European Commission

Model-driven INSPIRE – blessing or curse?

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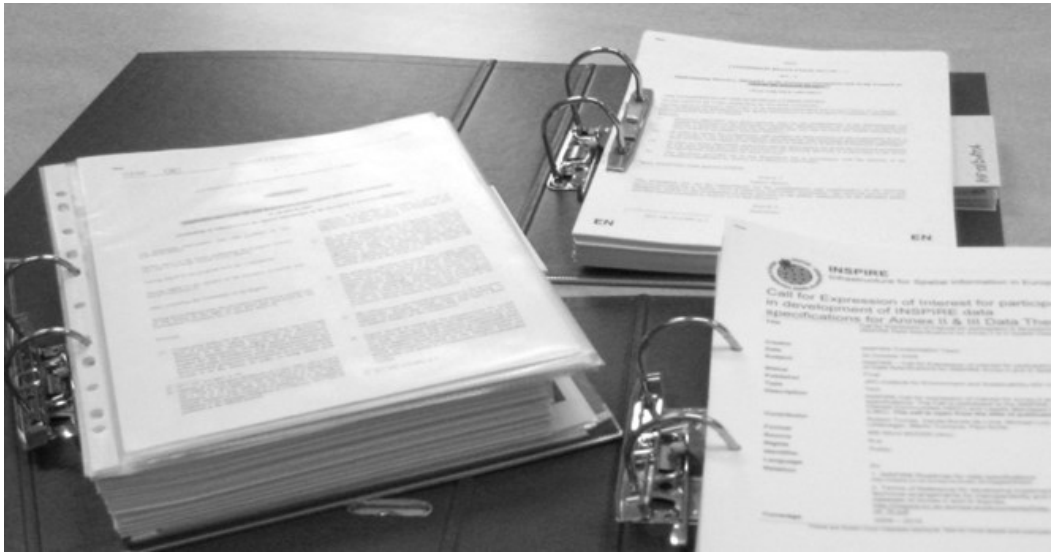

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Supporting legislation

First of all…

Apologies for not making it to the workshop

And **thanks to Clemens** for presenting these slides

INSPIRE data specifications

- Concurrent development of data models by
  - 8 experts groups for the 9 Annex I themes (2008-2010)
  - 19 expert groups for the 25 Annex II+III themes (2010-2013)
  - 74 core application schemas (plus several extensions)
- Probably one of the biggest ever endeavours of developing conceptual data models and data schemas in the geospatial domain
- Adopted approach
  - UML data models
  - Common version-controlled model repository
  - Automatic generation of GML schemas (ShapeChange)
  - Common development roadmap

Model-driven approach – Blessings

- Consistent and well-structured approach across all 34 themes (incl. modelling of cross-theme relationships)
- Allowed detecting many inconsistencies and errors
- Easy generation of encodings and other artefacts (feature catalogue, mapping tables, …)
- The model repository was the "master database" for all data specifications and even the legal acts on data interoperability!

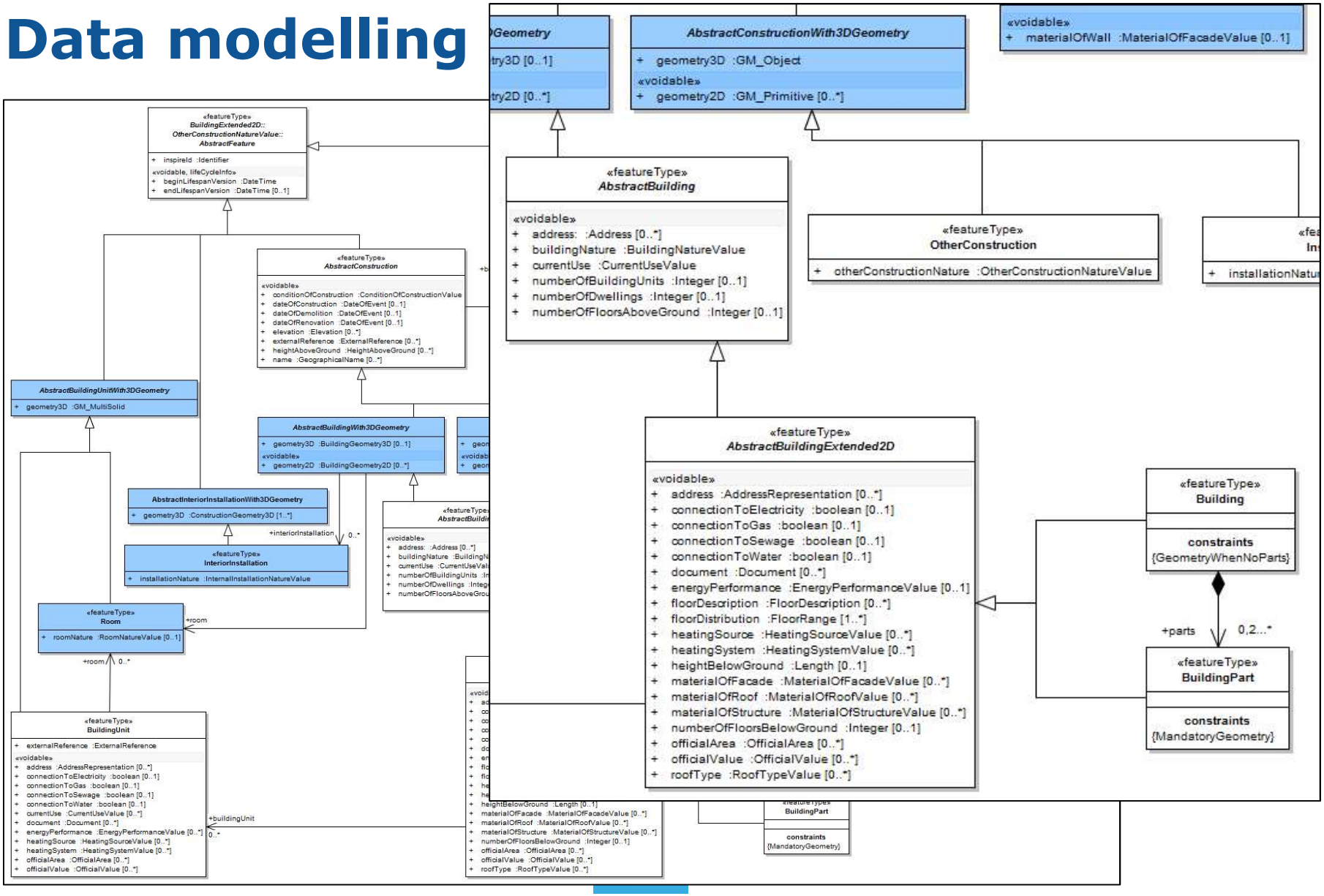
Model-driven approach – Curses

- Many GI experts don't know how to read & write UML
- UML-to-encoding rules understood by even fewer experts
- UML leaves many degrees of freedom for modelling → need for best practices & frequent exchange
- Missing support for managing dependencies between models
- Missing tools for describing model mappings

Data modelling

- Issues
  - Most GI experts are no UML modelling experts
  - UML leaves a lot of freedom → different modelling styles and approaches
  - In some cases overly complex models

Data modelling



Data modelling

- Issues
  - Most GI experts are no UML modelling experts
  - UML leaves a lot of freedom → different modelling styles and approaches
  - In some cases overly complex models
- How they were addressed in INSPIRE
  - Introductory training (UML & EA) to all TWG editors
  - Regular cross-theme meetings to discuss modelling issues
  - Several iterations, reviews and automatic checks of data models
  - JRC contact points helped TWGs to adopt common modelling approaches
- Areas for further work
  - Training material/courses & best practices
  - Communities of practice for data modellers
  - Tools for automatic consistency checking of data models

Code lists

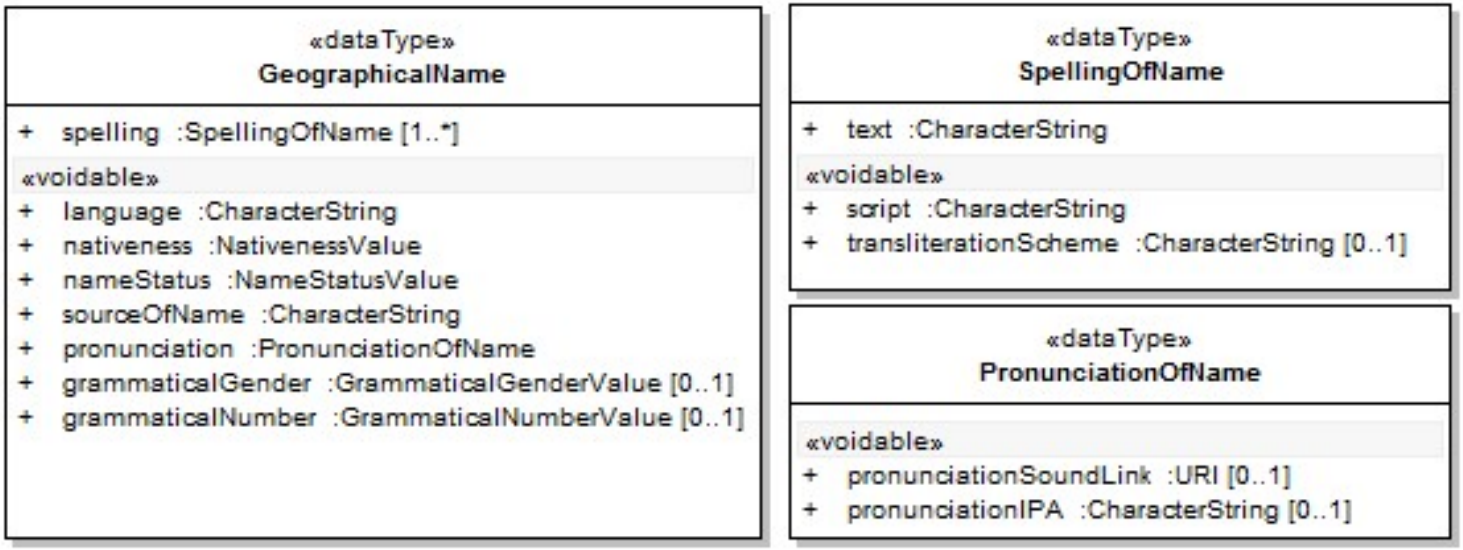
- Issues
  - Where to manage code list values during data model development?
  - If managed outside the UML model (e.g. in a register), how to connect the two?
- How they were addressed in INSPIRE
  - Initially, code list values were managed in the UML model
  - In Annex II+III, it was agreed to publish them in the INSPIRE registry (during development, Excel tables were used)
  - The link was established through a «CodeList» class and a tagged value with the code list URI
- Areas for further work
  - Common guidelines and tools for managing code lists, also during data model development

Presenting data models

- Issues
  - Many GI experts have difficulties with understanding UML class diagrams
  - Data providers have difficulties identifying relevant application schemas and feature types to map their INSPIRE-relevant data to
- How they were addressed in INSPIRE
  - Different representations (e.g. feature catalogues, searchable feature concept dictionary, legal acts) automatically created from UML models
- Areas for further work
  - Developing other, more intuitive representations to explore data models
  - Training for readers/consumers of UML data models ?

Directly generating encodings from UML

- Issue
  - Conceptual models may not always be directly suitable for generating data encodings, e.g. when
    - advanced modelling constructs (e.g. association classes) are used
    - Complex data types are used, e.g. GeographicalName



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- Issue
  - Conceptual models may not always be directly suitable for generating data encodings, e.g. when
    - advanced modelling constructs (e.g. association classes) are used
    - Complex data types are used, e.g. GeographicalName
- How they were addressed in INSPIRE
  - Custom encoding rules for specific modelling constructs
  - Complex data types were usually mapped 1:1
- Areas for further work
  - Guidelines for deriving implementation models from conceptual models
  - Methods for simplifying complex data types when generating the encoding

Managing dependencies & versioning

- Issues
  - Many dependencies between data models for 34 INSPIRE themes
  - Dependencies also reflected as imports in XML schemas
  - When updating individual application schemas and XML schemas, this creates a cascade of required updates in dependent schemas
- How they were addressed in INSPIRE
  - Version-controlled data model repository
  - Distinct releases of data models and schemas
  - Proposal to maintain the XML schemas for deprecated models for a certain period of time
- Areas for further work
  - Methods and tools for identifying and managing dependencies of data models and encodings

Mapping between data models

- Issues:
  - Model mappings may be required between
    - Conceptual and implementation models
    - Exchange data models and existing standards (e.g. GeoSciML, CityGML)
    - Exchange data models and data models of source data sets
  - Mappings are often expressed using mapping tables
    - Not easy to use
    - Not easy to maintain if one of the model changes

Mapping between data models

- Example: the mapping between the INSPIRE Addresses and the ISO 19160-1 data model required 39 mapping tables

Table B.4.3 – Core: Mapping Address (INSPIRE Addresses model) → Address (INSPIRE profile)

INSPIRE Addresses model attribute and data type		INSPIRE profile attribute	Mapping description
inspireId	Identifier	inspireId	
position		position	Refer to table B.4.19 (GeographicPosition → AddressPosition) for the mapping.
locator		addressComponent	Only map address components that are of type AddressLocator
alternativeIdentifier	CharacterString	id	Map CharacterString to Oid (from 19152) data type.
component		addressComponent	
parentAddress		parentAddress	

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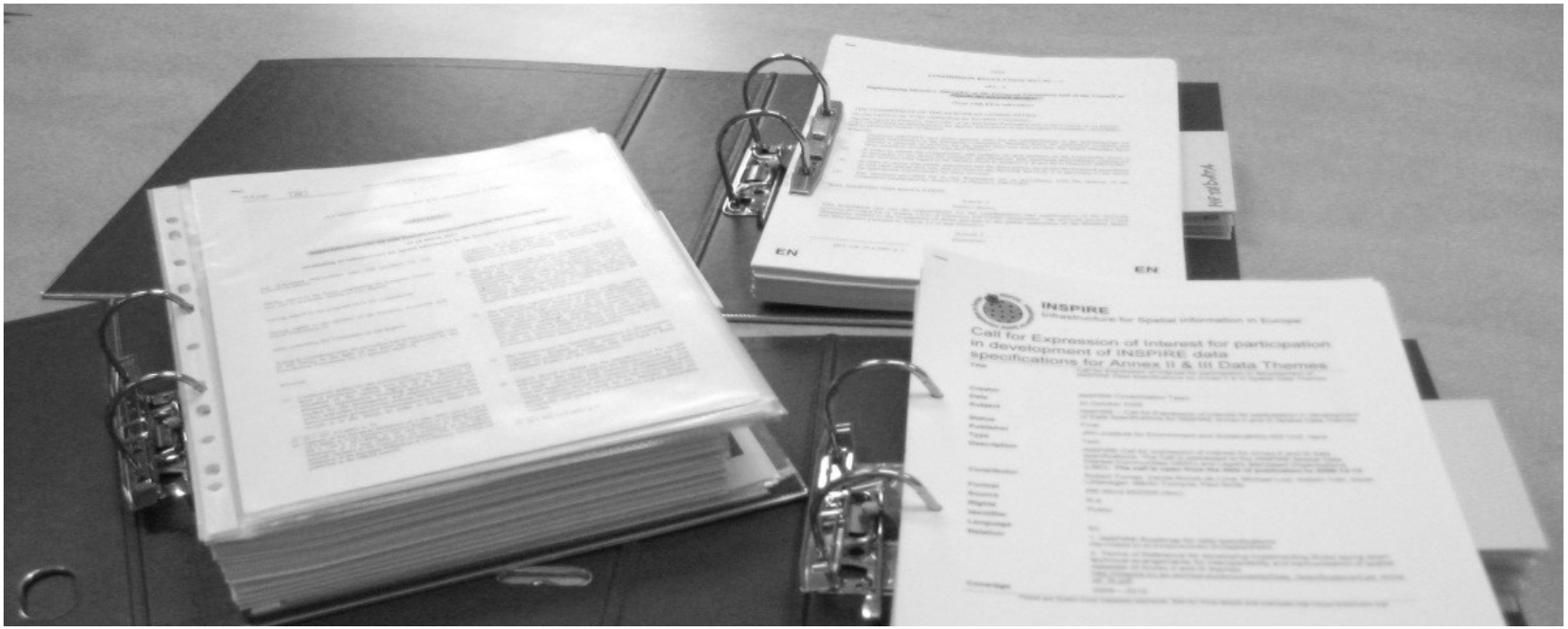
  - Mappings are often expressed using mapping tables
    - Not easy to use
    - Not easy to maintain if one of the model changes
- How they were addressed in INSPIRE
  - Mapping tables automatically generated to support mapping from source to INSPIRE data models
- Areas for future work
  - Development of other representations of mappings that can be linked / kept in sync with the data models

Conclusions

- The model-driven approach clearly was the key for successfully delivering the INSPIRE data specifications and data interoperability Regulation
- But it requires thorough understanding (→ training) and good tool and methodological support
- Work is still needed on
  - General training & guidelines
  - Model mappings
  - Management of dependencies and versioning
  - Guidelines and tools for generating (simple) encodings

Have a good workshop!



The INSPIRE Regulation on data interoperability – probably the first “model-driven legal act”