Visualisation in INSPIRE – Status and next steps

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1 Introduction

The goal of the INSPIRE initiative[1] is to set up an infrastructure for spatial information to facilitate pan-European and cross-border access to geospatial data from diverse domains (e.g. addresses, transport networks, geology and natural hazards). To this end, over the past decade a legal framework and interoperability guidelines have been developed that cover metadata, network services (for discovery, view, download, transformation and invocation), data interoperability and organizational aspects of the infrastructure. This paper describes how visualisation aspects are already addressed in INSPIRE and what possible next steps could be.

2 Visualisation in INSPIRE

The visualisation of spatial data is addressed in the INSPIRE Regulations and accompanying Technical Guidelines on view network services[2] and data interoperability[3].

The purpose of **view services** is to allow, as a minimum, "to display, navigate, zoom in/out, pan, or overlay viewable spatial data sets and to display legend information and any relevant content of metadata"[4]. The two basic operations (*Get View Service Metadata* and *Get Map*) defined for the view service have been inspired by the OGC Web Map Service (WMS, OGC-WMS 2006) specification. The view service Technical Guidelines illustrate how the requirements from the Regulation can be implemented using OGC WMS and Web Map Tile Service (WMTS, OGC-WMTS 2007) specifications. EU Member States have started

[1] http://inspire.jrc.ec.europa.eu/

[2] Commission Regulation (EC) No 976/2009 as regards the Network Services, OJ L 274, 20.10.2009, p. 9–18.

[3] Commission Regulation (EU) No 1089/2010 as regards interoperability of spatial data sets and services, OJ L 323, 8.12.2010, p. 11–102.

[4] Directive 2007/2/EC establishing an Infrastructure for Spatial Information in the European Community (INSPIRE), OJ L 108, 25.4.2007, p. 1.

providing view services since the end of 2011.

The work on **data interoperability** aims at enabling users to access and unambiguously interpret environmental data in a cross-border or pan- European context, despite the existing heterogeneity of data models, formats and vocabularies. To reach this goal, INSPIRE is establishing data specifications, which establish harmonised data models and encodings, but also harmonised layer names and portrayal rules. It is mandatory for INSPIRE data providers to use these layers and portrayal rules when publishing their data through INSPIRE view services. By standardising the layer names and portrayal rules, it will be possible for users to easily understand which data content is offered by a View Service and to interpret the map that is returned as a visualisation of this data.

The INSPIRE data specifications specify for each layer a unique identifier, a human readable title, the relevant feature type and a number of keywords to be provided. Layers are included for all feature types with spatial properties included in the harmonised data models. In most cases, a layer corresponds to exactly one feature type, while in some cases layers combine several related feature types or represent only subsets of a feature type (including all features that take a specific value for a certain attribute). The option to create hierarchical layers (i.e. layers consisting of other layers) has not been used for any of the data themes.

While not legally required, the Technical Guidelines recommend default and (optionally) other well-known portrayal styles that should be offered by view services that make the relevant INSPIRE data available. For each style, the Guidelines define an identifier, a title, an abstract, the symbology to be used and the minimum & maximum scales, for which the style applies. The symbology is specified using the OGC Symbology Encoding (SE) specification (OGC-SE, 2006). In most cases, the same style may be applied to all features of the layer, while in some cases, visualisation rules are specified based on the value of a specific attribute.

3 Toward more efficient INSPIRE view services

While the INSPIRE Regulations and Technical Guidelines provide a number of elements (standardised service interfaces, layer and style definitions) to ensure some degree of interoperability for visualisation, they are mainly designed to enable users to get a simple overview of spatial data sets available through the INSPIRE geoportal. This section presents possible future improvements for more efficient INSPIRE view services. The purpose is to address some of the issues presented by Harrie et al. (2011).

3.1 INSPIRE style register

Each INSPIRE theme defines its own layers and styles: There is no unique entry point to provide an overview of all INSPIRE styles. Such an entry point could be provided through a register listing and describing all INSPIRE styles. This register would act as a cartographic legend for the all INSPIRE view services. It would allow an easy comparison of existing styles and a detection of potential covisualisation problems (Bessadok F. & Dominguès C., 2011). It might also encourage the reuse of INSPIRE styles for other thematic geoportals.

3.2 User defined styles

Besides offering the pre-defined default and well-known styles, INSPIRE view services could in principle also support additional user-defined styles that are included as a parameter of the *GetMap* operation, as specified in the SLD profile of the WMS (OGC-SLD 2007) and Symbology Encoding (OGC-SE 2006) specifications. The view service would return a portrayal based on this user-defined style. Users may be allowed to enrich the INSPIRE style library by adding styles to the INSPIRE register. This would encourage the sharing of portrayal practices across Europe and across different thematic domains covered by INSPIRE. Improved portrayal profiles may emerge from these practices.

3.3 Thematic and cross-thematic portrayal profiles

View services allowing users to specify their layers and styles from scratch are often too cumbersome to use: Users often do not take the time to look through all available datasets, build layers from them, organise these layers and finally define appropriate styles. To solve this problem, default predefined portrayal profiles could be used. Such profiles would include the following components:

- A unique background data layer with discrete styles. This background layer will depend on the user needs. It might often be a topographic base map.
- Several foreground data layers showing the user's thematic data of interest with more prominent and sophisticated styles.

For example, users interested in visualizing air quality data may be proposed a background layer showing a basic topographic map (with built-up areas, transport and hydrography networks, land cover, etc.) and two foreground layers showing air quality measurement stations as points and an interpolation of air quality measurements over space at a given date. Several comparable sets of visualization layers may be proposed depending on the possible thematic or cross-thematic profiles. These profiles would be only a starting point to support

the exploration of INSPIRE data: It would still remain possible to adapt it depending on specific needs and preferences identified by users.

3.5 'Scale aware' portrayal

INSPIRE covers a wide range of thematic areas for several scales of interest. The following figure proposes a representation of INSPIRE's scope for some thematic areas. It shows that INSPIRE datasets potentially cover different scales of interest, from local to global scale. This multi-scale information may be reused by the INSPIRE view service in order to propose scale-dependant portrayal: The data displayed would be the most suitable for the user's zoom level. More detailed data may be displayed for low zoom levels, and more generalised data for higher zoom levels. For example, detailed building geometries may be displayed for low zoom levels and replaced by built-up areas when zooming out.

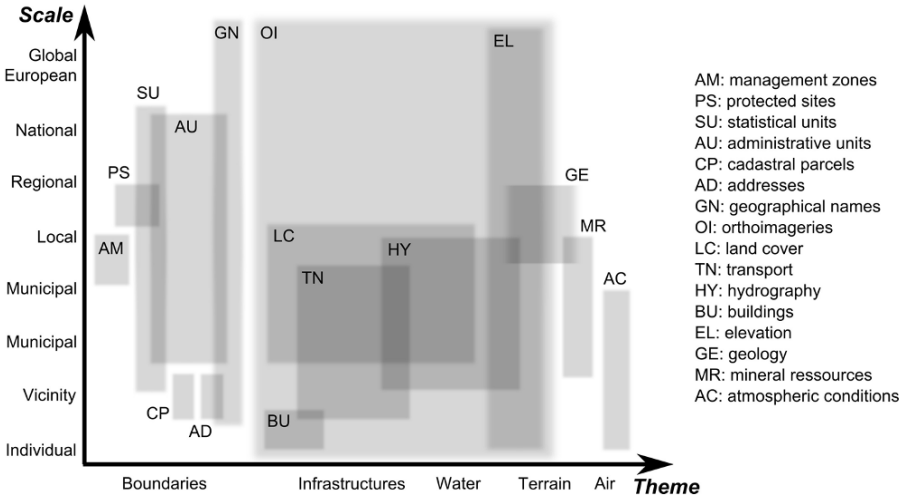

Figure 1. Proposition for a INSPIRE scope representation in a theme/scale space (Gaffuri & Tóth 2013).

To go further, automatic generalisation techniques may be used to fill the gaps along the scale dimension and produce multi-scale representations of INSPIRE data for each zoom level defined in the INSPIRE geoportal. Gaffuri (2011) proposes architecture to include such automatic generalisation techniques in spatial data infrastructures. A long term purpose would be to open the INSPIRE view service to vector web mapping (Gaffuri, 2012).

3.6 Portrayal based on non-spatial data

A significant contribution of INSPIRE is to provide spatial information to link other non-spatial information to space. For example, the INSPIRE transport network theme provides the location of transport infrastructures. This information may be reused to locate non-spatial car accident data. In the same way, INSPIRE provides statistical unit geometries to be reused to geo-reference statistical data. Unfortunately, INSPIRE view services currently allow only the definition of styles based on INSPIRE data. It is not possible to visualize car accident maps and statistical maps. To solve this problem, the INSPIRE view service may be extended to allow the definition of styles based on non-spatial data linked to INSPIRE spatial objects. For this purpose, a join of INSPIRE data with other external data based on the INSPIRE identifier might be performed by the view service. The OGC standard for Table Joining Service (OGC-TJS, 2010) may help reaching this goal.

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