‘INSPIRE-compliant web services’

An assessment of the quality and feasibility of the INSPIRE guidelines

MSc research project
GIMA programme

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• full-time and part-time
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Overview

1. Introduction (research problem)
2. Conceptual study
3. Prototype implementation
4. Compliance testing
5. Conclusion
RESEARCH PROJECT

What is a INSPIRE-compliant web service?

Do we know how to build one, based on the INSPIRE documents?

„INSPIRE-compliant” = conformant to INSPIRE requirements and recommendations (for Network Services + Data and Metadata)
• What is meant by INSPIRE-compliance/conformance?

• What is the quality of the specific guidelines? (completeness, clarity, consistency...)

• Is implementation of INSPIRE-compliant web services feasible?

• How to test compliance to INSPIRE in practice? (guidelines/methodologies + test automation?)
Research steps

**Conceptual study** - identification of the guidelines (requirements and recommendations) from INSPIRE documentation, synthesis of the guidelines

**Prototype implementation** - setting up prototype INSPIRE-compliant services (for the case study area)

**Compliance testing** - manual inspection and evaluation of the prototype, study on automated compliance testing methods, study on data compliance
CASE STUDY: web services for Narew National Park (Poland)

http://www.staypoland.com/img/maps/107_pl.jpg
Conceptual study
INSPIRE documentation - review

- INSPIRE Directive

- ‘INSPIRE Discovery and View Services Regulation’ (EC 976/2009) + Draft Commission Regulation as regards download services and transformation services

- Draft IRs (v.3.0) and Technical Guidance (v.2.0) for Discovery, View, Download, Transformation Services

- INSPIRE Network Architecture (v.3.0); INSPIRE NS SOAP Framework; SOAP Primer for Discovery & View Services

- ‘Draft CR as regards interoperability of spatial data sets and services’; Data Specifications (Annex 1)

- ‘INSPIRE Metadata Regulation’ (EC 1205/2008); Metadata IRs: TG based on ISO 19115 and 19119
What is meant by ‘compliance’ in the context of INSPIRE Network Services?

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<td>M</td>
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<td>C</td>
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M – mandatory; O – optional; C – conditional; n.a. – not applicable
What is meant by ‘compliance’ in the context of INSPIRE Network Services?

- support of *all mandatory* profiles for particular type of services (*HTTP GET* + *HTTP POST/SOAP* protocols → depending on type of service)

- implementation of mandatory (*OGC/ISO/other*) standards + proper versions (*e.g. WMS 1.3, WFS 2.0*) + mandatory service operations + operation parameters (request and response)

- required output formats + versions (*e.g. GML 3.2.1* for Download Service)

- INSPIRE-compliant data and metadata + harmonized layer names, portrayal styles, CRS’s, temporal aspects (*where applicable*)

- handling multilingual elements

- rights management requirements (*INSPIRE rules for access, licencing, pricing etc.*)

- Quality of Services (*performance, capacity, availability etc.*)
SOAP + XML + WSDL as communication protocols recommended for INSPIRE Network Services (WS-I Basic Profile 1.2 / 2.0 (in future))

The use of services relying on HTTP GET and HTTP POST bindings is acceptable, however in future all INSPIRE services shall migrate to the WS-I Profile. Details on the implementation of INSPIRE services according to the GET, POST and SOAP profiles are given in the Technical Guidance documents for particular services.

http://www.wikipedia.org
Quality of the guidelines

COMPLETENESS?

- Specific requirements/recommendations are present for all relevant aspects of INSPIRE services

- The current scope of the guidelines is, however, limited due to ongoing drafting process:
  - definitions of SOAP/WSDL bindings present for Discovery/View Services; not present for Download/Transformation Services
  - specific guidelines for Transformation Services only present for coordinate transformations
  - IRs and TGs for Invoke Services need to be drafted

- More work needed on some aspects of services, e.g.
  - multilingual aspects, rights management, Quality of Service requirements
  - ATS’s (Abstract Test Suites) and ETS’s (Executive Test Suites) for Network Services & Metadata/Spatial Data are missing
Quality of the guidelines

CLARITY AND CONSISTENCY?

• Documentation in general well-structured and understandable (TGs based on ISO/OGC standards)

• Problems with the consistency and clarity:
  - multiple HTTP GET/POST and SOAP-based profiles for INSPIRE services (what is obligatory?)
  - strict definition of some operations and their parameters is lacking, e.g. GetFeatureInfo - View Service (optional?)
  - lack of harmonized interpretation of the ‘Link Service’ operation across all services (how to implement it?)
  - inconsistencies in the approach to layer naming (View Service TGs vs. Data Specifications)
Prototype implementation
Do widely available software solutions support INSPIRE-compliant services?

How INSPIRE-compliant services could be implemented in practice?
Prototype services

- View and Download Service
- Sample GIS data from Narew National Park, corresponding to Annex 1 Data Themes
  - Administrative Units (borders of communes/municipalities)
  - Hydrography (rivers and streams; groundwater extraction points)
  - Protected Sites (area of the national park)
- INSPIRE-compliant metadata (XML)
- Implementation with Geoserver 1.7 /2.0 (WMS/WFS)
Why GeoServer?

• open-source project, one of the leading spatial data servers (web mapping applications) → http://geoserver.org

• implements the OGC standards, that INSPIRE View and Download Service are relying on (Web Map Service and Web Feature Service) → WMS 1.1.1, WFS 1.1.0 / 1.0.0 (INSPIRE requires WMS 1.3, WFS 2.0)

• it is possible to investigate the level of compliance of the services implemented with GeoServer to the INSPIRE guidelines
Prototype development

- data preparation (conversion, re-projection)

- metadata preparation (INSPIRE Metadata Editor)

- hosting of WMS/WFS services in GeoServer (configuration of data layers & services settings)

- testing View and Download Services with Quantum GIS and uDig
Prototype services
(example: testing WMS from Geoserver in Quantum GIS)
Compliance testing
Compliance testing

- Manual inspection of the prototype (evaluation)

- Study on (automated) testing methodologies
  - INSPIRE documentation review (ATS’s missing!)
  - ISO 19105 ‘Conformance and testing’ / ISO 19119 ‘Services’
  - OGC Compliance Testing Program (CITE) → practical tests
    (e.g. OGC CITE test for WMS 1.1.1)
What is supported with GeoServer?

DEFAULT:
- ‘Standard’ profile of INSPIRE View and Download Services (HTTP GET)
- all mandatory and optional operations of WFS and WMS
- mandatory output formats of View (PNG, JPEG) and Download Service (GML3)

CONFIGURABLE:
- in GeoServer: recommended CRS’s, harmonized data layer names, default portrayal rules (styling)
- outside GeoServer: INSPIRE-compliant data & metadata, QoS parameters

NOT SUPPORTED:
- WMS 1.3, WFS 2.0
- SOAP bindings
- multilingualism
- Rights Management layer
- ‘Link View/Download Service’ operations
Recommendations for GeoServer

- shall support **WMS 1.3**, as ‘ISO 19128:2005: Geographic Information - Web Map Server Interface’ recommended by INSPIRE for the View Service, relies on OGC WMS 1.3 specification (*a published standard*)

- shall support **WFS 2.0**, as ‘ISO/DIS 19142 Web Feature Service’ recommended by INSPIRE for the Download Service, relies on OGC WFS 2.0 specification (*still a draft, in the process of completion*)

- support for SOAP framework shall be considered to be implemented (no plans officially announced)

More information on future plans for GeoServer:  
[http://geoserver.org/display/GEOS/Roadmap+Ideas](http://geoserver.org/display/GEOS/Roadmap+Ideas)
Is implementation of INSPIRE-compliant web services feasible?

- OGC/ISO compliant services based on HTTP GET/POST bindings → straightforward, but INSPIRE-specific extensions needed (handling mandatory/optional parameters of operations, multilingual aspects of the services, rights management, etc.)

- INSPIRE-compliant services based on SOAP bindings → more complicated (no support from widely available technical solutions/development tools; prototyping and testing phase → OGC, Orchestra, Geonovum projects etc.)

- Spatial data and metadata shall be also provided compliant with the data models required by INSPIRE
Compliance testing

- manual inspection of the prototype (evaluation)

- study on (automated) testing methodologies
  - INSPIRE documentation review (ATS’s missing!)
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    (e.g. OGC CITE test for WMS 1.1.1)
TEST EXAMPLE:
OGC test for WMS 1.1.1

• Basic service elements
  • version numbering and negotiation
  • request parameter rules (parameter ordering and case)

• GetCapabilities operation
  • request parameters
  • GetCapabilities response (general service metadata, capability metadata, layer properties, layer attributes)
  • output formats

• GetMap operation
  • request parameters

• Get Feature operation
  • request parameters

Other relevant CITE tests: WMS 1.3.0, WFS 1.1.0 / 1.0.0, GML validation
## Compliance testing - synthesis

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OGC CITE testing - summary

• WMS and WFS can be tested, incl. versioning, mandatory operations, operation parameters (request and response), output formats
  - WMS 1.3.0 / 1.1.1
  - WFS 1.1.0 / 1.0.0

• GML validation tests are also available
  - GML 2.1.2 schema validation and instance validation

• CITE tests for WFS 2.0 and GML 3.2.1 are missing

• SOAP protocol bindings are not tested

• INSPIRE-specific elements of services are not tested (data and metadata models, quality of services, multilingual elements etc.)
How to test compliance to INSPIRE in practice?

• **ATS**, and preferably **ETS for INSPIRE Network Services** must be elaborated (not present at the moment)

• **automation of compliance tests** shall be considered to the possible extent

• **OGC CITE testing methodology** for web services may be used as a guidance (*INSPIRE services rely mostly on OGC standards*)

• OGC tests would need to be extended with **INSPIRE-specific extensions** (e.g. for harmonized layer names, reference systems, multilingual elements)

• other issues: **ATS/ETS for spatial data** (schema validation and spatial data validation); **benchmark tests for QoS** (performance, capacity, etc.)
Data compliance testing

• ATS’s for spatial data are needed
  (*Annex A* - missing in current Data Specifications)

• tools for schema validation and data validation against required
  XML application schema → XML Spy, oXygen XML, etc.

• validation of geometry/topology of data objects is an important
  aspect of testing

• OCL constraints for INSPIRE data shall be tested

• ATS in ISO 19152 LADM (*Land Administration Domain Model*)
  can be used as an example for INSPIRE data ATS’s

• ESDIN project → mapping tools for EU members
Conclusion

- INSPIRE guidelines - use OGC/ISO expertise but not always complete, clear and consistent
- Challenge: INSPIRE services based on ‘SOA-stack’
- Compliance testing methodology for INSPIRE NS is needed (ATS/ETS)
- INSPIRE-compliant data is crucial (mapping tools for EU members)
Thank you for your attention!

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