'INSPIRE compliant web services': An assessment of the quality and feasibility of the INSPIRE guidelines

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The INSPIRE infrastructure and its implementation could be considered as mainly a legal and practical implementation issue. However it also tends to be a topic dealt with on a scientific research and educational level, because of its highly innovative character. This paper presents the findings of a research project on 'INSPIRE compliant web services'. Main objective of the project is to assess the quality and feasibility (in the sense of completeness, consistency and ease-of-implementation) of the guidelines for INSPIRE Network Services. Part of this assessment is also the question: how can INSPIRE compliance be tested and measured?

1. Problem statement and methodology

The topic was tackled both from a theoretical and a practical point of view. For the practical part some prototype web services were set-up. This way two questions could be answered: are the INSPIRE implementing rules and guidelines for Network Services at the moment clear and elaborate enough to judge whether an implementation is INSPIRE compliant, and secondly: how can this compliance be tested. Although the focus of the assessment was on Network Services, it should be noted that INSPIRE compliant web services require INSPIRE compliant data (also see section 4).
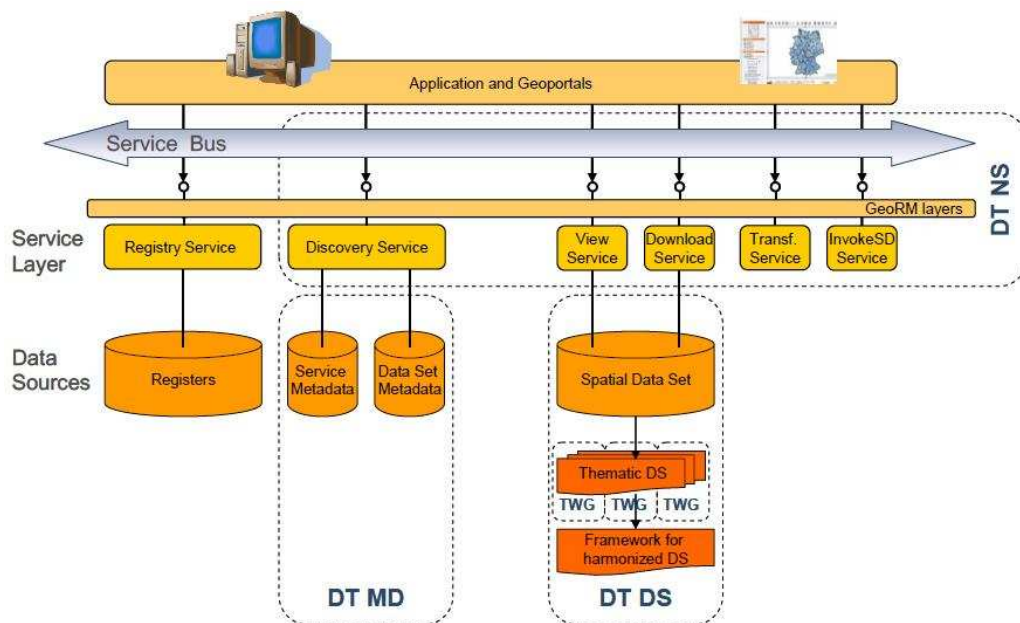

Fig.1 INSPIRE Technical Architecture
(source: INSPIRE Technical Architecture – Overview, 2007)

The theoretical part of the project included a detailed investigation and assessment of the INSPIRE requirements and recommendations as regards: technical architecture of the services (Fig.1), functionality of the particular network services, quality of services, rights management issues, elements of spatial data and metadata models. This part of the project has been finalized with the synthesis of the guidelines derived from the INSPIRE documentation (legislation, implementing rules, technical guidance documents and others). The practical part of the project was the implementation of some prototype View and Download services. The prototype was realized in order to validate and evaluate whether the Implementing Rules and other guidelines contained all necessary information to set-up INSPIRE compliant web services, with special attention to the question how this 'compliance' can be measured using automated testing methods.

2. Synthesis and assessment of INSPIRE guidelines
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The review of the INSPIRE documents showed that these documents are in most points specific and clear enough to provide a framework for implementation of INSPIRE compliant services, data and metadata.

However, the INSPIRE guidelines are not yet complete, a number of technical guidelines concerning Network Services is still to be published. The technical architecture, functionality of services, reference systems and output formats are well specified. Still more work is needed on issues such as multilingual aspects of services and rights management and also on the adaptation of the INSPIRE services to SOAP bindings.

Another item that is needed and that is currently missing in the guidelines is the provision of more strict rules for compliance testing (Abstract Test Suites (ATS) for INSPIRE services and data) and quality of service (QoS) testing.

Finally, the status of work on specific INSPIRE Network Services is different: the specifications are most advanced for the Discovery and View Services, less advanced for the Download and Transformation Services and almost no work is done yet for Invoke Services. Obviously this has consequences for the latter category of services: conclusive requirements and guidelines are simply not there yet.

3. Prototype implementation and evaluation

The prototype made for the project was aimed to be an implementation of sample 'INSPIRE compliant' web services based on real GIS data and a specific scenario (web services for a national park). The services that have been chosen for the implementation are View Service and Download Service. The spatial data was acquired from the resources of the Narew National Park (Poland).

For the implementation of the prototype services existing software was chosen, namely GeoServer (version 1.7), one of the spatial data server products implementing the OGC standards (http://geoserver.org). GeoServer is open source software, well documented and widely used for the publishing of geodata. The prototyping process included the following steps: data selection, data conversion/transformation, metadata creation,

installation of GeoServer on a web server, configuration of GeoServer and the web services, testing of services via the Internet (Fig.2) and evaluation.
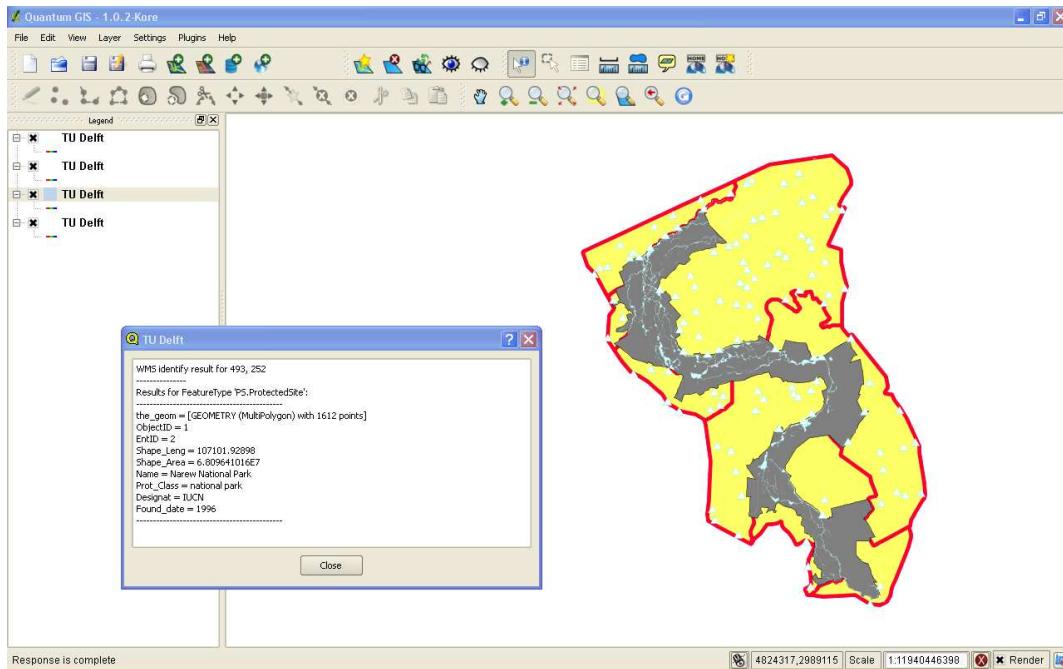

Fig.2 Testing of GeoServer WMS (View Service) in Quantum GIS client:
GetMap and GetFeatureInfo operations; INSPIRE default SLD styling
(source data: GIS database, Management Plan of Narew National Park)

The prototype realized with the use of GeoServer has been evaluated for the compliance with INSPIRE guidelines. The evaluation was done in two ways: by manual inspection of the prototype services, and by using the compliance test methodology proposed by OGC. The findings from the theoretical part of the research have been used as a guidance. The evaluation of the prototype embraces major elements of the INSPIRE services – technical protocols, functionality, reference systems, output formats, data and metadata.

The evaluation of the prototype showed that web services provided with GeoServer fulfill the majority of requirements for View/Download Services through the WMS/WFS functionalities (mandatory operation parameters, offered output formats etc.) Some elements need to be configured within GeoServer (e.g. the required spatial reference system, layer/feature type names that conform to the INSPIRE data specifications). Still, some INSPIRE-specific extensions to the functionality provided by GeoServer are needed for both services (support of the SOAP/POST methods for the service operations, solutions for multilingual aspects of services and rights management - access rights, pricing and licensing). Furthermore, GeoServer does not yet support WMS 1.3 (the last version it supports is WMS 1.1.1) while the INSPIRE View Service implementation shall be based on ISO 19128, which relies on the OGC WMS version 1.3 specification.
The INSPIRE documentation provides guidelines for both approaches while supporting the 'SOA-stack' as the future framework for all INSPIRE network services. However,

the support from development tools is lacking. OGC has issued several discussion papers to discover the feasibility and usefulness of enabling SOAP communication in OGC services. Pilot projects for the establishment of such services have begun (for example a project carried out by Geonovum, the Dutch NSDI coordinating organization, http://www.geonovum.nl).

4. Compliance testing of INSPIRE services and data

The prototype implementation and evaluation phase of the research was followed by a study on methodologies for compliance testing of INSPIRE network services (in particular: a study on the development of Abstract Test Suites for INSPIRE services). In this context, the standards and testing programs from ISO and OGC can be of particular relevance (c.f. ISO 19105 and ISO 19119). The reference framework for INSPIRE compliance testing can be partially based on the OGC Compliance & Interoperability Testing & Evaluation Initiative (CITE) testing program. The OGC tests are especially suitable as reference since the core technical specifications for implementation of the particular INSPIRE Network Services are the OGC web services specifications.

The topic of compliance testing methodologies for data sets is also discussed in this paper. As indicated above a service cannot be INSPIRE compliant if the data is not INSPIRE compliant. One of the obvious tests in this category is validating the delivered data set (in GML encoding, as produced by a Download service) against the official INSPIRE XML application schema for the specific data theme, with tools like XML Spy or oXygen. However, this will not be complete and cover all aspects (e.g. the constraints specified in OCL are not tested). A more complete test procedure is required and this should be provided in the Annex A (Abstract Test Suite) of the INSPIRE data product specifications. However, these are currently missing. An example of such a Abstract Test Suite is that of ISO 19152 (Land Administration Domain Model).

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