

Plan4All GeoPortal: Web of Spatial Data

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ABSTRACT

Plan4All project contributes on the harmonization of spatial data and related metadata in order to make them available through Web across a linked data platform. A prototype of a Web search European spatial data portal is already available at <http://www.plan4all.eu>. The key aim is to provide a methodology and present best practices towards the standardization of spatial data according to the INSPIRE principles and provide results that would be a reference material for linking data and data specification from the spatial planning point of view. The results include methodology and implementation of multilingual search for data and common portrayal rules for content providers. These are critical services for sharing and understanding spatial data across Europe. Plan4All paradigm shows that a clear applicable methodology for harmonization of spatial data on all different topics of interest can be achieved efficiently. Plan4All shows that it is possible to build Pan European Web access, to link spatial data and to utilize multilingual metadata providing a roadmap for linked spatial data across and hopefully beyond Europe. **The proposed demonstration based on Plan4All experience aims to show experience, best practices and methods to achieve data harmonization and provision of linked spatial data on the Web.**

Categories and Subject Descriptors

H.3.5 Online Information Services,
D.2.12 Interoperability

General Terms

Design, Management, Standardization.

Keywords

GeoPortal, Plan4All, linked spatial data, spatial Web

1 INTRODUCTION

Plan4all is a European project co-funded by the Community programme eContentplus. The main aim of the project is to harmonise spatial planning data and related multilingual metadata according to the INSPIRE principles. Key results include practical methodology to provide linked spatial data online and a Web GeoPortal [1] to access seamlessly spatial data.

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The Plan4all consortium is composed of 24 partners from 15 European countries. It also includes 127 affiliated partners forming a wide network of excellence in spatial data provision. The Plan4all GeoPortal provides the means to search for spatial data sets and spatial data services coming from all participating countries after a methodological harmonization. It allows the user to view and download spatial data sets (subject to access restrictions) and related metadata. The online Plan4all GeoPortal allows discovery and viewing of spatial data sets and services.

Plan4All focused mainly on the spatial planning side of spatial data as they included a wealth of underlying information for researchers, politicians and end users. Spatial planning data interoperability, harmonization and spatial data infrastructure building in Europe has been examined by Plan4All for over two years long. The analysis shows best practices as well as leading local and regional administrations in Spatial Data Infrastructure (SDI) building and in particular Wide Scale Web based Spatial Data provisioning. Due to the heterogeneous spatial planning systems in Europe, a Pan European and holistic spatial data harmonization is difficult and that has been the big challenge for Plan4all. Furthermore the technical part of Plan4all includes demonstrating the technical variety and possibilities in Spatial Data Web provision. Plan4All attempts to revisit and to implement Web GeoPortal having in mind the INSPIRE principles about the harmonization of spatial data in Europe.

Spatial planning data exist in very different formats and data structures in European countries. Plan4all team proposed the harmonisation process where the source data from countries is converted into the general data structure. This data structure is created on the basis of the INSPIRE Data Specification v2.0. The mechanisms for data harmonisations were tested and each partner transformed its data in according to the INSPIRE specifications and published them through web services on the GeoPortal.

Moreover, to guarantee interoperability across different platforms, regional implementations have been deployed with spatial data by Plan4all partners. These pilots' deployments were a base for wide scale Plan4all GeoPortal infrastructure and also were necessary for spatial planning data and metadata harmonization methodology development. The regional deployments were in the first stage focused on metadata and data, as they were. In initial stage metadata Web Map Services (WMS), and Web Feature Services (WFS) of original data were deployed. Using deployed platforms and implemented Plan4all tools data and metadata are published in Plan4all and INSPIRE profiles. Deployed regional pilot platforms are the part of global Plan4all Networking services.

Next running implementation of transformation services, which support transformation of data in existing models into data following the Plan4All conceptual models for linked spatial data.

The aim of the Pan European Plan4all Platform is to demonstrate the technological feasibility of Plan4all designed harmonization models. Based on the analysis and recommendations, large scale testbeds are realized. The standards and models coming from the architecture design are platform neutral, to give potential and involved content providers a chance to reuse their current technological platform. The large scale testbed required additional investment into technologies covering functionality, which is necessary for publishing the data and metadata with respect to spatial planning based on INSPIRE Implementing Rules. The large scale testbed was focused on building a platform supporting common sharing of content related to spatial planning, including issues such as Digital Right Management. In establishing such a solution, there are two basic objectives:

- To extend or to fully implement platforms on the premises of every single content providers, which will allow them to publish data and metadata according to the INSPIRE principles.
- To implement one central spatial planning portal supporting access to spatial planning data of all partners based on Pan European Plan4all Networking services.

Pan European deployment is focused on deployment of central portal with client applications and using network services like discovery and portrayal services, where important role is to play multilingual search for data and common portrayal rules. These are critical services for sharing and understanding spatial planning data across Europe. In the Europe area Plan4All recommends to provide metadata *at least* bilingual – in national language and in English.

The system design is based on the principles of the Service Oriented Architecture (SOA) and is INSPIRE compliant. The INSPIRE requirements give to the overall system architecture a loosely coupled integration based on OGC standard usage, which allows to use any OGC-compliant software component and easy replace it with another if necessary. In order to achieve interoperability, the main software interface among each

particular component has to be based on ISO standards and OGC specifications, following the INSPIRE Directive. The Plan4all GeoPortal is accessible at <http://www.plan4all.eu/>.

The Pan European Plan4all Platform has been designed and implemented on the basis of analysis and architecture design following characteristics:

- service oriented;
- loosely coupled integration;
- persistent identifiers;
- trusted infrastructures.

Overall, the Plan4all project implements INSPIRE principles in spatial data practice and provides a methodology in order to show a way how to achieve it. Spatial information services allow users to identify and access spatial or geographical information from a wide range of sources, from the local level to the global level, in an interoperable and interactive way for a variety of uses.

This proposal is organized as follows: Section 2 presents technological details on the metadata harmonization processes and methods discovered and followed. Section 3 gives in short the verification process of the data and metadata transformations. Section 4 presents a summarization of the harmonization results. Section 5 gives a short presentation of the Plan4All GeoPortal resource management system. Section 6 discusses the impact of the project, next steps and the proposed demonstration program.

2 HARMONIZATION

Information contained in the Implementing Rules for INSPIRE metadata seems not sufficient enough to describe all spatial data theme specific aspects. Therefore a Plan4all metadata profile with respect to specific aspects of the spatial data theme (i.e. land use) was defined.

The Plan4all metadata profile is a European spatial planning metadata profile designed based on the analysis of national requirements on spatial planning metadata (15 countries) as well as on the experiences of designing conceptual data models for selected INSPIRE themes. The Plan4all metadata profile extends the INSPIRE metadata requirements. It is compliant to ISO

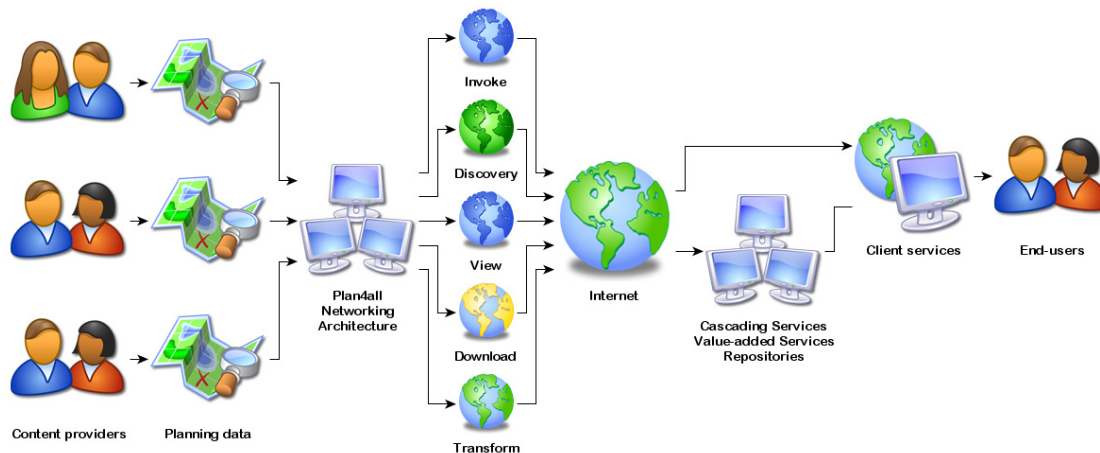


Fig.1: Plan4All GeoPortal: overview of the networking service architecture.

19115/19119/19139 standards, INSPIRE metadata profile and INSPIRE metadata implementing rules. There is no extension beyond ISO 19115/19119 to enable users to maximize the interoperability across different software platforms.

Existing local, regional or national metadata are transformed into the Plan4all metadata profile and provided as CSW services (Catalogue Services for Web). The CSW servers are cascaded and published using the platform. Besides this alternative it is also possible to collect metadata in Plan4all Metadata Portal.

How to make spatial data interoperable. Spatial data and especially spatial planning data exist today in European countries in very diverse forms and data structures. A main task of the Plan4all project was to achieve such a process of data interoperability which would allow utilization of source data from individual countries in the form common to all of them. There were specified three main stages within Plan4all how to get interoperability for spatial data available:

- Definition of appropriate conceptual models
- Process of spatial data harmonization
- Publishing of harmonized data

INSPIRE data specifications and Plan4all conceptual models for relevant themes were corner stones of the whole harmonization process. On the basis of these models, a final structure of harmonized data was formed as the first step of the data harmonization process.

The next step represents a precise description of source data intended for harmonization. It allows better understanding of data for determination of transformation conditions. This description includes a layout of the data structure, characterization of individual object types and an overview or a list of codes. Sometimes spatial data are not in a GIS structure and therefore must be modified and transformed into an appropriate format. Set up of transformation conditions is a key point of the harmonization process. The conditions are formed by relations between source and target data that should be defined at the objects, features and attributes levels. For representation of the relations, a transformation table or scheme usually are used.

When the transformation conditions have been defined, the final step of the whole harmonization process can be run. Harmonized data, which are saved in the target structure, may be published on the Web.

In the individual regions included in the Plan4all project, publishing of harmonized spatial planning data were tested through the regions' web map applications and also by providing data via OGC web services, Web Map Services (WMS), Web Feature Services (WFS) and Catalogue Services for Web (CSW). Harmonized data are presented as map layers in a web client or in the form of web services.

3 VERIFICATION AND VALIDATION

The Plan4All metadata profile is the result of research and discussions among partners and stakeholders. Both questionnaires and evaluations performed through the instantiation of case studies highlighted that a core of elements is shared and accepted in terms of name, type, and properties. However, there is a subset of elements that appear to be critical, due to the strong

dependency of spatial planning management on organization / institution in charge of it, whose task also consists of bounding the scope and establishing the appropriate threshold of detail. A solution suggested by stakeholders is to allow each country to design their own catalog profiles by extending existing code list elements. This would retain the integration on the European level while allowing sufficient detail on the local. Another current concern refers to metadata availability. The challenge is that existing metadata are generally rather poor because a lot of information is implicit when used in the context of a municipality – but becomes explicit when taken out of this context. This will lead to a significant challenge when creating metadata from local profiles.

As for Plan4all themes, the proposal suitably covers all elements featuring the spatial planning domain. It also supports INSPIRE requirements and may be a good starting point for evolving national metadata profiles for data within all themes. Moreover, many stakeholders shared the opinion that some limitations met during the case study instancing phase are due to the meaning of terms. In fact, they have frequently annotated that sometimes it is difficult to understand what item is under investigation, and information provided by designers does not bridge this gap, due to the lack of a common shared approach.

Another issue highlighted by stakeholders refers to the overlaps among themes. Researchers, partners and stakeholders from different countries pointed out that these overlaps also depend on national regulations. Besides INSPIRE indications, which propose high level links for inter-institutional and cross-border purposes, other relationships among themes were identified by domain expert users, which have to be managed in order to obtain an exhaustive representation of real scenarios.

4 PLAN4ALL HARMONIZATION EXPERIENCE

Present experience with spatial data harmonization process within Plan4all testing may be summarized into several recommendations; some of them may be mentioned:

- To better understand source-target relations a precise definition of the source data should be created and described. There is not any fixed standard for spatial data and the definition should help to harmonize different data in the same way.
- Exact specification of code lists and enumerations with explanation of terms is highly valued as expected. However, the same values may imply different meaning to people from different countries and consequently harmonized datasets may be syntactically correct, but are not in reality semantically and therefore technically correct. This is not a problem of the data model, but a consequence of differences in the perception of spatial data and spatial planning notions in European countries.
- Multiplicity of harmonized attributes is often an obstacle. Plan4All results show that it is better to avoid this situation and to modify appropriately the data sources
- Simplicity is really a virtue when it comes to spatial data harmonization. It is needed to keep models, schemes and tables as simple as possible.
- Precise specification of metadata fields and leaving them out of the data make clear the data structure.

- Definition of symbols and colors for harmonized data is necessary for right presentation and publishing on the Web.

5 PLAN4ALL RESOURCE MANAGEMENT

GeoPortal contains common visualization, data sharing, metadata and catalogue functionalities. Additional parts of the proposed solution are also tools for management sensor observation and spatial data transformation and processing. The main requirements of the Plan4All GeoPortal are mainly satisfied by the Uniform Resource Management System (URM). The main objective of URM is easy description, discovery and validation of relevant information sources. The URM opens new possibilities, how to share knowledge and information inside of communities. The approach followed is compatible with an implementation of obligatory standards for European SDI building (INSPIRE). Therefore it is ready to be connected with other Web nodes of spatial metadata catalogues.

This new method of sharing of knowledge could increase collaboration and could be a useful tool for training and education on Web Spatial Data Provision. Global SDI building is usually described like pyramid building. Current experiences demonstrate, that for practical usage is more efficient “spider net infrastructure”, where different local or global levels are able directly share data. As examples could be for example mentioned cross border systems, system of different communities across Europe or world, etc. URM GeoPortal is the way to shift from the pyramid paradigm, to paradigm of spider net. With our concept URM concept is system of distributed data sources, where every provider could decide about accessibility of his data against concept of cloud computing, where one organization is managing all information.

The principle of URM allows building “spider-net” infrastructure supporting interconnection of any two portals and effective exchange of information. Plan4all GeoPortal could be divided into four basic buildings blocks, which are:

- Metadata management (editing, discovery, access, harvesting)
- Data management (upload, download, OGC service publishing)
- Data visualization (local data, WMS, WFS, KML and management of Web Map Context)
- Content management (publishing of context and connection with social networks)

All this four building blocks are interconnected through metadata, supporting effective exchange of information.

INSPIRE team: Plan4All Tests and Next Steps. While concluding the Plan4All, the INSPIRE team launched testing activities for the refinement of INSPIRE Annex II and III data specifications, starting in June 2011 and ending by October 2011. After this testing phase, the TWGs will deal with the comments received and elaborate the final versions of the data specifications by April 2012. This practically could imply a possible improvement of the INSPIRE data specifications, which in turn

will affect also Plan4all products. At this stage, a refinement of models may be fruitful, based on a top-down approach to capture general indications, which can be then deepened and integrated according to specific requirements

6 IMPACT & DEMONSTRATION

The problems of spatial planning, its governance, participation of all stakeholders and open decision processes are very important in Europe. With EU enlargement, their importance increases. There exist many cases where low levels of participation at all levels of government and low levels of involvement by NGOs, stakeholders and citizens lead to non-transparent processes. In the future phases of implementation, this can effectively block important investment opportunities.

On the other hand, Spatial Data Infrastructures (SDIs) are being created thanks to the INSPIRE Directive. These SDIs are opening doors to the release and exploitation of key Public Sector Information (PSI). Common spatial data catalogues can be queried from multiple locations and thus provide a consistent coverage and availability of spatial data to all relevant decision makers, even if linked virtually. Spatial data duplication is minimised and decision contexts are harmonised.

Plan4all can be considered as a test-bed for INSPIRE. Bottom-up approaches showed the feasibility of spatial planning data harmonisation using common standards with various technologies and platforms. The results create a significant role for follow-up activities focused on the interoperability of spatial data.

The Plan4all Geoportal and Catalogue are connected to GEOSS (Global Earth Observation System of Systems). Overall Plan4All has already achieved the following results in numbers:

136 Affiliated partners, 70 Workshops & seminars,
27 papers published, 121 Presentations done, 1,5M Website hits
323 Social networks’ members, 28 Contacts with related projects

Demonstration The Plan4All GeoPortal Web services and Web functionality will be presented through the critical view of the stakeholders and content providers. Moreover, the Plan4All methodology of harmonization and publishing on the Web will be demonstrated to show how the wealth of spatial data already available in the deep Web can be brought online.

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8 REFERENCES

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