2 have been made available for each specified layer.
- b) Reference: section 11.2.

c) Test method: Check whether the styles defined in section 11.2 have been made available for each specified layer.

Annex B: Use cases - (informative)

This section presents some use case examples of statistical units described in a narrative form. For each use case, the actor(s), the input and output data are given.

B.1. Statistical data georeferencing

Actor: A statistical data provider or user.

Description: A statistical data provider or user has some statistical data related to some locations. He wants to geolocalise these statistical data by linking them to existing reference statistical units. These statistical units can be any object present in the INSPIRE model (road, building, administrative unit, etc.), or statistical units.

Input: Statistical data with implicit geolocalisation. Statistical units.

Output: Georeferenced statistical data.

B.2. Risk exposure analysis

(Use case in common with theme "Natural risks zones")

Actor: A risk spatial analyst.

Description: A risk spatial analyst wants to know how many people are in risk for a certain threat (related to space). To estimate this risk, he computes the intersection of area geometries representing the hazard location with area statistical units having population data.

Inputs: Data on population distribution during day and night time. The hazard areas.

Output: Estimation of the risk on population.

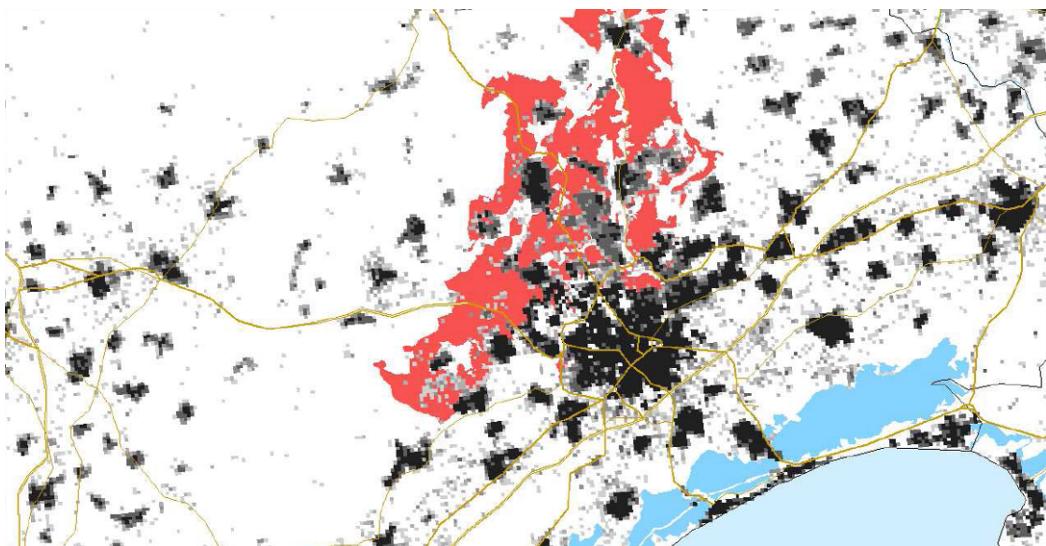


Figure 14: Fire hazard (Red) and fiscal population distribution (Gray) the 31/12/2008 in the region of Montpellier, France. (Sources: Cartorisque, Ministère de l'Ecologie, du Développement Durable, des Transports et du Logement INSEE)

B.3. Phenomenon spread analysis

Actor: A statistical data analyst.

Description: A statistical data analyst wants to show how a phenomenon spreads on statistical units. The user could be a social researcher who wants to show the spread of income in Europe, or a reporter who wants to show the results of elections in Europe. For that, he imports the phenomenon data and aggregates them on the statistical units.

Inputs: Statistical unit, phenomenon data.

Output: Visualisation of the phenomenon evolution across space and time on the statistical units.

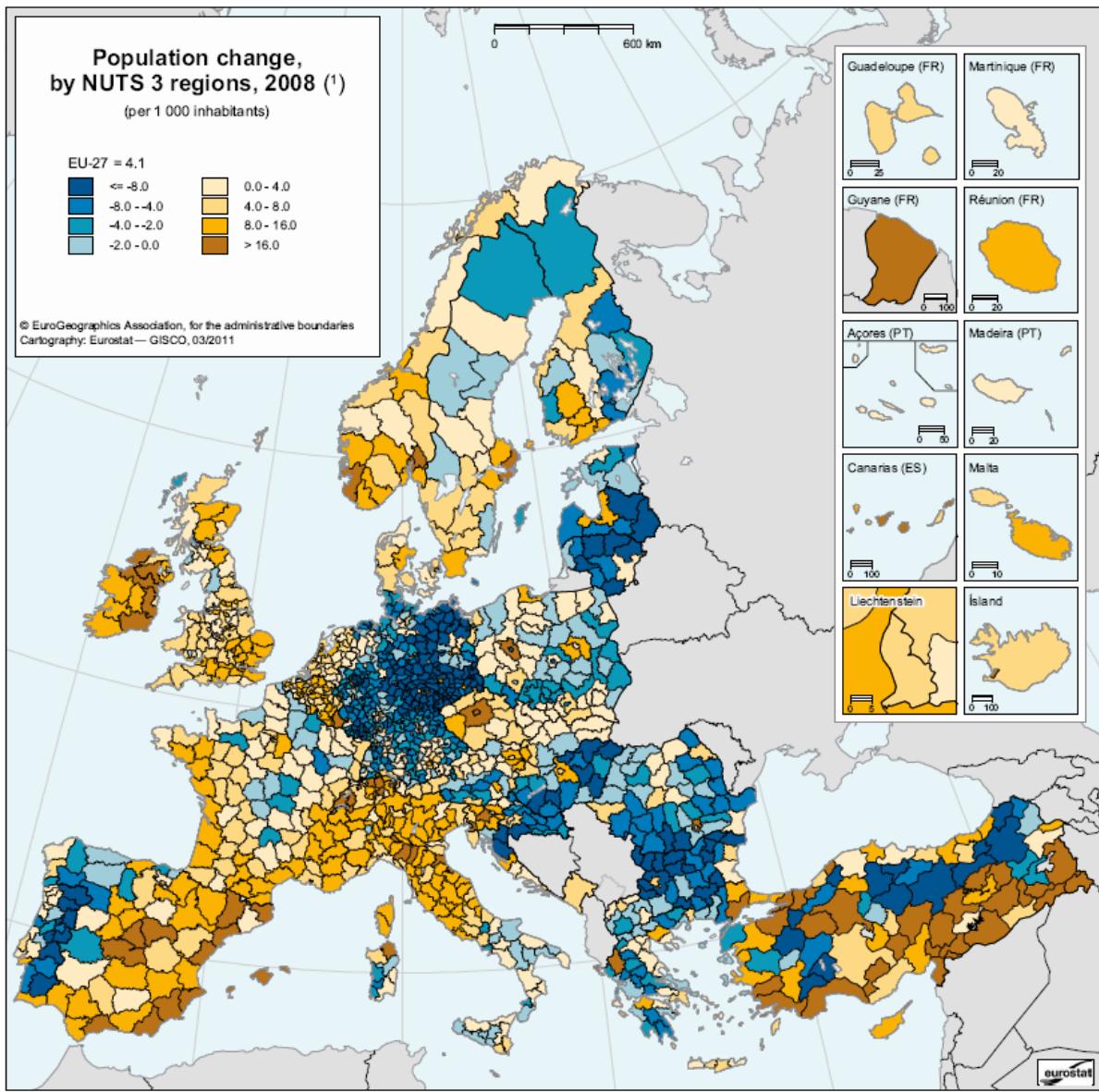
B.4. Evolution analysis

Actor: A statistical data analyst.

Description: A statistical data analyst wants to know how a given statistical data has evolved across space and time. For that, he needs historical statistical data and the different versions of the statistical units this data refer to.

Inputs: Historical data on statistical unit and statistical data.

Output: Evolution analysis (qualitative or quantitative outputs).



(1) Belgium and United Kingdom, 2007.

B.5. New facility location

Actors: A statistical data analyst, a land manager.

Description: A land manager wants to find the optimum location for a future facility. For that purpose, a statistical data analyst retrieves the distribution of the statistical data relevant to the future facility, the repartition of the already existing similar facilities, and computes a candidate location for the future facility. Examples: analysis of child repartition for school, analysis of risk activities for fire station, analysis of crime indicators for police stations, analysis of commuters behaviours for transport network extension, etc.

Inputs: Statistical data related to the facility, similar facilities already existing in the area of interest.

Outputs: A candidate location for the future facility.

B.6. Simulation

Actors: A statistical data analyst.

Description: A statistical data analyst wants to forecast the evolution of some statistical data using a simulation model. Such simulation models are usually based on a temporal extrapolation in the future of historical data. Examples of such simulation models: *SVERIGE* in Sweden and *Destinie* in France.

Inputs: Historical statistical data, historical statistical units.

Outputs: Forecasted statistical data.

B.7. Human health impact analysis

(Use case of interest for the theme "Human Health and Safety")

Actors: A statistical data analyst.

Description: A statistical analyst wants to determine if a given health determinant may have potential impact on human health. He retrieves statistical data related to the health on given statistical units, and data on the location of the potential health determinants. A health determinant is something that may have an impact, positive or negative, on human health, like a chemical factory (air pollution), a highway (air pollution and noise), a park, etc. Computing the spatial correlation of these data may allow to infer some causality relations between the suspected health determinant and the human health.

Inputs: Statistical data related to human health distribution, suspected health determinant location.

Outputs: Spatial correlation indicator, conclusion of the possible link between the suspected health determinant and the human health.

Annex C: Code list values - (normative)

INSPIRE Application Schema 'Statistical Units Vector'

Code List
<i>EvolutionTypeValue</i>
<i>GeometryTypeValue</i>

EvolutionTypeValue

Name:	Evolution type value
Definition:	The code values for evolution types.
Extensibility:	any
Identifier:	http://inspire.ec.europa.eu/codelist/EvolutionTypeValue
Values:	The allowed values for this code list comprise any values defined by data providers.

The table below includes recommended values that may be used by data providers. Before creating new terms, please check if one of them can be used.

creation	
Name:	creation
Definition:	The code value for creation.
change	
Name:	change
Definition:	The code value for change.
deletion	
Name:	deletion
Definition:	The code value for deletion.
aggregation	
Name:	aggregation
Definition:	The code value for aggregation.

splitting

Name:	splitting
Definition:	The code value for splitting.

GeometryTypeValue

Name:	Geometry type value
Definition:	The code values for the geometry types.
Extensibility:	open
Identifier:	http://inspire.ec.europa.eu/codelist/GeometryTypeValue
Values:	The allowed values for this code list comprise the values specified in the table below and additional values at any level defined by data providers.

referenceGeometry

Name:	reference geometry
Definition:	The described geometry is the reference geometry.

pointLabel

Name:	point label
Definition:	The described geometry is a point geometry for labeling.
Description:	"Of course, geometries having this type should be points."

centerOfGravity

Name:	center of gravity
Definition:	The described geometry is a point geometry located at the center of gravity of the unit.
Description:	"Of course, geometries having this type should be points."

generalisedGeometry

Name:	generalised geometry
Definition:	A generalised geometry of the statistical unit.
Description:	Geometries having such a code must have a descriptor for generalised geometries.

other

Name:	other
Definition:	Other kind of geometry type.

Annex D: Using Statistical Units application schema - (informative)

D.1. Linking statistical data to INSPIRE statistical units

Statistical data should be linked to statistical unit by referring them:

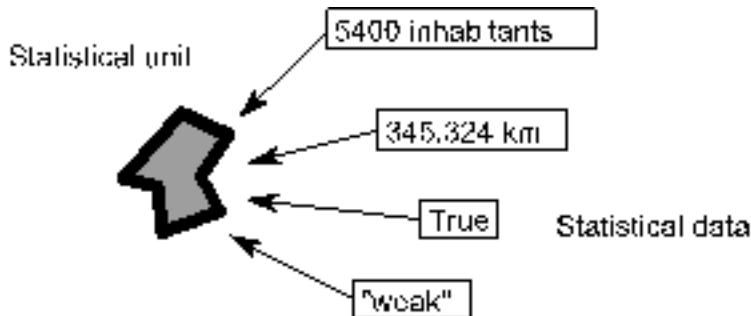


Figure 15 - Statistical data linked to a statistical unit

The link from statistical data to statistical units should use the statistical unit identifier as specified in the Generic Conceptual Model (document 2.5) section 13 and annex D (NB: This way to link external data to INSPIRE data is not specific to the theme statistical units).

IR Requirement

Annex IV, Section 1.5

Theme-specific Requirements



Statistical data shall refer to their statistical unit through the unit's external object identifier (`inspireId`) or thematic identifier (for vector units) or the unit's code (for grid cells).

The association from statistical data to a statistical unit should concern a specific version of the statistical unit. Consequently, all associations representing a link from statistical data to statistical units should bear the stereotype [\[version\]](#). If the linkage from statistical data to a statistical unit is done through a thematic identifier, the versioning of the thematic identifier is required.

IR Requirement

Annex IV, Section 1.5

Theme-specific Requirements



Statistical data shall refer to a specific version of a statistical unit.

EXAMPLE The German state of Brandenburg was classified in the NUTS 2003 regulation as one level 1 unit divided in 18 level 3 units; level 2 was equal to level 1. In the regulation 2007 the level 2 was divided in 2 units and the level 3 units have been reassigned. In the NUTS regulation 2010 the two level 2 units are aggregated to one level 2 unit and the level 3 units reassigned again. To distinguish the definition until 2003 from those of 2011 which have the same thematic identifier, the version ID (eg. 1999 and 2010 has to be added, see table below).

Gentlemen's Agreement until 2003 (NUTS1999)		Regulation 1059/2003 and 105 / 2007 (NUTS2003, NUTS2006)		Regulation 31/2011 (NUTS2010)		Name
NUTS1	NUTS2/3	NUTS1	NUTS2/3	NUTS1	NUTS2/3	
DE4.1999	DE40.1999	DE4.2003		DE4.2010	DE40.2010	BRANDENBURG
---	--		DE41.2003	---	--	Brandenburg - Nordost
	DE403.1999		DE411.2003		DE403.2010	Frankfurt (Oder)
	DE405.1999		DE412.2003		DE405.2010	Barnim
	DE409.1999		DE413.2003		DE409.2010	Märkisch-Oderland
	DE40A.1999		DE414.2003		DE40A.2010	Oberhavel
	DE40C.1999		DE415.2003		DE40C.2010	Oder-Spree
	DE40D.1999		DE416.2003		DE40D.2010	Ostprignitz-Ruppin
	DE40F.1999		DE417.2003		DE40F.2010	Prignitz
	DE40I.1999		DE418.2003		DE40I.2010	Uckermark
---	--		DE42.2003	---	--	Brandenburg - Südwest
	DE401.1999		DE421.2003		DE401.2010	Brandenburg an der Havel
	DE402.1999		DE422.2003		DE402.2010	Cottbus, Kreisfreie Stadt
	DE404.1999		DE423.2003		DE404.2010	Potsdam, Kreisfreie Stadt
	DE406.1999		DE424.2003		DE406.2010	Dahme-Spreewald
	DE407.1999		DE425.2003		DE407.2010	Elbe-Elster
	DE408.1999		DE426.2003		DE408.2010	Havelland
	DE40B.1999		DE427.2003		DE40B.2010	Oberspreewald-Lausitz
	DE40E.1999		DE428.2003		DE40E.2010	Potsdam-Mittelmark
	DE40G.1999		DE429.2003		DE40G.2010	Spree-Neiße
	DE40H.1999		DE42A.2003		DE40H.2010	Teltow-Fläming

Example of the evolution of NUTS units

Even if the way to encode statistical data is out of the scope of this document, the following recommendations are given:

Recomendation 33

 If encoding formats and infrastructures exist for statistical data, INSPIRE should only focus on the spatial units, and actions to develop interfaces between these infrastructures and INSPIRE should be undertaken based on the previous recommendation. For example, existing formats for statistical data should be extended to allow the linkage to statistical units published under INSPIRE.

The intention behind this recommendation is to build bridges between statistical and spatial data infrastructures.

EXAMPLE

European statistical data are already published by National Statistical Offices through the Census Hub maintained by Eurostat. The SDMX format allows the publication of statistical information, but it does not cover spatial representations of the statistical units. The link to the statistical unit is implicit through codelists. The explicit INSPIRE statistical units could be provided by extending

these codelists to INSPIRE statistical unit identifiers.

In case no format and infrastructure exist for specific statistical units, TJS (Table Joining Services) and GDAS (Geographic Data Attribute Set) defined in "Georeferenced Table Joining Service Implementation Standard, OpenGIS standard 10-070r2" are recommended to be used.

Recomendation 34



TJS service and GDAS format defined in: "Georeferenced Table Joining Service Implementation Standard, OpenGIS standard 10-070r2" should be used to publish statistical data to be linked to INSPIRE statistical units.

Recomendation 35



If statistical data are reported on statistical units (such as Population Distribution data), one should consider publishing through the same service.

D.2. Defining INSPIRE compliant statistical units datasets

The *Statistical Units* application schema is generic and needs to be specialised for existing datasets. Making an existing statistical unit dataset INSPIRE compliant consists in implementing this application schema for existing datasets.

The annex E on Eurostat datasets gives two examples on how to implement the *Statistical Units* application schema for the NUTS and Urban Audit datasets.

Annex E: Example of Eurostat models - (informative)

This annex provides two examples of how existing statistical units datasets can be made compliant with the application schema presented in this document. These examples concerns two datasets produced by Eurostat and usually used for European wide applications: NUTS and Urban Audit (versions 2009 and 2011).

E.1. The NUTS dataset

The NUTS dataset is a statistical unit dataset produced by Eurostat. This dataset contains area statistical units organised into a hierarchy of different levels (see Figure 16 and Figure 17).

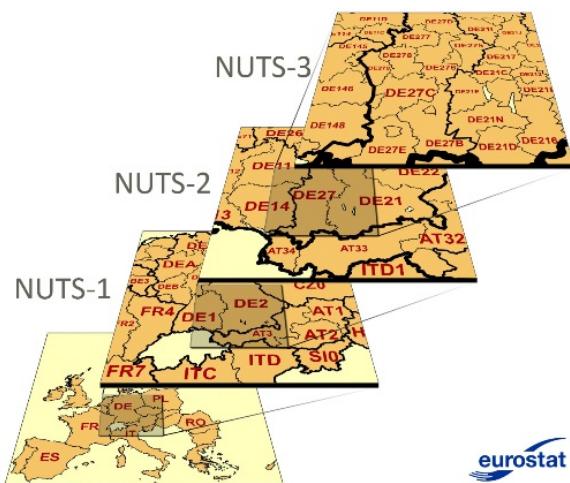


Figure 16 - The NUTS hierarchical structure.

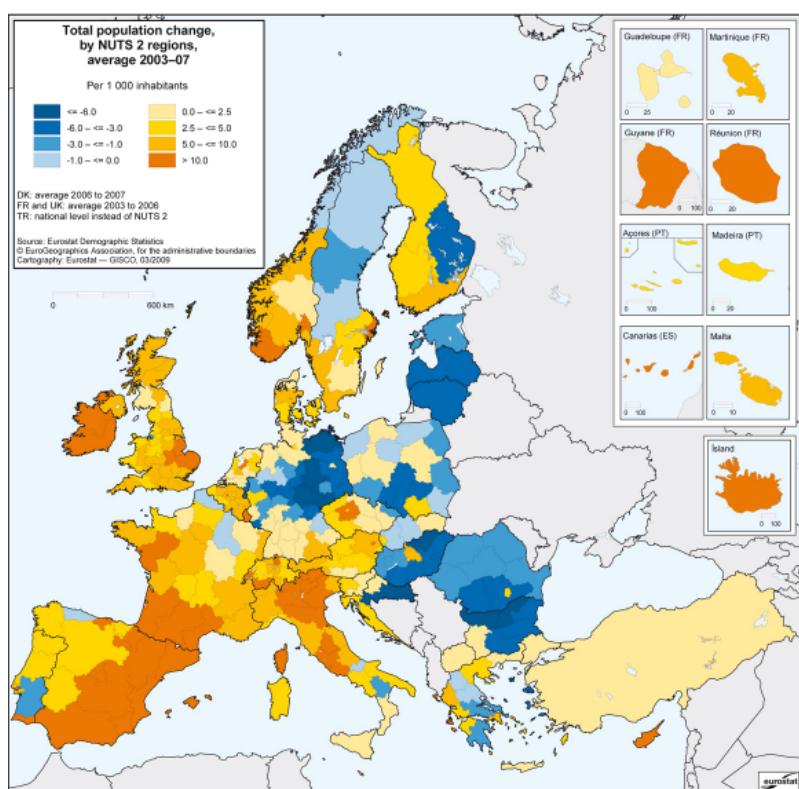


Figure 17 - Example of map using NUTS 2 regions.

E.1.1. Package diagram

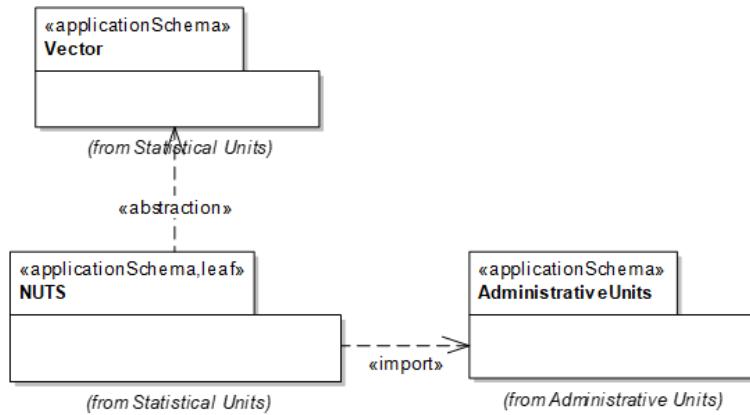


Figure 18 - NUTS dataset package diagram

The *NUTS* package specialises classes of the *Vector* package. It is imported by the *Administrative Units* package.

E.1.2. Class diagram

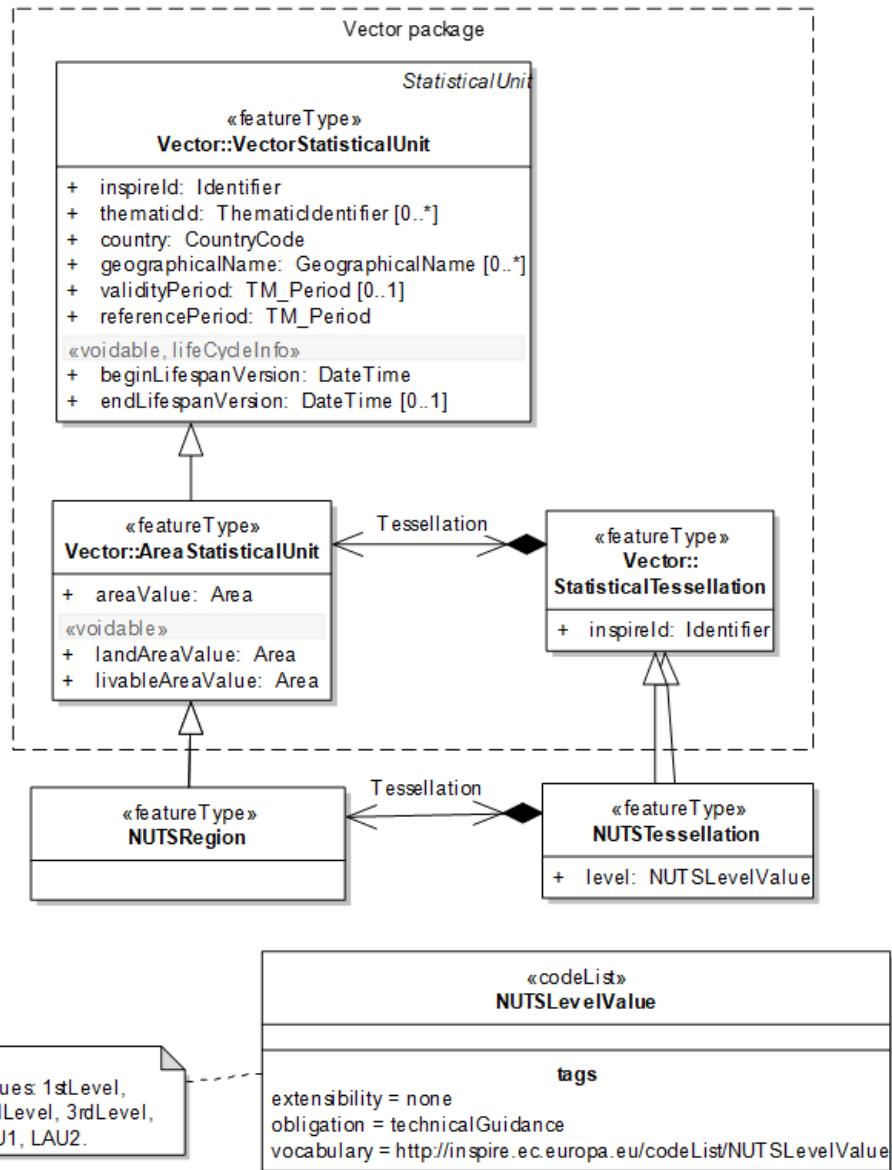


Figure 19 - NUTS dataset class diagram

NUTS regions are area statistical units identified by a NUTS code. NUTS regions compose NUTS tessellations. A NUTS tessellation has a level whose value has to be among the NUTS hierarchy code list.

NOTE NUTS regions are nowadays identified by a NUTS code – it is recommended to used this code to fill the *localId* field of the *inspireId*.

NUTS regions are built from administrative units. There is an explicit link from a given administrative unit toward the three NUTS regions from levels 1, 2 and 3 it may contain.

E.1.3. INSPIRE-governed code lists

The INSPIRE-defined code lists included in this application schema include the values specified in this section.

E.1.3.1. Values of code list NUTSLevelValue

INSPIRE Application Schema 'NUTS'

Code List
<i>NUTSLevelValue</i>

NUTSLevelValue

Name:	NUTS level value
Definition:	The code values for the NUTS levels.
Extensibility:	open
Identifier:	http://inspire.ec.europa.eu/codelist/ NUTSLevelValue
Values:	

The table below includes recommended values that may be used by data providers. Before creating new terms, please check if one of them can be used.

1stLevel
Name:
Definition:
Description:

Name:	First level
Definition:	The first NUTS level.
Description:	<p>"Correspond to areas having a population within 3 and 7 millions.</p> <p>EXAMPLE "Gewesten/Regions" in Belgium; "Laender " in Germany; "Continente", "Regio dos Aores" and "Regio da Madeira" in Portugal; "Scotland, Wales, Northern Ireland" and "Government Office Regions of England" in the United Kingdom.</p> <p>SOURCE NUTS Directive (Regulation (EC) No 1059/2003)."</p>

2ndLevel

Name:	Second level
Definition:	The second NUTS level.
Description:	<p>"Correspond to areas having a population within 800000 and 7 millions.</p> <p>EXAMPLE "Provinces/Provinces" in Belgium; "Regierungsbezirke" in Germany; "Periferies" in Greece; "Comunidades y ciudades autonomas" in Spain; "Regions" in France; "Regions" in Ireland; "Regioni" in Italy; "Provinces" in the Netherlands; "Laender" in Austria.</p> <p>SOURCE NUTS Directive (Regulation (EC) No 1059/2003)."</p>

3rdLevel

Name:	Third level
Definition:	The third NUTS level.
Description:	<p>"Correspond to areas having a population within 150 000 and 800 000.</p> <p>EXAMPLE "arrondissements" in Belgium; "amtskommuner" in Denmark; "Kreise/kreisfreie Staedte" in Germany; "nomoi" in Greece; "provincias" in Spain; "departements" in France; "regional authority regions" in Ireland; "provincie" in Italy; "lon" in Sweden; "maakunnat/landskapen" in Finland.</p> <p>SOURCE NUTS Directive (Regulation (EC) No 1059/2003)."</p>

LAU1

Name:	First Local Administrative Units level
Definition:	The LAU (Local Administrative Units) first level (former NUTS level 4).

LAU2

Name:	Second Local Administrative Units level
Definition:	The LAU (Local Administrative Units) second level (former NUTS level 5).

E.1.4. Feature catalogue

Feature catalogue metadata

Application Schema	INSPIRE Application Schema NUTS
Version number	3.0

Types defined in the feature catalogue

Type	Package	Stereotypes
<i>NUTSLevelValue</i>	NUTS	«codeList»
<i>NUTSRegion</i>	NUTS	«featureType»
<i>NUTSTessellation</i>	NUTS	«featureType»

E.1.4.1. Spatial object types

E.1.4.1.1. *NUTSRegion*

NUTSRegion	
Name:	NUTS region
Subtype of:	AreaStatisticalUnit
Definition:	Territorial unit for statistics defined in the framework of the Regulation (EC) No 1059/2003 of the European Parliament and of the Council of 26 May 2003.
Description:	NOTE NUTS regions subdivide each Member State into a whole number of territorial units for statistic at NUTS1 level. Each of these is then subdivided into regions at NUTS2 level and these in turn into regions at NUTS3 level.
Stereotypes:	«featureType»

Association role: tessellation

Value type:	NUTSTessellation
Definition:	The tessellation composed of units.
Multiplicity:	0..1
Stereotypes:	«voidable»

E.1.4.1.2. *NUTSTessellation*

NUTSTessellation

Name:	NUTS tessellation
Subtype of:	StatisticalTessellation
Definition:	A statistical tessellation composed of NUTS regions.
Description:	NOTE level attribute values should be among the NUTSHierarchy CodeList.
Stereotypes:	«featureType»

Attribute: level

Name:	Level
Value type:	NUTSLevelValue
Definition:	The level in the hierarchy.
Multiplicity:	1

Association role: units

Value type:	NUTSRegion
Definition:	The units composing a tessellation.
Multiplicity:	0..*
Stereotypes:	«voidable»

E.1.4.2. Code lists

E.1.4.2.1. NUTSLevelValue

NUTSLevelValue

Name:	NUTS level value
Definition:	The code values for the NUTS levels.
Extensibility:	open
Identifier:	http://inspire.ec.europa.eu/codelist/NUTSLevelValue
Values:	The allowed values for this code list comprise the values specified in Annex C and additional values at any level defined by data providers. Annex C includes recommended values that may be used by data providers.

E.1.4.3. Imported types (informative)

This section lists definitions for feature types, data types and enumerations and code lists that are

defined in other application schemas. The section is purely informative and should help the reader understand the feature catalogue presented in the previous sections. For the normative documentation of these types, see the given references.

E.1.4.3.1. *AreaStatisticalUnit*

AreaStatisticalUnit	
Package:	Statistical Units Vector
Reference:	INSPIRE Data specification on <i>Statistical Units</i> [DS-D2.8.III.1]
Definition:	Vector statistical unit with a surfacic reference geometry.
Description:	Such object can be composed of other area statistical unit. EXAMPLE A country area, an administrative unit, a NUTS region.

E.1.4.3.2. *StatisticalTessellation*

StatisticalTessellation	
Package:	Statistical Units Vector
Reference:	INSPIRE Data specification on Statistical Units [DS-D2.8.III.1]
Definition:	A tessellation composed of area statistical units.
Description:	EXAMPLE A NUTS regions coverage.

E.2. The Urban Audit dataset

The Urban Audit dataset contains statistical units used for statistical data comparison on European cities. These units are larger urban zones, kernels, cities, city districts and sub districts (see Figure 20 and Figure 21).

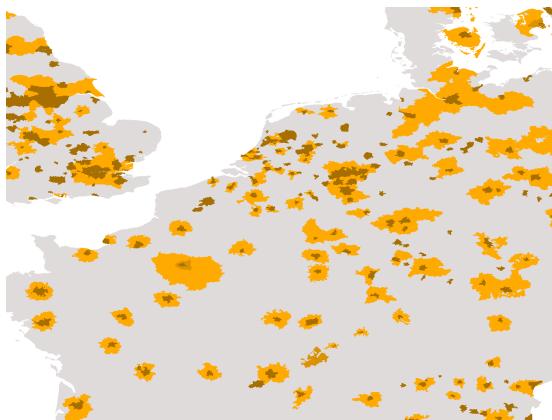


Figure 20 – Overview of the Urban Audit 2009 dataset in Western Europe

E.2.1. Urban Audit 2009 version

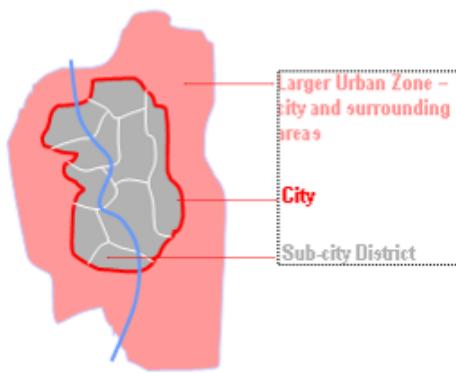


Figure 21 - Schematic view of some Urban Audit 2009 spatial concepts.

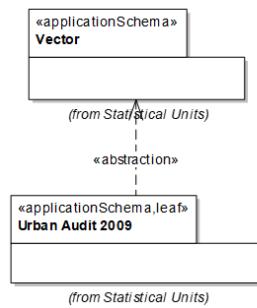


Figure 22 - Urban Audit 2009 dataset package diagram

The *Urban Audit 2009* package specialises classes of the *Vector* package.

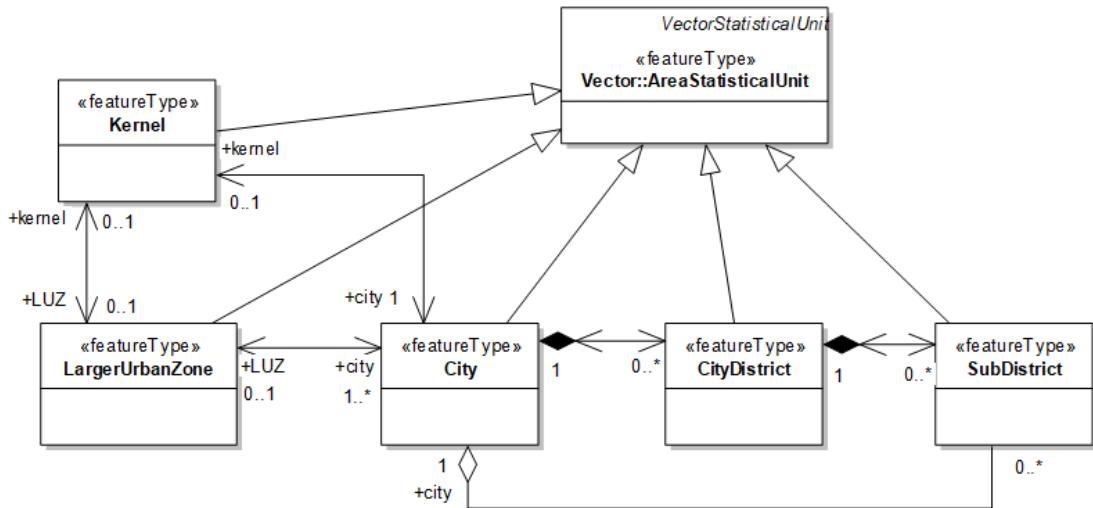


Figure 23 - Urban Audit 2009 dataset class diagram

All Urban Audit spatial objects are area statistical units. For a definition of these classes, refer to <http://www.urbanaudit.org/help.aspx>. Sub districts compose city districts, city districts compose cities, and cities compose larger urban zones. These composition associations are specialisations of the *AreaStatisticalUnit* self-composition *Hierarchical composition*. Some cities like London and Paris

are associated with an additional *Kernel* spatial object.

E.2.2. Feature catalogue

Feature catalogue metadata

Application Schema	INSPIRE Application Schema Urban Audit 2009
Version number	3.0

Types defined in the feature catalogue

Type	Package	Stereotypes
<i>City</i>	Urban Audit 2009	«featureType»
<i>CityDistrict</i>	Urban Audit 2009	«featureType»
<i>Kernel</i>	Urban Audit 2009	«featureType»
<i>LargerUrbanZone</i>	Urban Audit 2009	«featureType»
<i>SubDistrict</i>	Urban Audit 2009	«featureType»

E.2.2.1. Spatial object types

E.2.2.1.1. *City*

City	
Name:	City
Subtype of:	AreaStatisticalUnit
Definition:	Urban audit 2009 city.
Description:	SOURCE [http://www.urbanaudit.org/].
Stereotypes:	«featureType»

Association role: LUZ

Value type:	LargerUrbanZone
Definition:	The larger urban zone linked to the city.
Multiplicity:	0..1
Stereotypes:	«voidable»

Association role: kernel

Value type:	Kernel
Definition:	The kernel of the city.
Multiplicity:	0..1

City	
Association role: lowers	
Value type:	CityDistrict
Definition:	The city districts composing the city.
Multiplicity:	0..*
Stereotypes:	«voidable»

E.2.2.1.2. *CityDistrict*

CityDistrict	
Name:	City district
Subtype of:	AreaStatisticalUnit
Definition:	Urban audit 2009 city district.
Description:	SOURCE [http://www.urbanaudit.org/].
Stereotypes:	«featureType»

Association role: lowers

Value type:	SubDistrict
Definition:	The sub districts composing a district.
Multiplicity:	0..*

Association role: uppers

Value type:	City
Definition:	The city composed of city districts.
Multiplicity:	1
Stereotypes:	«voidable»

E.2.2.1.3. *Kernel*

Kernel	
Name:	Kernel
Subtype of:	AreaStatisticalUnit
Definition:	Urban audit 2009 kernel
Description:	SOURCE [http://www.urbanaudit.org/].
Stereotypes:	«featureType»

Kernel

Association role: LUZ

Value type:	LargerUrbanZone
Definition:	The larger urban zone of the kernel.
Multiplicity:	0..1

Association role: city

Value type:	City
Definition:	The city of the kernel.
Multiplicity:	1

E.2.2.1.4. LargerUrbanZone

LargerUrbanZone

Name:	Larger urban zone
Subtype of:	AreaStatisticalUnit
Definition:	Urban audit 2009 larger urban zone.
Description:	SOURCE [http://www.urbanaudit.org/].
Stereotypes:	«featureType»

Association role: kernel

Value type:	Kernel
Definition:	The kernel linked to the larger urban zone.
Multiplicity:	0..1

Association role: city

Value type:	City
Definition:	The city linked to the larger urban zone.
Multiplicity:	1..*
Stereotypes:	«voidable»

E.2.2.1.5. SubDistrict

SubDistrict

Name:	Sub district
Subtype of:	AreaStatisticalUnit
Definition:	Urban audit 2009 sub-district.
Description:	SOURCE [http://www.urbanaudit.org/].
Stereotypes:	«featureType»

Association role: city

Value type:	City
Definition:	The city the sub district belong to.
Multiplicity:	1

Association role: uppers

Value type:	CityDistrict
Definition:	The district composed of sub districts.
Multiplicity:	1

E.2.2.2. Imported types (informative)

This section lists definitions for feature types, data types and enumerations and code lists that are defined in other application schemas. The section is purely informative and should help the reader understand the feature catalogue presented in the previous sections. For the normative documentation of these types, see the given references.

E.2.2.2.1. AreaStatisticalUnit

AreaStatisticalUnit	
Package:	Statistical Units Vector
Reference:	INSPIRE Data specification on <i>Statistical Units</i> [DS-D2.8.III.1]
Definition:	Vector statistical unit with a surfacic reference geometry.
Description:	Such object can be composed of other area statistical unit. EXAMPLE A country area, an administrative unit, a NUTS region.

E.2.3. Urban Audit 2011 version

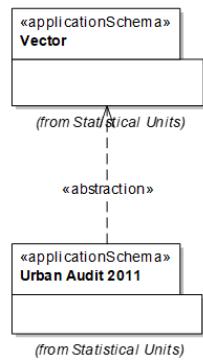


Figure 24 - Urban Audit 2011 dataset package diagram

The *Urban Audit 2011* package specialises classes of the *Vector* package.

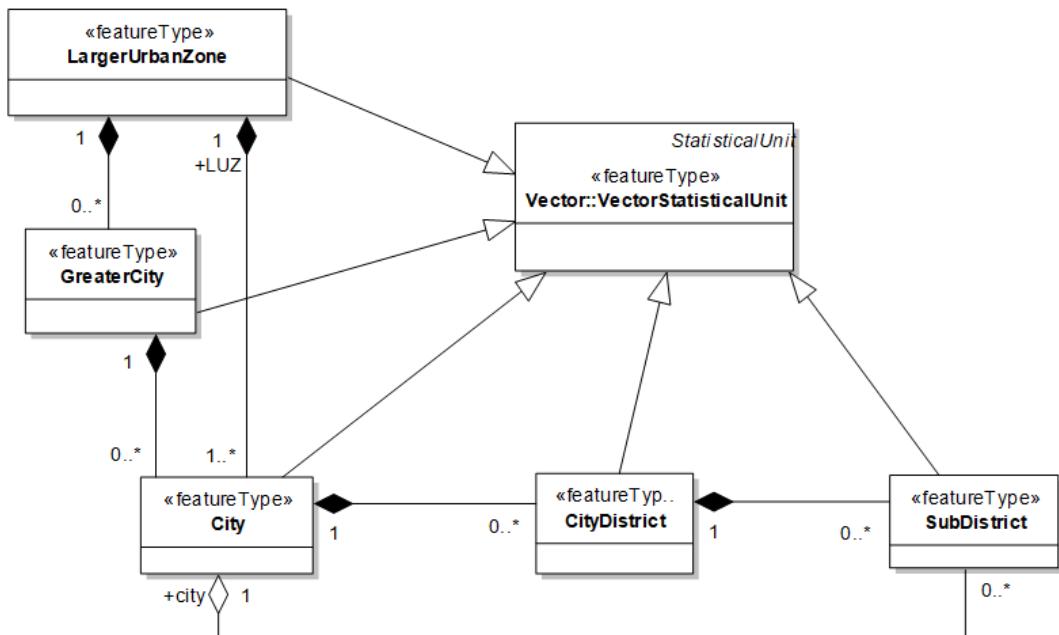


Figure 25 - Urban Audit 2009 dataset class diagram

All Urban Audit spatial objects are area statistical units. For a definition of these classes, refer to <http://www.urbanaudit.org/help.aspx>. Sub districts compose city districts, city districts compose cities, and cities compose larger urban zones. These composition associations are specialisations of the *AreaStatisticalUnit* self-composition *Hierarchical composition*. Some cities like London and Paris are associated with an additional *Kernel* spatial object.

E.2.4. Feature catalogue

Feature catalogue metadata

Application Schema	INSPIRE Application Schema Urban Audit 2011
Version number	3.0

Types defined in the feature catalogue

Type	Package	Stereotypes
<i>City</i>	Urban Audit 2011	«featureType»
<i>CityDistrict</i>	Urban Audit 2011	«featureType»
<i>GreaterCity</i>	Urban Audit 2011	«featureType»
<i>LargerUrbanZone</i>	Urban Audit 2011	«featureType»
<i>SubDistrict</i>	Urban Audit 2011	«featureType»

E.2.4.1. Spatial object types

E.2.4.1.1. *City*

City	
Name:	City
Subtype of:	VectorStatisticalUnit
Definition:	Urban audit 2011 city.
Description:	SOURCE [http://www.urbanaudit.org/].
Stereotypes:	«featureType»

Association role: LUZ

Value type:	LargerUrbanZone
Definition:	The larger urban zone the city composes.
Multiplicity:	1

Association role: uppers

Value type:	GreaterCity
Definition:	The greater city the city composes.
Multiplicity:	1
Stereotypes:	«voidable»

E.2.4.1.2. *CityDistrict*

CityDistrict	
Name:	City district
Subtype of:	VectorStatisticalUnit
Definition:	Urban audit 2011 city district.
Description:	SOURCE [http://www.urbanaudit.org/].
Stereotypes:	«featureType»

CityDistrict

Association role: uppers

Value type:	City
Definition:	The city the city district composes.
Multiplicity:	1
Stereotypes:	«voidable»

E.2.4.1.3. GreaterCity

GreaterCity

Name:	Greater city
Subtype of:	VectorStatisticalUnit
Definition:	Urban audit 2011 greater city.
Description:	SOURCE [http://www.urbanaudit.org/].
Stereotypes:	«featureType»

Association role: uppers

Value type:	LargerUrbanZone
Definition:	The larger urban zone the greater city composes.
Multiplicity:	1
Stereotypes:	«voidable»

E.2.4.1.4. LargerUrbanZone

LargerUrbanZone

Name:	Larger urban zone
Subtype of:	VectorStatisticalUnit
Definition:	Urban audit 2011 larger urban zone.
Description:	SOURCE [http://www.urbanaudit.org/].
Stereotypes:	«featureType»

E.2.4.1.5. SubDistrict

SubDistrict

Name:	Sub district
Subtype of:	VectorStatisticalUnit
Definition:	Urban audit 2011 sub district.
Description:	SOURCE [http://www.urbanaudit.org/].
Stereotypes:	«featureType»

Association role: uppers

Value type:	CityDistrict
Definition:	The city district the sub district composes.
Multiplicity:	1
Stereotypes:	«voidable»

Association role: city

Value type:	City
Definition:	The city the sub district composes.
Multiplicity:	1

E.2.4.2. Imported types (informative)

This section lists definitions for feature types, data types and enumerations and code lists that are defined in other application schemas. The section is purely informative and should help the reader understand the feature catalogue presented in the previous sections. For the normative documentation of these types, see the given references.

E.2.4.2.1. VectorStatisticalUnit

VectorStatisticalUnit	
Package:	Statistical Units Vector
Reference:	INSPIRE Data specification on <i>Statistical Units</i> [DS-D2.8.III.1]
Definition:	Statistical unit represented as a vector geometry (point, line or surface).

Annex F: Temporal aspects - examples - (informative)

This section provides some examples of use of the temporal aspects provided by the *Statistical Units* application schema. The following changes in statistical unit feature datasets can be represented: Creation, deletion, change, aggregation (for area statistical units) and splitting (for area statistical units).

F.1. Creation, deletion, change

Creation, deletion and change of statistical units can be represented through the attributes *versionId*, *beginLifespanVersion*, *endLifespanVersion* and *validityPeriod*. The following examples can be given:

Creation:

The creation of a statistical unit is decided. This statistical unit should become an official reporting unit from 01-04-2008. The new statistical unit is inserted into the dataset the 22-03-2008 with an Id 816. An object with the following attributes is inserted:

Id - VersionId	validityPeriod.be gin	validityPeriod.en d	beginLifespanVer sion	endLifespanVersi on
816 - 1	01-04-2008		22-03-2008	

Change:

An attribute value or the geometry of the statistical unit is changed. This change is inserted into the database the 25-12-2008 and is supposed to be official from the 01-01-2009. A version second of the object with the following attributes are inserted:

Id - VersionId	validityPeriod.be gin	validityPeriod.en d	beginLifespanVer sion	endLifespanVersi on
816 - 1	01-04-2008	01-01-2009	22-03-2008	25-12-2008
816 - 2	01-01-2009		25-12-2008	

Deletion:

The statistical unit will be officially deleted from 04-09-2011. This information is inserted into the dataset the 03-10-2011. The attributes *validityPeriod.end* and *endLifespanVersion* are filled:

Id - VersionId	validityPeriod.be gin	validityPeriod.en d	beginLifespanVer sion	endLifespanVersi on
816 - 1	01-04-2008	01-01-2009	22-03-2008	25-12-2008
816 - 2	01-01-2009	04-09-2011	25-12-2008	03-10-2011

F.2. Aggregation

An aggregation occurs when two (or more) statistical units are merged into a single one. This case occurs often, and there is a need to track the predecessors of the new statistical unit. This tracking can be represented using the *Lineage* association. This example illustrates how it can be used.

Simple aggregation: We consider the two following statistical units:

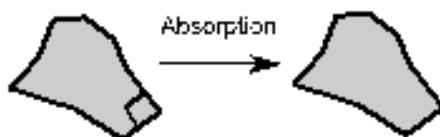
Id - VersionId	validityPeriod.begin	validityPeriod.end	beginLifespanVersion	endLifespanVersion	predecessors	successors
169 - 4	31-03-2010		21-02-2010			
182 - 2	12-03-2010		14-02-2010			

These statistical units are aggregated into a new one, with an Id 216. This aggregation is planned for the 01-01-2011, and this change is inserted into the dataset the 30-01-2010:

Id - VersionId	validityPeriod.begin	validityPeriod.end	beginLifespanVersion	endLifespanVersion	predecessors	successors
169 - 4	31-03-2010	01-01-2011	21-02-2010	30-01-2010		216
182 - 2	12-03-2010	01-01-2011	14-02-2010	30-01-2010		216
216 - 1	01-01-2011		30-01-2010		169, 182	

This change is equivalent to a deletion of the two initial statistical units with a creation of the new one. The *Lineage* association roles *predecessors* and *successors* allow the additional information to be stored. This example involves only two statistical units that are aggregated into a new one – it can be extended to the cases of aggregation of more than two statistical units.

The "absorption" case: A specific case can be considered when one of the initial statistical units absorbs the other one.



If in the previous example 182 absorbs 169, this change can be represented. It is equivalent to a deletion of the absorbed statistical units and a change of the absorbent one.

Id - VersionId	validityPeriod.begin	validityPeriod.end	beginLifespanVersion	endLifespanVersion	predecessors	successors
169 - 4	31-03-2010	01-01-2011	21-02-2010	30-01-2010		182
182 - 2	12-03-2010	01-01-2011	14-02-2010	30-01-2010		
182 - 3	01-01-2011		30-01-2010		169	

F.3. Splitting

A splitting occurs when a statistical unit is split into two (or more) new statistical units. This case occurs often, and there is a need to track the predecessor of the new statistical units. This tracking can be represented using the *Lineage* association. This example illustrates how it can be used.

Simple splitting: We consider the following statistical unit:

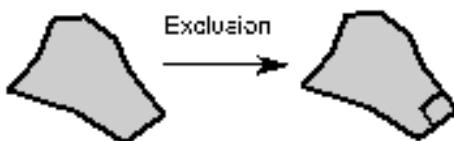
Id - VersionId	validityPeriod.begin	validityPeriod.end	beginLifespanVersion	endLifespanVersion	predecessors	successors
179 - 3	28-08-2010		17-08-2010			

The statistical unit is split into two new ones. These new statistical units are represented with two new objects with an Id 217 and 218. This splitting is planned for the 01-01-2011, and this change is inserted into the dataset the 17-12-2010:

Id - VersionId	validityPeriod.begin	validityPeriod.end	beginLifespanVersion	endLifespanVersion	predecessors	successors
179 - 3	28-08-2010	01-01-2011	17-08-2010	17-12-2010		217, 218
217 - 1	01-01-2011		17-12-2010		179	
218 - 1	01-01-2011		17-12-2010		179	

This change is equivalent to a deletion of the initial object, and a creation of the new ones. The *Lineage* association roles *predecessors* and *successors* allow the additional information to be stored. This example involves the splitting of one statistical unit into only two new ones – it can be extended to the cases of splitting into more than two statistical units.

The "exclusion" case: As for the absorption case (see example 2), a specific case can be considered when one of the final statistical units is the same as the initial one. In this case, the splitting can be seen as an exclusion of one part of the statistical unit as a new one.



If in the previous example 179 excludes 217, this change can be represented. It is equivalent to a creation of the excluded statistical unit and a change of the initial one.

Id - VersionId	validityPeriod.begin	validityPeriod.end	beginLifespanVersion	endLifespanVersion	predecessors	successors
179 - 3	28-08-2010	01-01-2011	17-08-2010	17-12-2010		
179 - 4	01-01-2011		17-12-2010			217
217 - 1	01-01-2011		17-12-2010		179	

[1] The common document template is available in the "Framework documents" section of the data specifications web page at <http://inspire.jrc.ec.europa.eu/index.cfm/pageid/2>

- [2] For all 34 Annex I,II and III data themes: within two years of the adoption of the corresponding Implementing Rules for newly collected and extensively restructured data and within 5 years for other data in electronic format still in use
- [3] The current status of registered SDICs/LMOs is available via INSPIRE website: <http://inspire.jrc.ec.europa.eu/index.cfm/pageid/42>
- [4] Surveys on unique identifiers and usage of the elements of the spatial and temporal schema,
- [5] The Data Specification Drafting Team has been composed of experts from Austria, Belgium, Czech Republic, France, Germany, Greece, Italy, Netherlands, Norway, Poland, Switzerland, UK, and the European Environment Agency
- [6] The Thematic Working Groups of Annex II and III themes have been composed of experts from Austria, Belgium, Bulgaria, Czech Republic, Denmark, Finland, France, Germany, Hungary, Ireland, Italy, Latvia, Netherlands, Norway, Poland, Romania, Slovakia, Spain, Sweden, Switzerland, Turkey, UK, the European Commission, and the European Environment Agency
- [7] For Annex IIII, the consultation and testing phase lasted from 20 June to 21 October 2011.
- [8] Commission Regulation (EU) No 1089/2010 [implementing Directive 2007/2/EC of the European Parliament and of the Council as regards interoperability of spatial data sets and services](#), published in the Official Journal of the European Union on 8th of December 2010.
- [9] The framework documents are available in the "Framework documents" section of the data specifications web page at <http://inspire.jrc.ec.europa.eu/index.cfm/pageid/2>
- [10] UML – Unified Modelling Language
- [11] Conceptual models related to specific areas (e.g. INSPIRE themes)
- [12] In the case of the Annex IIII data specifications, the extracted requirements are used to formulate an amendment to the existing Implementing Rule.
- [13] The INSPIRE Glossary is available from <http://inspire-registry.jrc.ec.europa.eu/registers/GLOSSARY>
- [14] OJ L 326, 4.12.2008, p. 12.
- [15] The Implementing Rules and Technical Guidelines on INSPIRE Network Services are available at <http://inspire.jrc.ec.europa.eu/index.cfm/pageid/5>
- [16] OJ L 274, 20.10.2009, p. 9.