Transformation for INSPIRE

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Why transform?

- “As a general rule, the most successful man in life is the man who has the best information.”
  Benjamin Disraeli, 19th C prime minister.

“It is the unexpected re-use of information which is the value added by the web.”
  Sir Tim Berners-Lee, W3C
The Semantic Web

- The web of data
- Needs semantic interoperability
- Real features provide vital links
- But how do features match?
  - Your river is my stream
  - Your buildings are my factory
  - Your region is my ‘devolved’
  - Your intersection is my roundabout
Schemas & Data Models

- **Existing datasets** conform – more or less – to data models (or schemas) devised by providers – but may not be publicly known or available.

- **INSPIRE** provides a **public set** of well specified schemas/data models in order to facilitate common understanding & interoperability.

- Therefore we must transform from one to the other:

  **Schema transformation!**
INSPIRE Technical Architecture

Service Layer
- Registry Service
- Discovery Service

Data Sources
- Registers
- Service Metadata
- Data Set Metadata
- Spatial Data Set

Application and Geoportals
- Service Bus
- GeoRM layers

DT NS
- View Service
- Download Service
- Transit Service
- InvokeSD Service

Transformation Service

DT MD

DT DS

Framework for harmonized DS

Thematic DS

TWG TWG TWG
From INSPIRE Regulations


- Article 12 of the INSPIRE Directive states that:
  - Member States shall ensure that public authorities are given the technical possibility to link their spatial datasets and services to the network referred to in Article 11(1). This service shall also be made available upon request to third parties whose spatial data sets and services comply with implementing rules laying down obligations with regard, in particular, to metadata, network services and interoperability.

- However Draft IR for INSPIRE Transformation Services [4] state that this does not apply to transformation services:
  - The technical possibility to link services referred to in the Article 12 does not apply to the Transformation Service as transformations cannot be aggregated in a straightforward manner, as data content can be.

- The State of the Art Report discusses this contradiction.
Technical Guidance for Schema Transformation

- INSPIRE has:
  - Implementing Rules with Technical Guidance

- Network Services IR
  - Discovery, View, Download, *Invoke* and Transform

- Transformation of:
  - Coordinate Systems
  - Natural Languages
  - File Formats
  - Geometries
  - Schemas
Transformations – Who Provides?

- TnS
- Data Publisher
- Data Provider
- Third parties
- on-line delivery

Data Providers & Publishers on-line delivery

Service Bus

GeoRM layers
TG Contract – 2009/10

- Tendered in August 2009
- Awarded November 2009
- Winning consortium –
  - RSW Geomatics Ltd
  - Spatial
  - Rob Walker Consultancy

- Delivery
  - Dec 2009 – July 2010
TG Progress – 2010

- Analyse & report on the State of the Art
  - Existing projects and vendors
  - Rules and languages
- Draft Technical Guidance
- Produce Prototype demonstrator
- Incorporate TG stakeholder comments
  - Including DTs, LMOs, SDICs
  - Krakow workshop
- Final Technical Guidance and Video

**Completed**

**In progress**

**By end July**
State of the Art Analysis

- Schema Description Languages
- Model Mapping Languages
- Transformation Tools
- Enterprise Architecture

Conceptual Scope

Transformation Service Consumer

Source Data

Source Schema

Target Schema

Register

Model Mapping

Transformation Web Service

IMPLEMENTING RULES

Web Service Interface Operations

CRS transformation

Language translation

File format translation

Geom transformation

Schema transformation

Web Service Provider X

Technology Engine X

Web Service Provider Y

Technology Engine Y

Web Service Provider Z

Technology Engine Z

Multiple Vendors Or Service Providers
## Schema Description Languages

<table>
<thead>
<tr>
<th>Name / Version of Language</th>
<th>From</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unified Modelling Language (UML) 2.2</td>
<td>OMG</td>
</tr>
<tr>
<td>XML Metadata Interchange (XMI) 1.1</td>
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</tr>
<tr>
<td>XML Schema Definition (XSD) 1.1</td>
<td>W3C</td>
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<tr>
<td>Geography Markup Language (GML) 3.2.1</td>
<td></td>
</tr>
<tr>
<td>Resource Description Framework (RDF) 1.0</td>
<td>W3C</td>
</tr>
<tr>
<td>Web Ontology Language (OWL) 2.0</td>
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## Model Mapping Languages

<table>
<thead>
<tr>
<th>Language</th>
<th>Vrsn/Date</th>
<th>Originator</th>
<th>Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>Extensible Stylesheet Language for Transformations (XSLT)</td>
<td>2.0</td>
<td>W3C</td>
<td>Standard</td>
</tr>
<tr>
<td>Web Ontology Language (OWL)</td>
<td>2.0</td>
<td>W3C</td>
<td>Standard</td>
</tr>
<tr>
<td>Rule Interchange Format (RIF)</td>
<td>1.0</td>
<td>W3C</td>
<td>Standard</td>
</tr>
<tr>
<td>Semantic Web Rule Language (SWRL)</td>
<td>21/05/2004</td>
<td>W3C</td>
<td>Standard</td>
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<tr>
<td>Query/View/Transform (QVT)</td>
<td>1.0</td>
<td>OMG</td>
<td>Standard</td>
</tr>
<tr>
<td>Common Logic (CL)</td>
<td>ISO/IECIS2470 7:2007</td>
<td>ISO</td>
<td>Standard</td>
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<tr>
<td>Ontology Mapping Language (OML)</td>
<td>06/10/2005</td>
<td>DERI OMWG</td>
<td>Specification</td>
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<tr>
<td>Rewerse II Rule Markup Language (R2ML)</td>
<td>0.5</td>
<td>WGI1</td>
<td>Specification</td>
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<tr>
<td>Tefkat</td>
<td>2.1.0.lawley266</td>
<td>DSTC Australia</td>
<td>Other</td>
</tr>
</tbody>
</table>
Vendors/projects contacted

- SAFE Software
- Snowflake Software
- interactive instruments GmbH
- 1Spatial
- Geodan
- GIS4EU
- con terra GmbH (using SAFE)
- lat / long GmbH
- Talend
- Humboldt
- Oracle
- ERDAS
- Altova
- GeoTools
- 52° North
- GeoServer
- AuScope

Bold indicates response
Key results of survey - 1

- **No** widely used standards for schema descriptions or model mappings
  - Justifies contract remit!
- **Most** vendors claim support for many levels of transformation functionality
  - Rich mapping language with necessary ‘expressiveness’ assured by most vendors.
- **Most** support GML, Oracle, ESRI Shape files.
  - But - check GML versions supported for INSPIRE
- **Mapping definition process**
  - From intuitive user interfaces > editing structured text
Key results of survey - 2

- **Schema compliance**
  - Most support syntactic validation of model mapping, (for target schema).
  - Few support semantic validation to ensure target data is compliant with specs.

- **Deployment**
  - Most run on several platforms in desktop or batch.
  - Some tools provide web accessible interfaces.

- **Performance**
  - Most claim support for scalable processing, inc. multiple simultaneous requests.
  - Performance requirements therefore likely to be met.
SAA Conclusions

- **Core capability**
  - Need source & target schemas and desc. of model mapping.
  - Several capable open standards do exist
  - But most tools don’t use these open standards
  - However, many tools can perform highly expressive transformations.

- **Business processes**
  - details are vital to operational deployment of INSPIRE transformation services.
Technical Guidance

- Architectural Goals & Constraints
- Use Case View
- Logical View
- Data View
- System Qualities
- Implementation & Deployment View

Architectural Constraints

- **EC Regulations**
- **Mapping Flexibility & vendor neutrality**
- **Open Interfaces** - enables ‘Plug and Play’
- **Statelessness**
- **Control Messages separate**
  (from Data & Schema Transfer – size, reference, audit)
- **Schema & Data Agnostic**
- **Automated Process**
  In overall integrated network: orchestration, security, rights management and quality of service provisions.
Prototype Components

Workflow Management System and/or Client App

DBMS Data

Source
GML 2 / 3.1.1

TNS
Radius Studio

Source/Target Schemas
Mapping Rules Interpretation

INSPIRE GML 3.2.1

WFS-T or FTP
GML File

GIS Viewer
e.g. Tatuk

Mapping Rules Encoding

INSPIRE App Schema

Geo File Data e.g. shp

WFS
Geo Server

Geo File Data

Mapping
Defns
(RIF)

Mapping Defns
(XSD/GML)

Standards Based XML Repository

INSPIRE

GML 3.2.1

Source/Target
Schemas

Mapping Rules

Encoding

HALE

Mapping Defn UI
<table>
<thead>
<tr>
<th>Theme</th>
<th>Data Provider</th>
<th>Data Format</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cadastral Parcels</td>
<td>NLS Sweden (Lantmäteriet)</td>
<td>SHP</td>
</tr>
<tr>
<td></td>
<td>NLS Finland</td>
<td>GML</td>
</tr>
<tr>
<td></td>
<td>Belgium Cadastre</td>
<td></td>
</tr>
<tr>
<td></td>
<td>France Cadastre</td>
<td></td>
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<td>Hydrography</td>
<td>Dutch Kadaster</td>
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<td></td>
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<td>Transport Networks</td>
<td>OS Ireland</td>
<td>AutoCAD DWG</td>
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<tr>
<td></td>
<td>LPS Northern Ireland</td>
<td>SHP</td>
</tr>
</tbody>
</table>
Prototype demonstrates

- Vendor neutrality

- Decoupling of ‘rule authoring’ from ‘execution’

- Defined interfaces that meet ANY INSPIRE schema transformations
  - Even if implementations have own ‘local’ constraints
Enabled by standards

- **GML/XSD**
  - for source & target schema descriptions
  - Established standards; good tool support
  - Physical data model closely tied to data itself
  - Reinforces INSPIRE use of GML

- **RIF (Rules Interchange Format)**
  - Output from rule authoring process
  - Rigorous academic backing
  - Final stages of W3C adoption
  - HALE > RIF open source from this project

Ultimately: Do we want our own ‘geoweb’ or Do we participate in the real web?
Thank you

For

Rob Walker Consultancy