

Procedures for Data and Metadata harmonisation



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Introduction

This self-learning module gives an overview on the procedures used to transform heterogeneous source datasets and metadata according to the relevant INSPIRE target schemas.

It outlines the principles of data and metadata harmonisation related to INSPIRE and describes the steps needed in a harmonisation process. The module explains how to analyse the data models (source and target) and how to utilize mapping tables in order to perform the matching between source data and INSPIRE target schema elements.

It gives an overview of some transformation tools in order to help the selection of the most suitable one.

The module introduces the principles of validation, as a necessary step to check/claim the compliance of the harmonised data and/or metadata to the relevant specification.

Practical examples of data transformation and validation are provided in the modules "Examples of Data Transformation" and "Metadata and Data Validation for INSPIRE" respectively.



Learning outcomes: After the module, the participant will be able to identify and describe the steps needed to perform a data/metadata harmonisation, identify the applicable regulations/guidelines needed in an harmonisation and/or validation process, identify the suitable transformation tool(s), evaluate the complexity of a data/metadata harmonisation process.

Intended Audience: GIS and ICT professionals, who aim to understand the principles of an INSPIRE harmonisation. Non technical staff belonging to organizations aiming to implement INSPIRE.

Pre-requisites: Basic knowledge of the INSPIRE directive.



Summary

- Principles of Data and Metadata harmonisation
- 2. Source and Target Data models
- 3. Mapping tables
- 4. Transformation of Data and Metadata
- 5. Principles of validation of transformed data and metadata

Principles of Data harmonisation

- <u>Definition</u>: providing access to spatial data through network services in a representation that allows for combining it with other harmonised data in a coherent way by using a common set of data product specifications
- This includes agreements about coordinate reference systems, classification systems, application schemas, etc.
- Key to harmonisation for INSPIRE is the use of a common data model in the context of an open standard, service oriented environment.
- Typically, the stages involved in harmonisation processes are:
 - Evaluation
 - Matching
 - Transformation
 - Validation
 - Publication

Principles of Data harmonisation

- Evaluation: Source, target schemas and actual data should be closely examined before design begins.
- Matching: this step often involves extraction of data from available sources, often with some combination of queries and translation. Sometimes data assembly is required.
- Transformation: a process which reshapes source schema and geometry to match the required target schema.
- Validation: conformance assessment process i.e. process for assessing the conformance of an implementation to standards.
- Publication: transformed datasets have to be made available through network services.

Which legislations have to be considered in an INSPIRE Data harmonisation process?



Principles of Data harmonisation

Legislation	Short name	Involved stage
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 and its sub-sequent amendments (Commission Regulation (EU) No 102/2011 of 4 February 2011 and Commission Regulation (EU) No 1253/2013 of 21 October 2013)	Implementing Rules for Interoperability of Spatial Datasets and Services (ISDSS Regulation)	Evaluation, Matching, Transformation and Validation
Commission Regulation (EC) No 976/2009 of 19 October 2009 implementing Directive 2007/2/EC of the European Parliament and of the Council as regards the Network Services	INSPIRE Regulation on Discovery and View Services	Publication
Commission Regulation (EU) No 1088/2010 of 23 November 2010 amending Regulation (EC) No 976/2009 as regards download services and transformation services	INSPIRE Regulation on Download and Transformation Services	Publication



Principles of Data harmonisation

How to fulfill the data requirements?

Guidelines	Support
INSPIRE Data Specifications (DS) Technical Guidelines for the Annex I, II and III Spatial Data Themes.	 Provide guidelines for the implementation of the provisions laid down in the Implementing Rule for spatial data sets and services of the INSPIRE Directive (ISDSS Regulation). Include additional requirements and recommendations that, although not included in the Implementing Rule, are relevant to guarantee or to increase data interoperability. Help the conformance testing process providing an Abstract Test Suite (ATS) which include a set of tests to be applied on a data set to evaluate whether it fulfils the requirements included in the relevant DS and the corresponding parts of ISDSS

Regulation.



Principles of Metadata harmonisation

- Article 5(1) of INSPIRE Directive states that Member States shall ensure that metadata are created for the spatial data sets and services corresponding to the themes listed in Annexes I, II and III, and that those metadata are kept up to date.
- Article 5(4) of INSPIRE Directive states that Implementing Rules shall be adopted taking account of relevant, existing international standards and user requirements.

Which legislations have to be considered in an INSPIRE Metadata harmonisation process?



Principles of Metadata Harmonisation

Legislation OMMISSION REGULATION (EC) No 205/2008 of 3 December 2008 nplementing Directive 2007/2/EC of the uropean Parliament and of the Council s regards metadata OMMISSION REGULATION (EU) No 089/2010 of 23 November 2010 nplementing Directive 2007/2/EC of the uropean Parliament and of the Council s regards interoperability of spatial data ets and services and its sub-sequent mendments (Commission Regulation (EU) to 102/2011 of 4 February 2011 and Commission	Short legislation name	Name of metadata elements
COMMISSION REGULATION (EC) No 1205/2008 of 3 December 2008 implementing Directive 2007/2/EC of the European Parliament and of the Council as regards metadata	Implementing Rules for Metadata	Discovery Metadata
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 and its sub-sequent amendments (Commission Regulation (EU) No 102/2011 of 4 February 2011 and Commission Regulation (EU) No 1253/2013 of 21 October 2013)	Implementing Rules for Interoperability of Spatial Datasets and Services (ISDSS Regulation)	Metadata for interoperability (or also "Evaluation and use Metadata")

Principles of Metadata harmonisation

- In addition to the Metadata elements defined in the mentioned legislations there are also a set of «Recommended Metadata elements» defined in the INSPIRE Data Specifications Technical Guidelines for Annexes I, II and III Spatial Data Themes.
- No legal act binds the provision of this third set of metadata.



Principles of Metadata harmonisation

How to fulfill the metadata requirements?

Guidelines	Support
INSPIRE Metadata Implementing Rules: Technical Guidelines based on EN ISO 19115 and EN ISO 19119	It defines how the requirements of the Implementing Rules for Metadata can be implemented using EN ISO 19115 and EN ISO 19119.
INSPIRE Data Specifications Technical Guidelines for the Annex I, II and III Spatial Data Themes	 They provide: 1. additional theme-specific recommendations and requirements for the implementation of the Discovery metadata 2. guidance and recommendations for the implementation of the: a) metadata for interoperability required by the ISDSS Regulation b) recommended theme-specific metadata elements.



Data and Metadata harmonisation





Evaluation, Matching, Transformation of data

- Step 1: Analysis of the dataset and identification of the Source Data Model
- Step 2: Identification and analysis of the Target Data Model
- Step 3: Updating and filling of the Mapping Table
- Step 4: Analysis and solution of matching problems
- Step 5: Execution of the transformation with the selected tool
- Step 6: Creation of the transformed data



Evaluation, Matching, Transformation of data





Summary

- 1. Principles of Data and Metadata harmonisation
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Source Data model

- Identify source data model (UML, doc, etc.)
 - if no documentation is present analyze the dataset to understand data content (meaning of the attributes, datatype, codelists, etc.)
- Verify data format (shape, gml, DB tables, etc.)



- INSPIRE website:
 - Data Themes definition
 - Legislation/Data Specification
 - Data Models
 - UML (HTML view, EA project)
 - Mapping tables
 - GML Application schemas



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Commission	intrastructure for Spatial information in the European Community	
uropean Commission > INSP	IRE >	
About	INSPIRE DIRECTIVE	Print font size
Home	In Europe a major recent development has been the entering in force of the INSPIRE Directive in May 2007, establishing an infrastructure	
About INSPIRE	for spatial information in Europe to support Community environmental policies, and policies or activities which may have an impact on the environment.	SEARCH IN SPIRE
Legislation	INSPIRE is based on the infrastructures for spatial information established and operated by the 27 Member States of the European Union.	
History	implementing rules. This makes INSPIRE a unique example of a legislative "regional" approach.	• Website and documents
Who's who in INSPIRE	Legislation	Website only
INSPIRE library	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) was published in the official Journal on the 25th April 2007. The INSPIRE Directive entered into force on	OK
INSPIRE Conferences	the 15th May 2007 To ensure that the spatial data infrastructures of the Nember States are compatible and usable in a Community and transhoundary context	LOGIN / REGISTRATION
mplementation	the Directive requires that common Implementing Rules (IR) are adopted in a number of specific areas (Metadata, Data Specifications, Natural's Spruces, Data and Spruce Sharing and Monitoring and Pendenting). These IPs are adopted as Commission Decisions or Pendelting	
Roadmap	and are binding in their entirety. The Commission is assisted in the process of adopting such rules by a regulatory committee composed of representatives of the Mapher State and chained by a regulatory committee composed of the composition	INSPIRE CONFERENCE
Monitoring and Reporting	Directive 2007/2/EC of the European Parliament and of the Council of 14 March 2007 establishing an Infrastructure for Spatial	C. Ala
IOC	Information in the European Community (INSPIRE) 14.03.2007	
INSPIRE GeoPortal	INSPIRE Metadata Regulation 03.12.2008	
Maintenance and	Commission Decision regarding INSPIRE monitoring and reporting 05.06.2009	INSPIRE for good governance
Implementation	Commission Regulation (EC) No 976/2009 of 19 October 2009 implementing Directive 2007/2/EC of the European Parliament and of the Council as regards the Network Services 19.10.2009	INSPIRE
doption	Corrigendum to INSPIRE Metadata Regulation 15.12.2009	
Roadmap	Regulation on INSPIRE Data and Service Sharing 29.03.2010	
Implementing Rules Monitoring and Reporting	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 08.12.2010	
Metaldia	Commission Regulation (EU) No 1089/2010 as regards interoperability of spatial data sets and services 08.12.2010	
Data Specifications	Commission Regulation amending Regulation (EC) No 976/2009 as regards download services and transformation service 08.12.2010	IN YOUR COUNTRY
Network Contracts	COMMISSION REGULATION amending Regulation 1089/2010 as regards interoperability of spatial data sets and services 05.02.2011	
Spatial Data Services	COMMISSION REGULATION (EU) No 1253/2013 of 21 October 2013 amending Regulation (EU) No 1089/2010 implementing Directive	
Data and Service Sharing	2007/2/EC as regards interoperability of spatial data sets and services 10.12.2013	SEARCH FOR
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Stakeholder Participation	01-Apr-2014 Unanimous consent for Spatial Data Services IR	
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News

Definition of Annex Themes and Scope (D 2.3 Version 3), This document identifies definitions and scope of the spatial data themes



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Network Services	Guidelines 10.12.2013		
Spatial Data Services	INSPIRE Data Specification on Bio-geographical Regions - Technical Guidelines 10.12.2013		
Data and Service Sharing	INSPIRE Data Specification on Buildings - Technical Guidelines 10.12.2013 INSPIRE Data Specification on Elevation - Technical Guidelines 10.12.2013 INSPIRE Data Specification on Elevation - Technical Guidelines 10.12.2013		
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Organisations	INSPIRE Data Specification on Land Cover – Technical Guidelines 10.12.2013	HEADLINE	ES
Consultations	INSPIRE Data Specification on Land Use – Technical Guidelines 10.12.2013 INSPIRE Data Specification on Minard December 2014 June 10.12.2013	News 01-Apr-2014: Un	animous
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Common matching problems

Matching problem	Possible solutions
A corresponding source value for an INSPIRE mandatory attribute is missing.	 If the missing value is common to all spatial objects, it can be added as a constant during transformation process. Otherwise, the missing value must be added in the source dataset for each spatial object.
The source codelist (list of predefined values for an attribute) differs from the target INSPIRE codelist.	 Conversion of values can be executed during transformation process, if the transformation tool allows it. Otherwise, conversion of values must be executed in the source dataset.



Summary

- Principles of Data and Metadata harmonisation
- 2. Source and Target Data models
- 3. Mapping tables
- 4. Transformation of Data and Metadata
- 5. Principles of validation of transformed data and metadata



- The easiest way to transform a dataset is to follow the Data Specifications – Technical Guidelines (DS) which allow to obtain a dataset conformant to the Implementing Rules.
- The DS propose the use of GML as the default encoding. GML application schemas (XSD files) are available for all data themes at the INSPIRE schema repository (<u>http://inspire.ec.europa.eu/schemas/</u>).
- Several transformation tools are available for the transformation of source datasets by means of the relevant application schema.



- Among the many transformation tools available, a mention is given for two of them:
 - HUMBOLDT Alignment Editor (HALE), open source tool to define and evaluate conceptual schema mapping and to transform geodata based on these mapping. <u>http://hale.igd.fraunhofer.de/2.8.0/help/index.j</u> <u>Sp</u>
 - GO Publisher, proprietary tool distributed by Snowflake Software -<u>http://www.snowflakesoftware.com/products/</u> <u>gopublisher/</u>.



- Main functionalities common to the transformation tools are:
 - ✓ Import of target schemas from online resource
 - ✓ On-the-fly conversion of attribute values
 - ✓ Preview of the transformed dataset
 - Real-time validation of the transformed dataset against relevant XSD schema
 - ✓ Export of the transformed dataset in GML format



Main differences:

Functionality	HALE	GoPublisher
Format of source dataset	 Shape file WFS PostGIS CSV (for non-spatial data) 	 ORACLE PostGIS SQL Server and MS Access or Excel file (for non-spatial data)
Conversion of values	 Predefined classification function 	SQL scripting
Mapping of INSPIRE complex data type	 Predefined function for "inspireId" and "Geographical name" 	 Manual creation of the data type structure





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Data Transformation

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Metadata Transformation/Creation

- There are two possible options to obtain INSPIRE compliant metadata:
 - ➢ to transform existing metadata
 - ➢ to create new metadata from scratch
- In the first case the same transformation methodology described for the data still applies.
 - ✓ Because an XSD metadata target schema is still missing, the users has to load the full ISO 19115 profile and use the elements defined in the applicable Regulation for the transformation.
- In the second case the procedure to be followed is to use one of the many available metadata editors.



Metadata Editing

- Among the many editing tools available, a quick overview is given on two of them:
 - INSPIRE Geoportal Metadata Editor, a free online metadata editor (<u>http://inspire-</u> <u>geoportal.ec.europa.eu/editor/</u>)
 - GeoNetwork opensource, a catalog application to manage spatially referenced resources. It provides powerful metadata editing and search functions as well as an embedded interactive web map viewer. (http://geonetwork-opensource.org/)



Metadata Editing

	Contact Search Legal notice
Enhancing access to European spatial data	
FAN COMMISSION > INSPIRE > INSPIRE GEOPORTAL > Netadata Editor	
	User guide What's
New Open Validate Save Save as template Help About INSPIRE Spatial Dataset - en	
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Organisation name (*)	
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Metadata date	
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Metadata language (*)	
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(*) This field is mandatory	



Metadata Editing

Default view		Reset Save Sav	e and close Chec	k 🛛 🕀 Other act	ions Cancel 🗆 M	nor edit
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Summary

- Principles of Data and Metadata harmonisation
- 2. Source and Target Data models
- 3. Mapping tables
- 4. Transformation of Data and Metadata
- 5. Principles of validation of transformed data and metadata

Principles of validation of transformed data and metadata

Once data/metadata is assembled and transformed, a validation process is essential to assess conformance to relevant requirements.

Data validation:

Requirements	How to assess conformance
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 and its sub-sequent amendments (Commission Regulation (EU) No 102/2011 of 4 February 2011 and Commission Regulation (EU) No 1253/2013 of 21 October 2013)	Implement the Abstract Test Suite (ATS) included in Annex A – Part 1 of Data Specifications Technical Guidelines
INSPIRE Data Specifications Technical Guidelines for the Annex I, II and III Spatial Data Themes	Implement the Abstract Test Suite (ATS) included in Annex A – Part 2 of Data Specifications Technical Guidelines

Principles of validation of transformed data and metadata

Metadata validation:

Requirements	How to assess conformance
COMMISSION REGULATION (EC) No 1205/2008 of 3 December 2008 implementing Directive 2007/2/EC of the European Parliament and of the Council as regards metadata	INSPIRE Geoportal Metadata Validator
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 and its sub-sequent amendments (Commission Regulation (EU) No 102/2011 of 4 February 2011 and Commission Regulation (EU) No 1253/2013 of 21 October 2013)	Manually verify the presence of the required metadata.