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Linked Open Data for Environmental Protection in Smart Regions – the New Challenge for the Use of Environmental Data and Information

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1 ABSTRACT

This paper will introduce the specific objectives of the recently initiated project SmartOpenData - "Linked Open Data for Environmental Protection in Smart Regions" (SOD project) that is supported by Seventh Framework ENV.2013.6.5-3: Exploiting the European Open Data Strategy to Mobilize the Use of Environmental Data and Information. The main concept of the project is to create a Linked Open Data (SOD) infrastructure (including software tools and data sets) fed by public and freely available data resources, existing sources for biodiversity and environment protection and research in rural and European protected areas and its national parks. The aim of the SOD project to develop real proposals for building a SOD infrastructure for biodiversity and environment protection in European protected areas that satisfy the requirements of four kinds of target users: public bodies, researchers, companies (also small and medium enterprises (SMEs) and citizens. The SOD project will focus also on how the SOD Initiative can be linked with the INSPIRE directive, GEOSS Data-CORE, GMES, completed European scale Geographic Information System (GIS) projects (like a Habitats project, which defines models and tools for managing spatial data in environmental protection areas), and external third parties, as well as how it can impact economic and sustainability progress in European environmental research and protection. The key elements of the project will be five target pilot projects in related areas (agro forestry management, environmental research and biodiversity, water monitoring, forest sustainability and environmental data re-use), where harmonization of metadata, improvement of spatial data fusion, as well as visualization and publication of the resulting information according to user requirements will take place.

2 THE CONTEXT OF THE SINGLE EUROPEAN INFORMATION SPACE

"Information is knowledge, information is power, information is security" Christiane Amanpour, fabulous CNN journalist and ABC Global Affair Ancor tells us again and again from the TV screen, and she is right. Nowadays the availability and content of genius and precise information is crutial and the decisive factor in the adoption of important, urgent and correct decisions. In using the term "information", very often we mean "spatial" or "geographic information" due to recent global "revolution" in consumer's habits and manner of information consumption – to use images as the most proofvisible evidence instead of (or in combination with) descriptive data.

Access to spatial information is becoming more and more possible for various purposes due to local, national and European initiatives. The INSPIRE directive (2007) laid down general rules for establishing an infrastructure for spatial information in the entire Community that is the basis of support for the Community's policies and for the fulfilment of the requirements of environmental issues around Europe. [3] To ensure that the spatial data infrastructures of the Member States are compatible and usable in a Community and trans-boundary context, the INSPIRE directive requires that common implementation rules are adopted in a number of specific areas: metadata, data specifications, network services, network services and technologies; licenses on sharing, access and use; and coordination and monitoring mechanisms, processes and procedures, established, operated or made available in accordance with the INSPIRE directive requirements. [3]

The ability of information technologies to handle geographic data has improved during the past two decades and GIS is well suited for the integration and management of local, national and international land and natural resources. [2] In particular, various sectors of the "property industry" represent significant market potential for GIS, especially in the use and processing of LC and LU geographic data for commercial and non-commercial purposes. [2] [4] [15] Many Europen initiatives took place in an effort to harmonize land information related data sets (for example: land use and land cover), but these past, mostly independently developed, activities produced numerous, mainly incompatible land related geographic data sets from the local to the Europen level, usually addressing their specific requremets to the information (scale, accuracy, data sources, update cicles, data standards, etc.) or the user (usually public, private bodies, also individuals). However in the context of monitoring environmental changes (loss of biodiversity, climate changes, food safety etc.), harmonization activities have increasingly touched global issues with regard to better integration of various sources of information on various scales (for example: the European CORINE Land Cover Initiative is integrated into the initial GMES programme framework). [6] [11] [12] [13] There are also exist many different open data sources for protecting biodiversity and environmental research in Europe (in coastal zones, agricultural areas, forestry, etc.), mainly focused on the Natura 2000 network [10] [19], and areas where environmental protection and activities like agriculture, forestry or tourism need to be balanced with the Habitats Directive [1] and the European Charter for Sustainable Tourism in Protected Areas [2].

3 THE MAIN CONCEPT AND OBJECTIVES OF THE PROJECT

The SOD project is a recently started (2013) activity supported by Seventh Framework ENV.2013.6.5-3: Exploiting the European Open Data Strategy to mobilize the use of environmental data and Information. The original idea of this project was funded by the EC and is a result of collaboration of 16 European organizations from nine European countries (Spain, Ireland, Italy, France, Czech Republic, Norway, Latvia, Portugal and Slovakia). The duration of the project is 24 months (2013-2015). [15]

The main strategy of the SOD project is to create a real SOD infrastructure (including software tools and data sets) fed by public and freely available data resources, existing sources for biodiversity and environment protection and research in rural and European protected areas and its National Parks. Nevertheless, in order for this strategy to become a reality, it is necessary to advance the publication of existing environmental data, usually owned by public bodies. The project also considers the idea that only a better understanding and managing of existing developed open data sources for protecting biodiversity and environmental research in Europe can provide real economic value for these areas (where real value is largely unknown), but will enable organizations to develop new services based on these data and open up new possibilities for public bodies and rural and protected areas to benefit from using data in innovative ways, improving their knowledge and environment protection through new innovation ecosystems. [5] [15]

The SOD project reuses existing European Spatial Data Infrastructures (SDI), based on INSPIRE, GMES and GEOSS. It will use and extend using SOD, free pan-European Data Sets such as those from Corine Land Cover, Natura 2000, Habitats, Plan4all, Plan4business, EnviroGRIDS, Briseide [15] [19], GEOSS registries, national INSPIRE portals, thematic portals like National Forestry portals together with local and regional data as well as related registers content (for example INSPIRE Registry or UKGovLD Registry). [15] [19]

It is also planned to concentrate ono how to create proposals and build a SOD infrastructure for biodiversity and environment protection in European protected areas that satisfy the requirements of four kinds of stakeholders (target users): public bodies, researchers, companies and citizens. The EU invests billions of euros in building the INSPIRE infrastructure, but most of all European users use Google maps for their applications. The potential of national and regional SDI information is not used because of this information is not available on Google. [15]

Project developments will also provide new opportunities for SMEs to generate new innovative products and services that can lead to new businesses in environmental areas, as well as promote successful (transparent) regional and national scale decision-making processes in environment protection.

It is planned to harmonize metadata, improve spatial data fusion and visualization, as well as publish the resulting information according to user requirements through five target pilot projects - in agro-forestry management, environmental research and biodiversity, water monitoring, forest sustainability and environmental data reuse. SMEs, researchers and citizens will play a central role in the pilots developed to enhance the potential of protected areas. Innovation by third party SMEs will be encouraged by the promotion of royalty-free open standards and best practices initiated by SOD.

The value of the data will be greatly enhanced by making it available through a common query language that gives access to related datasets available in the linked open data cloud. The commonality of data structure and query language will overcome the monolingual nature of typical datasets, making them available in multiple languages.

The research focus of the SOD project will address how to use existing geographic information (GI) data within the Resource Description Framework (RDF) and how existing GI data can be accessed as part of linked data. To achieve this, the SOD project will develop algorithms that expose the wealth of environmental data held by the partners as linked data. It is planned to test developed infrastructure and validate the project results in real scenarios in Smart Regions (http://www.smartregions.eu/). The evaluation of the project outcomes will be based on user feedback and recommendations.

SOD Project has determined the following core objectives:

- To create a sustainable SOD infrastructure [14] with the purpose of promoting environmental protection data sharing among public bodies in the European Union (EU);
- To make INSPIRE/GMES/GEOSS infrastructure [9] more available to all stakeholders: citizens, public and private organizations and SMEs developers;
- To enhance SOD with semantic support by integrating semantic technologies built upon connected SOD catalogues aimed at developing sustainable, profitable and standardized environment protection and climate change surveillance services;
- To define specific business models focused on the needs of stakeholders (especially on that of SMEs) and based on innovative services as new opportunities to align research results, previous work and projects, taking active involvement in the whole value chain in Smart Regions [1] [15] at policy, industry and society levels;
- To demonstrate the impact of the sharing and exploiting data and information from many varied resources, in rural and European protected areas;
- To provide public access to the data and developing demonstrators that will show how services can provide high quality results in regional development working with semantically integrated resources. [15] [18]

4 WHEN DOES IT MAKES SENSE TO DO IT?

The building of a semantic Linked Data structure makes sense when we need to integrate heterogeneous data based on different domains. This structure does not depend on any formats of data, size of databases or other attributes, but on common geographic concepts (river, road etc) and their relations (a road crosses a river). The relevant part of real data and, where needed, metadata will be transformed to subelements of basic concepts and then the relationship between concrete objects can be described. This approach enables us to integrate or harmonise originally heterogeneous data based on the same concepts. As an example we could mention: Protected Area “x” near road “y”; in protected area “XY” you can see bird “YY”. Results of such combination could be that near road “zy” you can see the bird “YY”. [15] [18]

To achieve this, the project partners foresee a number of key steps to be taken, each of which occurs in one or more of the planned five target pilots:

- Describe target use case/s domain/s focused on agroforestry management, environmental research and biodiversity, water monitoring, forest sustainability andenvironmental data reuse. The use cases will be dealt with from end user’s (related stakeholders) point of view. Each use case will be described with a minimal essential structure and list the basic concepts to be taken into consideration. The SOD project expect a maximal re-using of existing semantic structures (controlled vocabularies, gazetteers, registers, registry services, etc.);
- Analyse current available data and also current data models, which are available (in the ideal case INSPIRE base);
- Define new data RDF models (concepts and relations) or identify possible extensions of INSPIRE data models, which are optimal in order to fulfil all or particular use cases;
- Where necessary, define transformation model/s (processing service) for transferring original data into RDF. This could be a complex process running for a long time and through many databases.
- Run the transformation model (it could also include access to distributed databases).

- Eventually store or generate on the fly new transformed data in RDF (this information needs to also include links to the original data).
- Prepare user-friendly application interface for querying data (as a simple form to be able query data without standard experience). The queries should be divided (or fragmented) into two groups – spatial queries (processed in traditional spatial database) and semantic queries based on SPARQL;
- Prepare a visualization of the results of queries. It will include visualization list of objects in some form and cartographic visualization, which has to be provided in relation with the original data. So it will be necessary to define some mechanisms (like Filter Encoding etc. that could visualise results on the basis of queries).

In undertaking these steps there are several underlying questions to bear in mind:

- Which use cases really benefit from OLDa?
- How can we guarantee consistency among the RDF database and the original data? The application and possible extension of existing standards, if not the creation of new ones, will be important in this respect;
- How should we define the best possible protocol for accessing original data (WFS, SOS or querying directly database using SQL for example);
- How can we make the best use of existing tools for visualization;

How will this new mechanism influence efficiency and speed in data processing and querying? [15] [18

5 LINKED DATA FOR SPATIAL INFORMATION

In the context of the SOD the project, using linked data for spatial data means identifying possibilities for the establishment of semantic connections between INSPIRE/GMES/GEOSS and SOD spatial related content in order to generate added value. The project requirements are within the environmental research domain. This will be achieved by making existing "INSPIRE based" relevant spatial data sets, services and appropriate metadata available through a new SOD data structure. The main motivation to use the potential of SOD is to enrich the INSPIRE spatial content to enable improved related services to be offered and to increase the number, performance and functionality of applications. The project will allow for the avoidance of duplicating information. [19]

For the purpose of achieving the objectives of the SOD project, it is necessary to advance the publication of existing environmental data, which is mostly owned by public bodies. The SOD project will try to answer the following questions:

- How can SOD be applied generally to spatial data resource and specifically to public open data portals, GEOSS Data-CORE, GMES, INSPIRE and voluntary data (OpenStreetMap, GEP-WIKI, etc.)?
- How will it impact economic and sustainability progress in European environment research and biodiversity protection (this questions need to be addressed in order for us to benefit from an improved understanding and management of environmental data)?
- How can we make European Spatial Data also easily re-usable by various organizations and individuals at a larger scale (not only GIS professionals)? [15]
- To realize this, on a technical level, the SOD project will:
- Harmonise geospatial metadata (ISO19115/19119 based) with principles of Semantic Web;
- Provide spatial data fusion introducing principles of Linked Open Data (LOD);
- Improve spatial data visualization of Geospatial LOD;
- Publish the resulting information according to user requirements and LOD principles.[15]

The most advanced technical effort to reconcile the Linked Data and Geospatial Data worlds is embodied by OGC's GeoSPARQL standard [15]. This merges the two technologies, with the GeoSPARQL engine translating queries back and forth between RDF and geospatial engines. The INSPIRE standards have been developed entirely in an XML-centric manner and the EC's Joint Research Centre is currently working on making better use of linked data. Community Group is also considering better interplay between Web and geospatial technologies. SmartOpenData (SOD), pan-European initiative targeting to facilitate access to published local and national open datasets, also brings together specialists in both disciplines: RDF to describe a location or point of interest, GI to define where it is on the Earth's surface. [15] [19]

6 CONNECTION OPEN LINKED DATA TO METADATA

Qualitative and "low cost" metadata plays the crucial role as an interface to the spatial content it describes. In the context of SOD, metadata serves as the exchange component allowing the bridging of INSPIRE requrements with other spatial worlds. Metadata will act as the entry point (interface) providing essential information for transformation of spatial data to RDF structures. It is still an open question whether a file or a database should be one of the core concepts with attributes derived from metadata. Therefore primarily the SOD project will deal with objects that can inherit some attributes from metadata. [15] [19]

7 MULTIGINGUALISM

Multiligualism is among most important problems to be addressed in the context of SOD. The issues of translating geographical data and metadata has not yet been solved inside INSPIRE or GEOSS and seems it is a global problem of data utilization by local communities and local data by foreigners. Translation of geographical data is a great challenge for everyone within the SDI community and its importance will grow in relation with growing of SDI.

There are two principal approaches to machine translation: rule-based and statistical. Current state-of-the-art machine translation technology is based on the statistical machine translation (SMT) paradigm, which assumes the application data to match the training data, used during the learning phase to extract and generalise the parameters of the system. Combined methods are also being investigated currently, bringing together the linguistic and translation knowledge accumulated over the last 40 years with the SMT systems as deployed today. For SMT systems, the more distant the actual data is from the data used for training, the worse the results are. Concerning environmental and geographical data, there will be explore resource-limited adaptation to those domains in the context of SOD. [15] [19]

8 THE RESEARCH FOCUS

The research focus for SOD will address how to use existing GI data within an RDF framework and how existing GI data can be accessed as part of linked data. New algorithms will be developed that expose the wealth of environmental data as linked data. This may require some extra human intervention in some cases but such intervention will be minimized with a view to making it repeatable and scalable. For example, the Open Refine tool allows the same operation to be carried out on tabular datasets of unlimited size and is likely to be useful in this task, perhaps supported by a SOD reconciliation API. In a linked data environment, the definition of points, lines and polygons remains untouched. A more difficult task is the discovery of links to data already available in the linked open data cloud, such as GeoSpecies. [15]

Another area of research within a project will be the handling of large volumes of real time data. This puts a strain on the infrastructure and so methods to reduce that stress will need to be researched, possibly using the W3C POWDER technology as a data compression tool. Tracking the provenance of any data is important of course but as yet there is no (standardised) linkage within the Semantic Web technology stack between Provenance and SPARQL Update. [15]

However, creating the data as RDF and adding it to a triple store is only the first step. More difficult is the discovery of links to data already available in the linked open data cloud, such as GeoSpecies. [15]

Challenges that SOD must address in Open Data include:

- Discoverability - in order for data to be useful, it needs to be discoverable. Building strong catalogues of metadata from numerous sources is one of the best ways this can be achieved. Building referenceability into data catalogues is also an effective way of tracking how data propagates through different work products from a raw dataset;
- Federation - as open data becomes part of the day to day business of these organizations, the work of cultivating, publishing, and maintaining datasets and data catalogues will become more

decentralized. These decentralized catalogues still need to be aggregated into combined organizational catalogues, but their maintainers should still be able to pick and choose which open data technologies are most appropriate to their needs;

- Interoperability - catalogues from multiple sources are composed by federation, it becomes more and more important for the platforms that these data catalogues on which they are built be compatible, even if they are built by different providers. [15] [19]

9 LEGACY ARCHITECTURES AND BUILDING ON PREVIOUS RESULTS: THE HABITAS PROJECT

One of the objectives of the LOD project is also to reuse existing European SDI, based on developments of INSPIRE, GMES and GEOSS. There exist many different open data sources for protecting biodiversity and environmental research in Europe (in coastal zones, agricultural areas, forestry, etc.) mainly focused on the NATURA 2000 network, and areas where environmental protection and activities (like agriculture, forestry or tourism) need to be balanced with the Habitats Directive and the European Charter for Sustainable Tourism in Protected Areas. [5]

In the context of the SOD project, in addition to using tools (such as those available on the Plan4Business Open Data Repository, Habitas Reference Laboratory and EnviroGRIDS portal), use of linked data for spatial data means identifying possibilities for the establishment of semantic connections between INSPIRE/GMES/GEOSS and LOD spatially related content in order to generate added value. The project requirements are within the environmental research domain. This will be achieved by making existing “INSPIRE based” relevant spatial data sets, services and appropriate metadata available through a new Linked Data structure.

The Habitas project (Social Validation of INSPIRE Annex III Data Structures in EU Habitats) was a CIP PSP ICT project that focused on the adoption of INSPIRE directive standards through a participatory process to design and validate data, metadata and services specifications with real citizens and business.

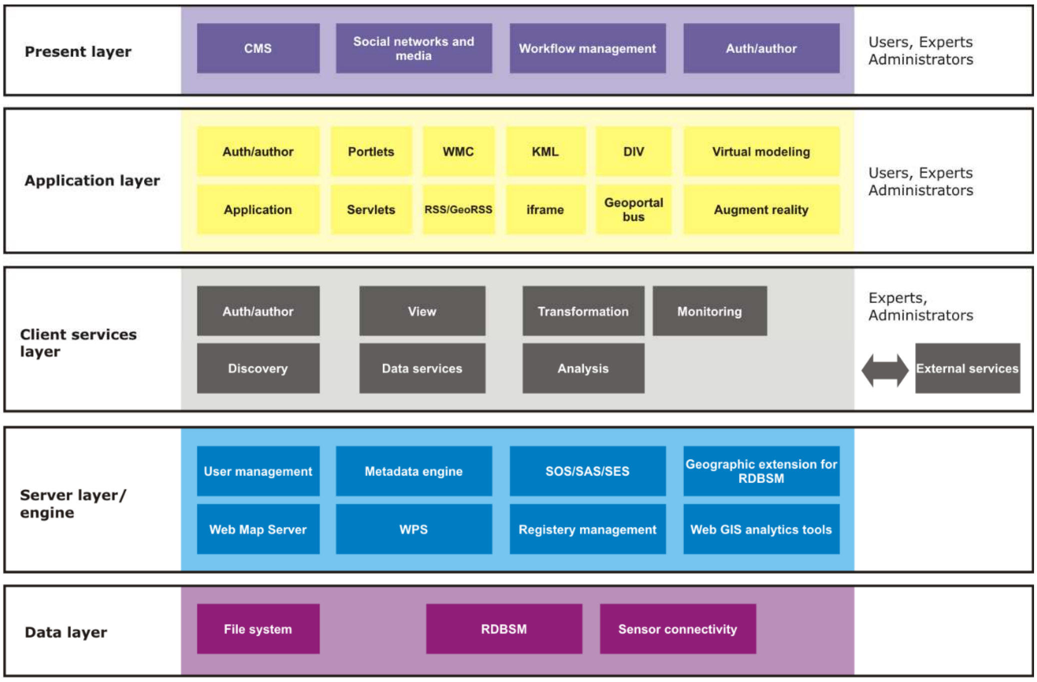

Fig. 1: The design of the SOD infrastructure. [15] [19]

The Habitas project [5] was built as an environment that enables to share and combine data from various sources. This project results were validated through the Habitats Reference Laboratory and developed pilot applications. On the basis of different pilot projects, Habitats defined and tested harmonization rules for spatial environmental data and designed the concept of Habitas Reference Laboratory as a tool for testing the interoperability and supporting unification of outputs across different pilots. [16] [17] The Habitas Reference Laboratory Architecture is shown in Fig.1. [5]

The challenges faced by Habitats were mainly due to data availability, integration and usage ability for decision-making and, in particular, its focus on metadata, Data Specifications, Network Services, Data and Service Sharing and Monitoring and Reporting. Habitats is to support the INSPIRE directive. [11]

The specific usage scenarios, including the state of the art baseline and user requirements coming from them represent the key input for the planned data and meta-data modeling activities and the SDI services that were developed in the Habitats project. In general, a positive correlation in all the pilots was detected between service development and user satisfaction. It cannot be taken for granted that the new services provided are also INSPIRE compliant. This can be due to several reasons, two of which seem more prominent than others:

- On the “supply side”, the cost of increasing the compliance, in terms of time, resources, etc., from the perspective of the SDI “owner”;
- On the “demand side”, lack of interest or simply ignorance of the advantages of compliance, from the perspective of the end users. [5]

10 THE DESIGN OF SMART OPEN DATA INFRASTRUCUTURE

From a user perspective the SOD system will meet the following high level requirements, as “web-based” flexible architecture, socio-environmental data (spatial and non-spatial data) content, all data and models used in the system must be tagged by origin (metadata), data integrity, INSPIRE defined services, and the system will be scalable for increasing number of users and further five pilots. [14] [16] [17]

The requirements of infrastructure of SOD are based on a description and analysis of:

- The relevant components in the proposed scenarios of the SOD project;
- The characteristics of the data components;
- How these components can be classified or generalized;
- What legacy architectures exist;
- What the relevant legal and political fundamentals are;
- What quality constraints exist and how they can be defined in the context of service level agreements;
- The requirements of the five target pilot projects.

The infrastructure will enhance SOD with semantic support by integrating semantic technologies built upon connected SOD catalogues aimed at building sustainable, profitable and standardized environmental protection and climate change surveillance services. This will cover the use of semantic technologies to build a new paradigm of environmental protection services through the extensive use of SOD, significantly improving their accuracy, power and scope and reducing implementation costs making them affordable and sustainable for the first time.

The project will research the integration of semantic results among public open data sources available by partners and other available public data including INSPIRE, GEOSS and GMES and external semantic services (such as DBPedia, Freebase, GeoLinkedData, the Commission’s Open Data Portal including valuable datasets by the EEA and Eurostat), in order to enrich environmental services, thus making available geographical and environment data also to other applications and service domains.

The main elements of SOD infrastructure are shown in Fig. 2. [1] [15]

All data sources can be grouped in two different sets:

- First - data sources that fulfil some of the standards supported by SOD system - green boxes;
- Second - data sources that does not fulfil those standards - blue boxes.

All external data sources are indicated in the lower layer. In the upper layer, three different scenarios have been identified: scenario for researchers, scenario for companies and a scenario for end-users. Each scenario will focus on one specific segment using provided functionalities of the SOD system and services for each group illustrating how the availability of such services can provide advantages to them.

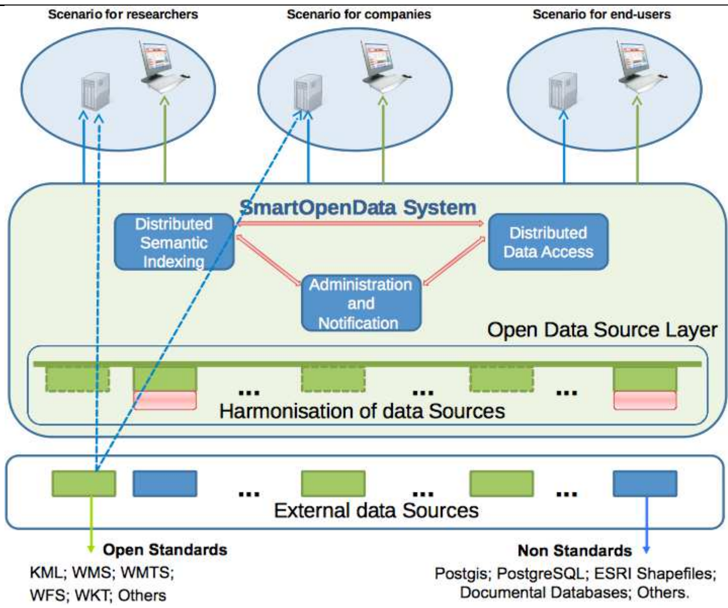

Fig. 2: The designe of SOD infrastructure. [15]

The basic element of the SOD system is the harmonization of data sources. The open data source layer provides semantic information of the data and data themselves. Three key functionalities are coordinated inside the SOD system, creating a distributed service system which can be accessed transparently from the scenarios:

- Distributed semantic indexing - provides a service for searching and locating data based on semantic information collected from all the available data sources;
- Distributed data access - provides data collected from external data sources, as an extra data source
- for easier and uniform data gathering from the users at the identified scenarios;
- Administration and notification, which provides administration facilities for managing users, workflows and data to data providers.

It is very important that services created on the scenarios be able to access directly external data sources selected through the distributed semantic indexing functionality of the SOD system if they are provided using one standard as shown on the scheme.

11 THE PILOTS

The most important objective of the SOD project are the five pilot projects in environment protection related areas:

- The pilot "Agro diversity management" (Spain and Portugal) – with the focus on building a web-based collaborative spatial data infrastructure prototype with the main goal of promoting sustainable agroforestry management; it will be built as a collaborative powerful tool for environment protection and economic development of rural areas, and as a key factor for water management and drinking water protection; [17]
- The pilot "Environmental Research and Biodiversity" (Ireland) – with the focus on the use of the SOD to provide open data and open "INSPIRE compliant" geospatial sources for environmental researchers particularly focused on biodiversity and habitats, building on the participative social validation and pilots of the Habitas project in particular;
- The pilot "Water Monitoring" (Italy) - this pilot in Sicily will explore the role of aggregating information from different Open Data sources in order to support ARPAÔÇÖ's institutional mission of providing up to date monitoring of water quality in Sicily. Some of the main issues to to be sddressed of overcoming the barriers (cultural, political, administrative) to opening up data and identifying the optimal role of the general public in crowdsourcing environmental information;

- The pilot “Forest Sustainability” (Czech Republic) – will be focused on forest site classification, sustainable management and the utilization of forest road network using the National Forest Inventory and the Regional Plans for Development datasets. Data products and statistical outcomes will be widely open, standardized and accessible by foresters and public bodies through web services and applications;
- The pilot “Environmental Data Reuse” (Slovakia) - will include the proposal, development and deployment of two conceptually different types of web applications in order to achieve the reuse of environmental data and information in line with European Open Data Strategy. [15]

The pilot applications will be developed by pilot partners with support of main technological partners (HSRS, SINDICE, FBK, and SDATI). The objectives of the pilots are to evaluate the SOD infrastructure and tools by the development and deployment of advanced demonstrators with:

- A specific focus on evaluation of the approach for the LOD and semantic services;
- An evvaluation of how well the proposed SOD architecture can be adapted to different scenarios for the purpose of environment protection;
- An evaluation of the limitations and benefits of the approach by comparing existing technologies.
- In general the SOD project will address demonstrators in the domains of public bodies, researchers, companies and citizens.

A first iteration of the demonstrator will provide early prototypes for its evaluation and assessment in order to provide feedback on project review and will be first tested by partners for the enhancement and completeness of the integrated architecture and bug fixing. Then an in-depth evaluation and assessment will be carried out by end users to get their user experiences and feedback to iteratively improve the project. All the demonstrators will be available on the public web site and will contribute as training material to the dissemination of the infrastructure. The final iteration of pilots will be based on the feedback collected by the first iteration of demonstrators as well as will provide final prototypes for their evaluation and testing. The focus of this evaluation will be the validation of the SOD infrastructure in real life case studies. [15]

12 CONCLUSIONS

The SOD project is a challenge to create a SOD Data infrastructure (including software tools and data) fed by public and freely available data resources, existing sources for biodiversity and environment protection and research in rural and European protected areas and its National Parks.

SOD infrastructure has been used to evaluate infrastructure and tools by the development and deployment of five advanced demonstrators focused on agroforestry management, environmental research water monitoring respectivwly, forest sustainability and environmental data reuse. This will provide opportunities for organizations (also SMEs) to generate new innovative products and services that can lead to new businesses in, among others, the environmental, regional decision-making and policy areas. The value of the data will be greatly enhanced by making it available through a common query language that gives access to related datasets available in the linked open data cloud. Organizations such as environmental agencies and national parks will benefit by improving their knowledge of biodiversity status, maintenance and protection, including achievement of “the INSPIRE and Open Data Ready” status for their digital (not only spatial) content. Public bodies, researchers, companies and European citizens will play a central role in user-driven pilots developed to enhance the potential of protected areas. Innovation by third party companies will be encouraged by the promotion of royalty-free open standards and best practices generated, initiated or simply highlighted by SmartOpenData. The project will also contribute and, where possible, benefit from ongoing and upcoming related initiatives like the Open Government Partnership, the INSPIRE maintenance and implementation framework, the EU Location Framework and Interoperability Solutions for European Public Administrations (also the Working Group on Spatial Information and Services). [1] [4] [7] [8]

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[18] Source: http://www.smartopendata.eu/sites/default/files/SmartOpenData_D2.1_Requirements_of_the_infrastructure_0.pdf [Access March 2014]
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