ESDI: Setting the Framework

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ESDI: Setting the Framework

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ABSTRACTS FOR PARALLEL SESSIONS

Session: INSPIRE Facts

Thursday 30th June 09:00 – 10:30

Meeting Room Hotel Calabona

INSPIRE - State of Play Study: Status of the National Spatial Data Infrastructures in Europe

D. Vandenbroucke[1], K. Janssen[2], J. Van Orshoven[1]
[1] *Katholieke Universiteit Leuven, Research & Development Office, Spatial Applications Division (SADL), Leuven, Belgium*
[2]*Katholieke Universiteit Leuven, Faculty of Law, Interdisciplinary Centre for Law and ICT (ICRI), Leuven, Belgium*

In 2001, the European Commission initiated the INSPIRE initiative. It was based on the observation that the accessibility, interoperability and affordability of spatial data and information systems were limited. It was generally recognised that this situation prevents society to fully benefit from the potential of the technology to improve the relevancy, accuracy, impact and public control of territorial policies and related decisions at all scales and to involve citizens, businesses, non governmental and research organisations in a participatory information society.

With the INSPIRE initiative, the European Union – in collaboration with all the relevant stakeholders - intends to establish an infrastructure for spatial information in Europe that will allow the public sector users at the European, national, regional and local levels to share spatial data from a wide range of sources in an interoperable way for the execution of a variety of public tasks at conditions which do not restrain its use. Moreover, users in private, research and NGO-environments and the citizen will be offered services to discover, access and view these spatial data sources. Environmental policies, for which the spatial dimension constitutes an important component, have been chosen as the starting point to establish this spatial infrastructure.

To reach these objectives, the European Commissioners of Environment, Economic and Monetary affairs and Research agreed in 2002 about a Memorandum of Understanding, not only recognising the problem but also indicating the steps to be taken to develop such an infrastructure. One of the key elements in the MoU was the need for a legislative framework. In order to develop the INSPIRE legislation, all GI stakeholders were mobilised in relevant working groups in order to prepare the drafting process of the proposed Directive. Mid 2004, the proposal for a Directive of the European Parliament and of the Council - Establishing an infrastructure for spatial information in the Community (INSPIRE) - saw light.

The EC, the INSPIRE expert group and all the stakeholders recognised that the building blocks for a European spatial information infrastructure consist of the operational or emerging national, regional and local SDI. However, in 2002, the Commission had only a partial view of what was going on in Europe.

Therefore, the EC launched a study, "Status of the National Spatial Data Infrastructures in Europe, a State of Play" covering the period mid 2002- mid 2005, to describe, monitor and analyse the activities related to the national spatial data infrastructures in 32 European countries: 25 EU Member States[1], 3 Candidate Countries and 4 EFTA countries. The major activity of this ongoing study is to collect and structure all the relevant information on the status of the 5 components which form together a SDI: legal framework and funding, reference data and core thematic data, metadata, access and other services, and standards. It was decided to study a sixth component, i.e. thematic environmental data. The study aimed also to provide some underpinning for drafting the INSPIRE Directive in the form of a series of recommendations.

[1] At the time the study started, there were 15 Member States and 10 Accession Countries.

In a first stage, a survey of web sites and literature on the NSDI was conducted for the 32 countries between September and December 2002. The survey yielded pertinent information on various SDI components and building blocks at various stages of development for 31 of them. For 29 countries, this information could be completed and corrected with the help of national GI- and SDI-experts so that by June 2003, a useful description of (N)SDI was available. In a second stage, 9 countries were visited to study in more detail the development of the NSDI and RSDI, to detect future plans and to understand better the requirements, the encountered problems and the way INSPIRE could help in addressing these. As a result, a country report was drafted describing the 6 components of the SDI for each of the 32 countries studied, while a more detailed assessment was made for the 9 visited countries in a dedicated country report. Based on all this material, a summary report was compiled in which the status of the NSDI was assessed and analysed in terms of their ‘distance to target’, i.e. in relation to the INSPIRE requirements. In spring 2004 and in spring 2005, the reports were updated with the help of experts in the different countries to reflect and evaluate changes occurring over time. While the first summary report was helpful for drafting the proposal for the Directive, the updates will rather provide input for the implementation of the INSPIRE directive.

From the wealth of collected information we can conclude that operational NSDI made up of the all the integrated components as identified in the GSDI-cookbook and INSPIRE-position papers, do not exist in Europe. However, various components of NSDI are definitely in place or being developed. This happens almost exclusively in the public sector sphere of every studied European country. Driving forces are modernization of government, modernization of NMA or similar institutions, creation or modernization of cadastre, programmes related to the promotion of e-government and information society, shortcomings in disaster prevention and management, and the need to enhance and make more cost-efficient administrations. The information allowed to come up with a classification, valid for spring 2003, of countries based mainly on organisational characteristics of the NSDI, taking into account also their degree of maturity (operational, planned). Some countries could not be included in this analysis due to a lack of information or the unclear status of the NSDI. In 18 countries a ‘National Data Producer (NDP)’, i.e. the NMA or a similar agency (Cadastre or Land Survey Agency) was taking the lead. Along the other line, one or more organizations other than traditional data producers are driving the development of an NSDI, possibly RSDI. This was happening in 10 countries.

Only in a few exceptional cases has legislation been drafted which devotes to these initiatives formal mandates and substantial funding. The status of (digital) reference and core thematic data production and repositories was such that a workable basis is provided to start gap filling, harmonization and integration to cover the pan-European territory. Most of these data had been documented by metadata but clearly in very variable ways. A fraction only of these metadata records were maintained in operational metadata catalogues of which only part could be accessed through a web-based service. Harmonisation and standardization of data production within one data producing organisation was rather common practice. This was not the case among producing agencies. Clear organisational frameworks and division of tasks among agencies were in place in a limited number of countries. Except for web-mapping, web-based services for GI were weak or inexistent. CEN, ISO and OGC were often mentioned as providing the guidelines for standardization efforts. However, concrete results of standardization were limited.

The updates of the country reports in 2004 and 2005 revealed that since 2003, the level of operationality has changed for several countries and that smaller or bigger organisational/legal initiatives were taken for further developing the NSDI. In the same period a lot of initiatives were taken or are emerging to improve access to metadata and data (catalogues and data services, mainly through web portals).

The paper presents the findings and results of the study in depth. It will illustrate how the NSDI in the 32 countries evolved over time and draft some conclusions on how the NSDI could help in building the European spatial data infrastructure and vice versa. One general conclusion that is already obvious is that there is not just one single solution or uniform approach for setting up a successful NSDI, i.e. an infrastructure which succeeds in delivering to the user spatial data and services at conditions which do not restrain their use. Customisation to national ways of organization is imperative. However, there seems to be a basis for a stepwise integration into an ESDI, especially since the draft INSPIRE Directive will help in guiding the development of the NSDI and ESDI.

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SDIGER: A cross-border inter-administration SDI to support WFD information access for Adour-Garonne and Ebro River Basins

M.A.Latre, F.J.Zarazaga-Soria, J.Nogueras-Iso, R. Béjar, P.R.Muro-Medrano
Computer Science and Systems Engineering Department, University of Zaragoza
Zaragoza, Spain

SDIGER is a pilot project on the implementation of the Infrastructure for Spatial Information in Europe (INSPIRE) [CEC, 2004]. This project is part of the "Call for Tender 2004/S 111-092104/EN" for the supply of informatics services in the various domains of the Community Statistical Programme. It is funded by the European Commission through the Statistical Office of The European Communities.

The project proposed for this "call for tender" consists in the development of a Spatial Data Infrastructure (SDI) to support access to geographic information resources concerned with the Water Framework Directive (WFD) [OJ, 2000; Vogt, 2002] within an inter-administration and cross-border scenario that involves: two countries, France and Spain; and, the two main river basin districts at both sides of the border, the Adour-Garonne basin district, managed by the Water Agency for the Adour-Garonne River Basins ("L'Agence de l'Eau Adour-Garonne"[1]) and the Ebro river basin district, managed by the Ebro River Basin Authority ("Confederación Hidrográfica del Ebro"[2]).

The area covered by this SDI project is particularly interesting because although most of the Adour and Garonne river basins lay in French territory and Ebro river basin lay in Spanish territory, some streams and rivers headwaters are located in the other country territory. This is the case, for instance, of the Garonne river source, which is located at Spain and managed by the Ebro River Basin Authority, and of the Irati river headwaters, an Ebro river tributary which, on the contrary, is located at France and managed by the Water Agency for the Adour-Garonne River Basins. Cross-border information is, thus, of great importance for each of the Basin Authorities in order to assure that the Water Framework Directive requirements are fulfilled in each of the river basin districts. Additionally, this cross-border area includes several protected areas included within Natura 2000, the network of protected areas in the European Union.

This project is going to be developed by a consortium consisting of the following entities: IGN France International ("Institut Géographique National France International"[3]), the National Geographic Institute of France ("Institut Géographique National"[4]), the National Geographic Information Centre of Spain ("Centro Nacional de Información Geográfica"[5]), and the University of Zaragoza ("Universidad de Zaragoza"[6]). Additionally, this consortium counts on the help of the following collaboration entities: the National Geographic Institute of Spain ("Instituto Geográfico Nacional"[7]), the Water Agency of Adour-Garonne ("L'Agence de l'Eau Adour Garonne"), the Ebro River Basin Authority ("Confederación Hidrográfica del Ebro"), the Regional Direction of the Ministry of Environment for the Midi-Pyrenees region, and the GIS-ECOBAG association[8]. As it can be observed, these entities (most of them public institutions) are the main providers of the topographic data and hydrographic data in the cross-border area.

[1] http://www.eau-adour-garonne.fr
[2] http://www.chebro.es
[3] http://www.ignfi.fr
[4] http://www.ign.fr
[5] http://www.cnig.es
[6] http://www.unizar.es
[7] http://www.ign.es
[8] http://www.ecobag.org

Concerning the data served through the SDIGER infrastructure, it must be said that it will be served from different levels and that it can categorized as follows:
Basic topographic data. The National Mapping Agencies forming part of the SDIGER consortium will provide topographic data from national to regional level. Additionally, European data may be used for small scales and European overview maps.
Raster satellite imaging of the basins in the cross-border area. This satellite imaging will be provided either by the water agencies or by the IMAGE2000 project[9].
And specialized hydrological resources. The agencies responsible for the river basins in the cross-border area will provide the resources (water bodies, catchment areas and related information) being developed as a result of implementing the Water Framework Directive.

However, although the specific thematic selected for this project is the data related to the requirements of the Water Framework Directive, this is not the first priority. On one hand, some of the functionality concerned with WFD issues is subject to the availability of these data for the two river basin districts and the workload of the river basin competent authorities in charge of producing these data. And on the other hand, the real priority of this project is to demonstrate the interoperability of spatial data according to the guidelines of the INSPIRE directive proposal [Smits, 2002]. Therefore, as INSPIRE principles must guide the objectives of this project, the main aims of the project will be the following:
Data should be collected once and maintained at the level where this can be done most effectively.
It should be possible to combine seamless spatial information from different sources across Europe and share it between many users and application.
It should be possible for information collected at one level to be shared between all the different levels, detailed for detailed investigations, general for strategic purposes.
Geographic information needed for good governance at all levels should be abundant under conditions that do not refrain its extensive use.
It should be easy to discover which geographic information is available, fits the needs for a particular use and under which conditions it can be acquired and used.
Geographic data should become easy to understand and interpret because it can be visualised within the appropriate context selected in a user-friendly way.

As regards the users of the SDIGER, it is expected that the main users of the Spatial Data Infrastructure will be the staff of public administrations related with WFD issues at either at regional, national or European level. Nevertheless, the Spatial Data Infrastructure will be also open to every citizen who may be interested in browsing the availability and characteristics of the hydrographic resources in the cross-border area.

Another aspect of this scenario that must be mentioned in this overview is the multilingual requirements. French and Spanish are the official languages of the two countries involved in the project. Besides offering data and services in these two languages, an English version of the geoportal will be also available to facilitate accessibility to users not familiar with these two first languages. Therefore, multilingual resources like multilingual thesauri (GEMET [EEA, 2001], UNESCO [UNESCO, 2005], EUROVOC[10] and AGROVOC[11]) and multilingual gazetteers will be used to facilitate the creation of metadata and the development of ergonomic search interfaces for data and services catalogs [Nogueras-Iso et al.,2004].

Finally, with respect to data downloads, this project will focus mainly in the download of thematic data related with the WFD. Although part of the results of this project will be open to

[9] http://image2000.jrc.it
[10] http://europa.eu.int/celex/eurovoc
[11] http://www.fao.org/agrovoc

the general public, the download of topographic data produced by National Mapping Agencies will be subject to the rights and licenses established by these institutions.

The final version of this paper will present the activities of this project and the distribution of nodes that will form part of the Spatial Data Infrastructure created for this project. Then, it will focus on the description of the functionality of this Spatial Data Infrastructure. This description will be mainly based on the functionalities that the Geoportal will offer.

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INSPIRE and the PSI Directive: Public Task versus Commercial Activities?

K. Janssen
Interdisciplinary Centre for Law and ICT (ICRI), K.U.Leuven, Belgium

In 2005, the importance of INSPIRE for European environmental (and other) policy is no longer under discussion: a European infrastructure for spatial information is deemed indispensable for creating and implementing Community policy. The focus of the discussion is now on the concrete actions needed to put this infrastructure into place. These actions will be supported by a legal framework, under the form of a directive. A draft directive was proposed by the Commission in July 2004[1] and is now being scrutinized by the European Parliament and the Council in a co-decision procedure.

There are numerous elements in the INSPIRE draft directive that deserve attention, but in this paper we will focus on its relationship with the directive on the re-use of public sector information of 17 November 2003 (hereafter 'PSI directive')[2]. The PSI directive aims to bring out the economic potential of public sector information by ensuring a harmonisation between the national rules and practices on the re-use of public sector documents. Currently, differences in these rules and practices prevent the development of the information society and the pan-European information market. The PSI directive should be transposed into national law by July 1st, 2005. Its general principle is that, where the re-use of documents held by public sector bodies is allowed, these documents are re-usable for commercial and non-commercial purposes in accordance with the conditions set out by the directive.[3] Those conditions concern e.g. time limits for the processing of a request for documents, the format in which the documents should be made available, charging and pricing principles, transparency and non-discrimination.

In general terms, INSPIRE and the PSI directive can be considered as complementary in the field of spatial information[4], as the INSPIRE draft directive is mainly aimed at the sharing of spatial information between public authorities for the purpose of performing their public tasks, while the PSI directive addresses the use of public sector information for any purpose outside of the public task.[5] However, some articles in the INSPIRE draft directive might raise concerns for the coherency of both systems, and could create unnecessary confusion for the participants in the information market.

Irrespective of the interaction with the PSI directive, the articles in the INSPIRE draft directive on the re-use and sharing of data also seem to create quite a consternation by themselves. According to some, they will lead to the bankruptcy of the national mapping agencies, while others seem inclined to think that private business will suffer under state-financed competition. In any case, the relationship with the PSI directive complicates things even more. Arguably, this might lead to differences in the availability of the data mentioned in the annexes of the INSPIRE directive and other (geographic) data.

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[1] COMMISSION OF THE EUROPEAN COMMUNITIES, *Proposal for a directive of the European Parliament and of the Council establishing an infrastructure for spatial information in the Community (INSPIRE)*, COM (2004) 516 final.
[2] Directive 2003/98/EC of the European Parliament and of the Council of 17 November 2003 on the re-use of public sector information, OJ L no. 345, 31 December 2004, 90.
[3] Article 3 of the PSI directive.
[4] A third pillar that should be taken into account is the directive on access to environmental information. This paper will address this where relevant, but it will focus on INSPIRE and the PSI directive.
[5] Article 2.4 of the PSI directive.

The INSPIRE draft directive explicitly states in its article 3 that it is without prejudice to the PSI directive. Considering the general wording of the PSI directive and the substantial options it leaves to the Member States and the public sector bodies, this should be quite an easy task. It is, however, resting within the scope of the PSI directive, easily possible to create inconsistencies with other data, which may not be contrary to the words of the directive, but might entail a risk for the transparency we are all longing for.

One example of such possible dissonances the paper will demonstrate, lies in article 24 of the INSPIRE draft directive. According to this article, the Commission can adopt, via the Comitology procedure, implementing rules to increase the potential of re-use of spatial data sets and services by third parties. These implementing rules may include the establishment of common licensing conditions. If such licensing conditions are indeed drawn up, they have to be in line with the PSI directive. As this directive does not oblige the member states to create licenses for PSI re-use, let alone give indications of the terms those licenses should contain, the licensing conditions established by the Commission for data included in the INSPIRE annexes could be completely different from the conditions for any other category of geographic data. This endangers transparency, and could create unnecessary difficulties for potential re-users.

Apart from a commentary on the articles of the INSPIRE draft directive on sharing and re-use, the paper will also address one of the questions that is most relevant in this issue: the division between the public task of the “public authority” under the INSPIRE draft directive, and the commercial activities of the “public sector body” under the PSI directive. If public authorities share their spatial information for the purpose of performing their public tasks, the INSPIRE draft directive articles on the sharing of data are applicable. When spatial information is made available by one public sector body to another for purposes outside of the public task, this delivery of information would fall under the PSI directive. Obviously, the delineation of the public task is pivotal for the relationship between both directives.

Defining this public task is, however, not an easy challenge. It is, moreover, not merely a legal issue, but a highly policy-oriented one. In a time when policy choices seem to indicate a strong penchant for privatisation (e.g. utilities, telecommunication, transport), and the public task of several public institutions is being questioned (e.g. public broadcasters), the discussion is also becoming increasingly important in the area of information. If a public sector body creates information products and services, is it performing a duty to provide information to the general public, or is it entering the information market and competing with the private sector? The latter case could entail the applicability of competition regulation in order to avoid market distortion. As many public sector bodies, also in the field of spatial information, are nowadays required to created information products and services to provide for their own funding, a fundamental discussion on the contents of the public task will be inevitable.

INSPIRE and e-Government

Eva Pauknerová
EC JRC, Ispra, Italy

INSPIRE lays down general rules for the establishment of an infrastructure for spatial information in Europe to support: (i) environmental policies and (ii) policies that affect the environment. INSPIRE shall be based on infrastructures for spatial information established and elaborated by the EU Member States. The success of future implementation of the INSPIRE Framework Directive will depend on the awareness and support by governments on national, regional and local levels.

According to the INSPIRE proposal the infrastructure includes: metadata, spatial data sets and services; network services; agreements on sharing, access and use; coordination and monitoring mechanisms, processes and procedures. All these topics are important also for the eGovernment development. In both initiatives issues such as interoperability need to be tackled.

From the EC Policy perspective, the main **Policy area** is defined by the Proposal for a Directive on Establishing of an Infrastructure for Spatial Information in the Community (INSPIRE) COM (2004) 614, Directive 2003/98/EC on the reuse of public sector information, Directive 2003/4/EC on public access to environmental information eEurope COM(2002) 263 and eGovernment COM(2003) 567. The Commission Proposal of the INSPIRE Directive is in the co-decision procedure of the European Parliament and Council. The eEurope 2005 Action Plan was launched at the Seville European Council in June 2002 and endorsed by the Council of Ministers in the eEurope Resolution of January 2003. Among others it aims to develop modern public services and improve the relationship between citizens and their governments.

The development of the Community Framework Directive INSPIRE is in the preparatory phase (2005-2006). Parallel to the INSPIRE legislation process, it is necessary to disseminate the INSPIRE principles and discuss and evaluate their impact with those officials who are involved in eGovernment programmes. Therefore ESDI Action initiated the **JRC Workshop on INSPIRE and e-Government.** This workshop was organized by the IES Land Management Unit, together with the Czech Ministry of Informatics and was held in Prague, Czech Republic, on 28-29 April 2005. This event aimed to:

(i) raise awareness about INSPIRE outside the professional fields concerning environment and spatial information, and
(ii) search for coordination and synergy between the INSPIRE and eGovernment programs and activities.

The workshop was realized as a part of the JRC Enlargement programme and had a link to the previous JRC workshops organised within the EU Enlargement scope together with EUROGI in November 2000 (Brussels) and autumn 2002 (Prague). This year's event was the first step to establish a link between e-Government programmes and INSPIRE, aiming at knowledge transfer, but also at formulating recommendations to be used for the INSPIRE Implementing Rules.

A panel was drawn up from heads of eGovernment departments at the Cabinet Offices or relevant ministries. Different government bodies were represented due to the diversities in structures of national governments and administration (ministries as of Informatics, Telecommunication, Infrastructure or Finance). This workshop was primary targeted on the eGovernment top-representatives from the New Member States or recent Accession Countries. The issue is more complex and therefore also representatives of selected international and national SDICs were invited in the later phase of the workshop preparation. After all, there were more than 30 active experts which represented a rich mosaic of 14 countries (from Bulgaria, Czech Republic, Estonia, Germany, Hungary, Italy, Latvia, Lithuania, Malta, Poland, Slovakia, Slovenia, Rumania to the United Kingdom).

The participants were familiarized with general terms of the directive and its development. On the other hand they were required to elaborate and introduce the structured presentations of the countries and/or SDICs they were representing. This approach, which has been used already since the 2000 workshop, enabled detection of trends and highlighting of bottlenecks. Possibilities and risks for integrating INSPIRE into the national eGovernment and infrastructure development programs were debated. Practical examples from countries as the Czech Republic, Estonia, Slovakia or Slovenia demonstrated possible interconnections between INSPIRE and the modern (electronic) governance. The re-use of public sector information and the role and needs of SMEs in the building-up process were debated as specific issues.

The workshop provided opportunities to: empower bridging between INSPIRE and eGovernment development in individual countries; map the state of the art in the fields of eGovernment and INSPIRE development in the involved countries and from the SDIC perspective; the knowledge transfer and further networking in this field cross Europe; contribute with workshop recommendations to the Implementing Rules development.

The proposed presentation aims to:
turn attention to cross-references between the INSPIRE and eGovernment;
inform about findings and recommendations formulated during the EC-JRC workshop “INSPIRE and eGovernment” held in Prague 28-29 April 2005;
illustrate the statements with practical examples from several countries.

The proposed presentation fits well to the main theme of the 11th EC-GI&GIS workshop. It concerns with eGovernment as the broader and important context and **framework for INSPIRE implementation.** The presentation contributes to the objectives of the Alghera workshop. In particular, (i) it furthers our understanding of the implementation challenges, costs, and benefits of SDIs at national and regional level; (ii) it also helps to identify some research issues that need addressing by the GI community to support the implementation of ESDIs.

Session: Technical Research Issues

Thursday 30th June 09:00 – 10:30

Hotel Carlos V

Approaches to Solve Schema Heterogeneity at the European Level

Anders Friis-Christensen, Sven Schade, Stephen Peedell
Joint Research Centre, Institute for Environment and Sustainability
I-21020 Ispra, IT, {anders.friis | sven.schade | stephen.peedell@jrc.it}

To satisfy increased demands for the use, sharing and exchange of geographic data in cross-border European applications, methods to support interoperability are required by the community. According to the INSPIRE needs [INSPIRE 2004] and to address the interoperability issues, implementing rules are mandatory to have harmonized data specifications and agreed arrangements for the exchange of spatial data. The implementing rules shall address common identifiers, spatiotemporal properties and relationships, multi-lingual thesauri, and the way updates and exchange of data occur.

As INSPIRE will not put restrictions on how data are structured and managed at the national level, there is a need to develop methods that allow the distribution of and access to national data in a standardized and commonly agreed form according to an infrastructure. Thus, schema transformation becomes pertinent for enabling the mapping of the structure of national data into this commonly agreed infrastructure. Even if some states will use a shared schema in the future, the problem of mapping of legacy structures still remains.

Schema mapping and heterogeneity in data have been a research issue for decades. Problems related to heterogeneity have been categorized previously, e.g. [Stuckenschmidt 2003]:

- *Syntax* (related to different data formats, e.g., db, shape files or MapInfo),
- *Structure* (related to differences in schemas, e.g., differences in attributes of two schemata), and
- *Semantics* (related to the differences in intended meaning of terms in specific contexts).

We assume syntax homogeneity (or at least syntax conversion possibility) and will not address this issue further. In recent years, the focus has been on the structural and semantic issues: The structural heterogeneity involves mapping of data models and in order to do so it involves knowledge of the semantics behind. Semantic heterogeneity problems are caused by various reasons, e.g., [Stuckenschmidt 2003; Kashyap and Sheth 1996]:

- Naming conflicts occur when classes or attributes with different semantics are given the same names (homonyms) or when classes or attributes that are semantically the same are named differently (synonyms). The later occurs in nearly all cases between states, because most use their native language.
- Scale conflicts occur when attribute values have different units or are represented in varying scales of measure, e.g., nominal, ordinal, or ratio.
- Precision or resolution conflicts occur when attribute values have different resolution and precision, e.g., if two similar measurements are made with sensors with different precision.
- Confounding conflicts occur when information seems to have the same meaning, but differ in reality, e.g. due to different temporal contexts.

We focus on the naming and scale conflicts. In order to identify and overcome heterogeneity problems among schemas caused by these conflicts, ontologies can help. An ontology can be defined as a logical theory accounting for the intended meaning of a formal vocabulary [Gaurino 1998]. In other words the ontologies can be used to formally describe the semantics and store this information explicitly. Depending on the logic used for these descriptions, it enables varying possibilities to reason about the conceptual data models.

A couple of ongoing projects are concerned with equal approaches to harmonised data access. Two of these which are relating to the geospatial domain are the meanings[1] and the Harmonisia[2] project. The meanings project focuses on enhancing geospatial catalogues with semantic descriptions and applies shared vocabularies formalised in Description Logic (DL) for service discovery, retrieval and transformation between data that underlie heterogeneous schemata. Harmonisia focuses on the harmonisation of land cover data and concerns the mapping of local schemas/models for land use applied in Friuli-Venezia-Giulia (a federal state of Italy), Carinthia (a federal state of Austria) and Slovenia to the European Model of Corine Land Cover. A task within INSPIRE is to survey such projects and transfer their results to the specific implementation rules and to provide the technical guidelines to enable contributions by all member states.

Since the our main interest is harmonisation issues related to domain dependent communities, the connection to highly sophisticated philosophical approaches of foundational ontologies like DOLCE [Masolo 2003] are out of scope. We plan to use ontologies to identifying local concepts which correspond to the same meaning as a European level concept and to transform the structure and content if necessary. Such ontologies are more light-weight, because they are closer related to implementation issues and restricted by a fixed community that share a basic understanding.

Based on a classification proposed by Wache et al. [2001], we identified a hybrid ontology approach (Figure 1(a)) to be required. In this approach, the user community commits to a structured description of shared concepts that is called a shared vocabulary. Local concepts are then defined using this offered vocabulary and the schema of the local data sources refers to the local concept definitions. This combination of a shared vocabulary and local ontologies is mandatory for schema transformations at the European level. On the one hand, local ontologies are required to avoid problems concerning the definition of a minimal shared ontological commitment [Gruber 1993]. Such problems would occur, because federal states, states and European Union use models of varying granularity. On the other hand, the cross ontological mappings have to be represented explicitly in absence of a shared vocabulary [Gruber 1993]. Since we want to improve the current situation, where such formulas have to be defined manually, this approach does not satisfy our requirements.

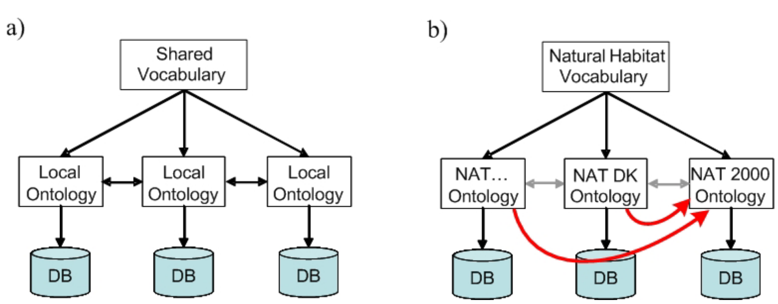

Figure 1 The Hybrid Approach of using ontologies to describe semantics in different sources [Ref].

[1] http://www.delphi-imm.de/meanings/index_eng.html
[2] http://www.isamap.info/html/harmonisa.html

The method to be applied for building this domain ontology needs to be chosen carefully. It should result in a stable shared vocabulary which does not have to be adopted later (e.g., if new states join the EU and, thus, need to transfer their models). Since the domain, in the example natural habitats, is fixed and the basic concepts are finite, it should be possible to do so.

In this paper we will investigate the feasibility of implementing a hybrid ontology approach for European-wide geospatial data harmonisation. We plan to apply description logics (DL) [Bader et al 2003] within a frame-based ontology structure [Noy 2000]. In this way, DL-based reasoning can be used to infer implicit subsumption hierarchies between the local ontologies [Tsarkov 2004] and the elements to be mapped to each other can be identified. Since the local ontologies include the models of the contries as well as the European-wide model, especially the subsumption-relations between the country specific models and the European model can be discovered following this approach (Figure 1(b)). The requirements for the user in defining local ontologies and the necessary reasoning over large ontologies will be in focus.

As case study we use Natura2000 data, which cover European habitats. All member states contribute data to this dataset, and currently all contributions are being harmonized as a very low-level data exchange, i.e. schema mappings are defined manually.

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Research Issues in Constructing Geographic Ontologies for Environmental Data Discovery and Exploitation

G. G. Wilkinson and D. Cobham
Faculty of Technology
University of Lincoln,
Lincoln, UK

Most environmental spatial data held in geographical information systems are organized as spatial objects at varying scales labelled with descriptors taken from standard classification schemes or map legends. Often these classification schemes are organized into hierarchal nomenclatures and come to represent taxonomies that describe landscapes at various levels of detail. There has been a significant amount of past work in developing European datasets that conform to certain standards. The Corine Land Cover database (CLC1990 and CLC2000) is a good example of such a spatial dataset that has been established at EU level according to a well defined classification scheme or land cover taxonomy. Whilst standardized European data sets may form the backbone of a European spatial data infrastructure, such an infrastructure must also enable the integration of national data constructed according to different schemes. In developing the INSPIRE infrastructure, therefore, it will be necessary to find ways in which data sets can be merged which may originate with different labelling schemes and in different languages. This poses significant issues in developing metadata and data discovery services in the INSPIRE context related to the semantics or meaning of geographical terms.

At one level, there is a need to harmonize feature catalogues and thesauri and to find ways to translate between different views of the same landscape and to account for language and cultural aspects [1]. A good example of a practical implementation of this is work on translating between two versions of the land cover map of Great Britain using an ontological approach [2]. There is growing evidence that humans differ greatly in their understanding of geographic concepts and that semantic issues will play a significant part in making effective use of data, including data derived from satellite remote sensing for example. A recent study has highlighted the potential role of class definition and semantic issues in the apparent lack of progress in the classification of remotely sensed satellite data [3]. Evidence suggests therefore that improvements in utilization of spatial data will come through the development not only of spatial data taxonomies or classification schemes, but also geographic "ontologies" that more completely capture or describe a domain of geographical knowledge [4]. In the geographical context such ontologies could go well beyond describing environmental data in terms of class labels and fixed nomenclatures. Classification schemes, taxonomies and thesauri lie at one end of an ontology spectrum which can include at a higher level conceptual models and logical theories encompassing a richness of description [5].

This research is concerned in particular with the development of ontologies for land cover spatial data. Such ontologies should capture the concepts in a domain area, their meaning and the relationships between them. Development of such ontologies should improve the exploitation of spatial data sets by enriching data discovery capability using "semantic web" technologies [5]. Failure to take account of semantic issues can considerably influence the way in which spatial data are used and the accuracy of spatial analysis carried out with such data sets. For example, humans differ significantly in the way they interpret geographical concepts such as "nearness" [6].

In the land cover context, there are many unexpected semantic issues relating to familiar class concepts such as space scale and temporal semantics. For example, the term "forest" is a widely used concept in environmental mapping. Although the term forest is widely understood, it carries with it an implicit meaning which to most people includes aspects such as a minimum size constraint (one tree is not normally considered a forest) and an expectation that it might contain grassy clearings, ponds, streams, pathways etc. At a simplistic level, a search for water features in a land spatial data set might ignore forested areas unless the knowledge that the linguistic descriptor "forest" could include a pond or stream within it were explicitly described in an appropriate geographic ontology. Other English terms for tree-covered areas such as "woodland", "wood", "coppice" etc are often perceived differently to forests and may or may not suggest an indication of minimum space scale or containment of non-tree features. In an urban context, spatial terms such as "park" or "gardens" may often be considered equivalent, but again there may be a human expectation of a space scale constraint or an ownership constraint –i.e. a park would most likely be public, gardens most likely private. In the agricultural context, cereal fields may only contain the actual crop for part of the year. During the rest of the year the land may consist of bare soil, stubble, or weeds. The concept "cereal field" might therefore have a temporal semantic dimension which may need to be taken into account in searching for objects in a spatial data set.

The semantics of geographic terms relate to subjective human knowledge and can be separated from the "human-independent reality", observations of the physical world, objects with properties, and the "social reality", according to the five tier ontology model of Frank [7]. In constructing Europe wide spatial data sets, the semantic issues of geographical terms are often ignored and it is assumed that nomenclatures are entirely objective. In building data discovery services as part of INSPIRE, however, it will be important to define the concepts within the data and also the expected meaning and inter-relationships between those concepts. There is now an increasing set of formal methods for doing this using some of the emerging web ontology tools and building on tools such as the resource description framework (RDF). It is clear that in going forward with INSPIRE, it will be useful to develop geographic ontologies to facilitate more precise spatial data retrieval, integration and analysis using approaches such as Concept Lattices [8]. What is needed now is more research into how semantic web technologies can be exploited in the INSPIRE context to achieve this and some examples of how this can be done will be examined.

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Web Ontology Service, a Key Component of a Spatial Data Infrastructure

Javier Lacasta, Pedro R. Muro-Medrano, F. Javier Zarazaga Soria, Javier Nogueras-Iso
Computer Science and Systems Engineering Department
University of Zaragoza, Zaragoza, Spain
Joint Research Centre - European Commission

The term ontology is used in information systems and knowledge representation to denote a knowledge model, which represents a particular domain of interest. A body of formally represented knowledge is based on a conceptualization: the objects, concepts, and other entities that are assumed to exist in some area of interest and the relationships that hold among them. And an ontology provides "a explicit formal specification of a shared conceptualization" [Gruber, 1992], i.e. it facilitates a formal notation interpretable by machines that enables a shared and common understanding of a domain.

As far as Geographic Information (GI) and Spatial Data Infrastructures (SDI) are concerned, this research community[1] is also aware of the potential benefits of using ontologies as a knowledge representation mechanism, which facilitates knowledge sharing and reuse in interoperable environments. First of all, they are used for data sharing and systems development. Ontologies help to define the meaning of features contained in geo-spatial data and they can provide a "common basis" (as the model proposed in [ISO, 2004]), for semantic mapping (e.g. to find the similarity between two features that represent the same object but have been defined using different languages). Some works [Fonseca, 2000] even propose the creation of software components from diverse ontologies as a way to share knowledge and data. Secondly, they facilitate the classification of resources and information retrieval. Metadata ("data about data") enhance information retrieval because they intend to describe unambiguously information resources. But this improvement depends greatly on the quality of metadata content. One way to enforce the quality of metadata is the use of a selected terminology for some metadata fields in the form of lexical ontologies, allowing not only to describe the contents but also to reason about them. And thirdly, ontologies also enable the management of metadata schemas. The structure of metadata schemas can be considered as ontologies, where metadata records are the instances of those ontologies. Then, ontologies may be used to profile the metadata needs of a specific geospatial resource and its relationships with the metadata of other related geospatial resources; or to provide interoperability across metadata schemas where transformations of metadata between two different standards could be resolved by systems that observe the commonalities of the two ontologies and automatically detect the metadata element mappings.

Given the importance of ontologies in the SDI context, this paper proposes the inclusion in an SDI of a specific component called Web Ontology Service (WOS), which enables the management of ontologies and gives ontology-based support for the rest of components of an SDI. In particular, this WOS component has been especially designed to facilitate the second of the above mentioned uses of ontologies, i.e. the classification of resources and information retrieval.

National and international organizations have defined standards that establish the structure of data descriptions (metadata) [ISO, 2003a; ISO, 2003b; FGDC, 1998]. Those descriptions are not

[1] See research groups at the Geosemantics Interest Group (*http://www.geosemantics.org*)

only used to describe geographical information, but also to describe other elements that integrate the SDI such as services or locations in a gazetteer. In this context, terms from a controlled vocabulary (controlled lists, taxonomies, thesaurus) are frequently used to harmonize the data and metadata of a SDI, because queries on homogeneous sets of descriptions produce better quality results than queries on heterogeneous sets in which each record has been classified following different criteria. However, despite the advantages derived from the use of a controlled vocabulary, certain problems of the ambiguity inherent to the language persist. This ambiguity is mainly caused by the different semantic relations between the concepts of a language such as polysemy, homonymy, meronymy, hypernym or hyponymy. These semantic relations are especially problematic when SDI users try to search data from several sources (and different cataloguing criteria) and their queries do not contain the same terms as the ones used in metadata, queries may be even expressed in a different language from the one used for metadata. Therefore, it becomes crucial to count on lexical ontologies that are able to deal with this ambiguity problems and inter-relate distinct controlled vocabularies. The objective of WOS will be to manage in an appropriate way these lexical ontologies that improve the quality of metadata. It is essential to compile the knowledge and the experience of their creators and to manage them uniformly, reusing and improving them when necessary.

The WOS component has been designed as a component in compliance with the general architecture of the Open Geospatial Consortium (OGC). [Vretanos, 2003] specifies the Application Programming Interface (API) that each OGC Web service should conform to. Thus, as the WOS component complies with this API, it can be easily integrated with the rest of OGC web services. Figure 1 shows the architecture of WOS, which is composed of three layers: the service layer that provides the access to the clients; the application layer which provides access to the concepts of the ontologies, their metadata and it provides utilities of disambiguation to allow semantic search; and the repository layer which stores the information of the service.

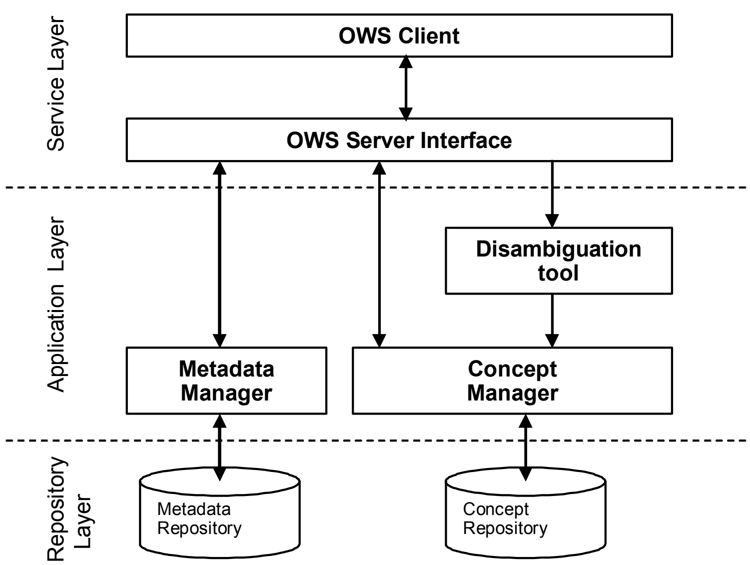

Figure 1: WOS Architecture

The API of WOS is displayed in Figure 2. It must be remarked that metadata plays an important role in this API and it is used as input parameters for most of the methods. The reason for this metadata-driven interface is that simply storing the ontologies in our system is not enough to

allow its use in a proper way. Quite the opposite, ontologies must be described and classified in different languages to facilitate the selection of the ontology that fits better with the user needs. A Dublin Core metadata profile has been created used for this purpose. The methods offered within this API can be classified in the following categories:
Queries. First of all, the compliance with the OGC Web Services Architecture is addressed by implementing the getCapabilities method, provides the description of the service and its content. And secondly, the query methods allow the client navigating by the relations between concepts, searching concepts by label in different languages and using the disambiguation tool [Nogueras, 2004] to expand the results returned.
Administration. On one hand, the API provides methods for Ontology administration. It is possible to create a new ontology given its metadata in multiple languages, delete an ontology, modify the metadata describing an specific ontology, and exchange ontologies using the SKOS format [Miles, 2005]. And on the other hand, there are also methods for administration of concepts. It is possible to create, update and delete concepts, attributes and relations between concepts.

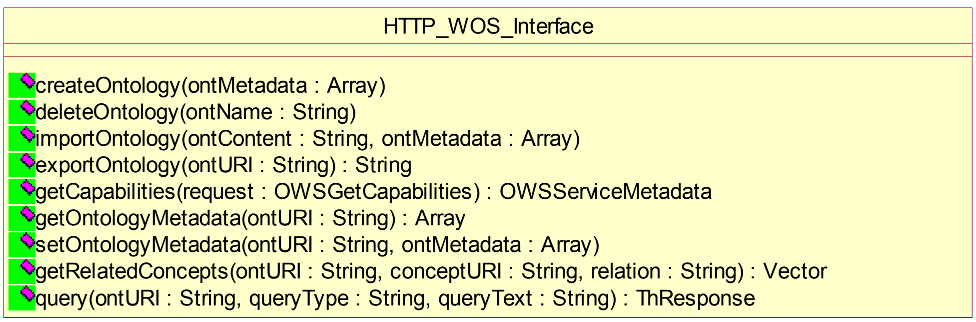

Figure 2: WOS API

Finally, it is worth mentioning the benefits the use of WOS will provide to rest of services of an SDI. The main areas where WOS will facilitate added-value functionality are the following:
Service description creation: Every OGC service has to implement the method getCapabilites, which provides a description of the service. To create this descriptions the WOS can provide concepts to use in the metadata in different languages from certain ontologies, related concepts as synonyms or narrower concepts, textual definitions to help the cataloguer to decide between similar concepts, and also it can suggest concepts from others ontologies.
Content creation: Services as geographic metadata catalogue, service catalogue [Nebert, 2004], gazetteer [Atkinson, 2001] or geocoder [Margoulies, 2001] store, between other elements, geographic data descriptions, services… The WOS can provide terms, relation and definitions in a similar way as in service description creation. It can also provide help to the data creator to describe the features in web map server [Beaujardiere, 2004], the feature description in a web feature service [Vretanos, 2002] or the coverages in a Web Coverage Service [Evans, 2003].
Query results improvement: The WOS can be used as the disambiguation base of a conceptual retrieval system for the metadata contained in the geographic metadata catalogue, service catalogue, gazetteer or geocoder. The advantage of using a conceptual retrieval system is that the user can use his own terms to define his query and the system, using the existent ontologies, is able to match this query with the metadata in the catalogue, although the terms were different. Other OGC services which could use the WOS in this same way would be the geoparser [Lansing, 2001] to disambiguate the context (e.g. city-village, river-brook) of the analyzed geographic terms, with the objective to identify with a higher liability the place which is being referred in the stored document, or the goeolocator in which the types of the stored elements can be named in different ways (hospitals, clinics, health centres…).

Content homogenization: The WOS can provide to the service catalogue the ability to eliminate inconsistencies between the descriptions stored in this service about the rest of the components of the SDI and the descriptions returned by the getCapabilities methods of those services.

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Developing an SDI for time-variant and multi-lingual information dissemination and data distribution

Nicole Ostländer, Sascha Tegtmeyer, Theodor Foerster
Institute for Geoinformatics, University of Münster
{ ostland | tegtmeyer | tfoeste@uni-muenster.de }

As number of regional, national and international spatial data and service infrastructures (SDI) is increasing (Groot and McLaughin 2000; Bernard, Annoni et al. 2004) the experience in this field of expertise is growing together with the number of identified SDI-specific problems and proposed solutions. Nevertheless some aspects have remained mostly untouched. The SDI developed by the Institute for Geoinformatics (IFGI) of the University of Muenster in the context of a research project for the assessment of climate change vulnerabilities in the Arctic faces a number of challenges: It has to (1) distribute, (2) portray and (3) process (4) time-variant data for (5) multi-lingual stakeholders from (6) different knowledge communities. This combination forms a distinctive ground for research questions and resulted in a number of solutions coupled with hands-on experience, which will be described in detail in the full paper.

Background

The Arctic has a high sensitivity and risk of exposure to climate change (cf. (McCarthy, Canziani et al. 2001)). The resulting concerns built the motivation for the integrated assessment project BALANCE1, funded by the European Union (BALANCE 2002). The BALANCE consortium models climate as well as ecological and socio-economic changes in the Barent Sea Region. The results of the regional climate model REMO, developed by the Max Planck Institute for Meteorology (MPIfM) (Jacob 2004), covers a range of 140 years and are the driving force for a number of terrestrial, marine, hydrological and socio-economic models.

The stakeholders to be addressed (people active in renewable resource industries) are situated in many different countries and speak 6 different languages: English, Swedish, Norwegian, Finnish and Russian as well as Saami, the language spoken by the indigenous people in the Barents Sea Region. The descriptive information provided in combination with the data dissemination has to be adapted to the knowledge and language of the different user groups.

The distribution of the REMO results in a grid coverage format to BALANCE partner institutes and the visualisation of time-variant and -invariant information for the BALANCE stakeholders is affiliated through an interoperable infrastructure of Model and Workflow Information Services, Processing Services and Human Interaction Services (ISO/TC-211&OGC 2002) using standards and specifications of the Open Geospatial Consortium[2] and the International Organization for Standardization[3].

SDI Elements: challenges and solutions

The following paragraphs describe the used service interfaces as well as the developed strategies and implemented features addressing the challenges named above. For better orientation the challenge numbers mentioned in the introduction initiate the paragraphs they are addressed in.
(1&4) The climate change data is distributed through a Web Coverage Service (WCS) Interface (OGC 2003a). The interface allows requesting the spatial, temporal domain and attribute domain. Different types of temporal-domain requests can be formulated: request for a single or a

[1] http://www.balance-eu.info
[2] http://www.opengeospatial.org
[3] http://www.iso.org

series of time instants and request for time sequences described as beginTime, endTime and temporal resolution.
(2&4) The Web Map Service (WMS) Interface (OGC 2004), which like the WCS Interface allows requesting the temporal domain[4], is used for data portrayal. Unfortunately the WMS-based visualisation of raster data accessed through a WCS did not turn out to be trivial: The Styled Layer Descriptor Specification (OGC 2002b), which would have been the most obvious choice for remote data access, provides only very limited means for coverage portrayal. An attempt to fill this gap is the OWS1 Coverage Portrayal Service (OGC 2002a), which has been tested within this infrastructure. Nevertheless due to technical restrictions we chose a tight coupling approach between WCS and WMS which will be described in more detail in the full paper. The WMS-based visualisation of series of time instants and time sequences has been implemented using Scalable Vector Graphics (SVG). Additional data from other project partners is available via WMS instances installed at the different partner institutes.
A client has been developed, which includes a number features to address multi-lingual stakeholders from different knowledge communities:

- (5) The client's tool descriptions and written menus are translated in the languages named above. The multi-language enablement for the WMS layers is adopting the method developed by (Foerster and Senkler 2003) (see also (Riecken, Bernard et al. 2003)): External language XML files provide the translations of WMS capabilities documents which are used by the client e.g. for layer name translations. A specific language XML file can be loaded into the client in combination with the WMS it has been created for.
- (6) The client implements the OGC Web Map Context Documents Specification (OGC 2003b) which allows the loading and saving of context documents referencing amongst others the connection details to different WMS data layers. In this way the user groups can be presented with an unbounded number of maps including additional explanations and descriptive layer names according to the users' level of knowledge while the underlying WMS layers stay untouched.
- (4) The client has a time request interface: It identifies if a WMS layer is time variant. In case it is, the user can request either a time instance which will be displayed in PNG format or a time sequence which will be displayed in SVG format.

(3) The climate change data provided by the WCS is used for further processing to quantify potential impacts of climate change and vulnerability. A Statistics Calculation Service currently developed by the IFGI as part of the Web Processing Services Interoperability Experiment (OGC 2004-01-31) will be used to request climate change coverages from the Web Coverage Service Interface and return statistic values to be used for attribute normalisation. The latter is part of a concept for the assessment of potential impacts and vulnerability to climate change described in more detail in (Bernard, Ostländer et al. 2003; Ostländer and Bernard 2005).

Expected social impact and outlook on further research

The World Wide Web was chosen as an appropriate time- and space-independent platform to inform stakeholders in different languages reaching over borders that might not be easy to cross in reality. We furthermore consider the chosen representation of information through maps as a highly effective mean for awareness building, as people not only learn more effectively through images but they can link their own physical position to the expected changes in space and time: The multi-lingual, time-variant and map-based approach of the BALANCE SDI will allow stakeholders to visualise information for their specific time and area of interest and in the appropriate language and hopefully increase their awareness for the changes their environment and their way of live might undergo.

[4] This is supported from WMS version 1.1.0 onwards

Further research undertaken for this service infrastructure covers the fields of geoprocessing, service chaining and web-based decision support for vulnerability and impact assessment based on the time variant WCS output. For further information on this topic see (Ostländer and Bernard 2005).

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Session: Thematic SDI

Thursday 30th June 11:00 – 12:30

Meeting Room Hotel Calabona

Delivering Geoscientific Information and Producing New Services based on Standard Protocols

F. Robida[1], J.J.Serrano[1]
1BRGM, Orléans, France

BRGM, the French Geological Survey, has been delivering geoscientific information on the web since 1997, through its InfoTerre site. Having identified interoperability as a strategic issue in 2001, it has implemented a new version in 2003, compliant with the OGC WMS and WFS specifications. Most of the information is available for free, and even the geological maps, can be viewed for free. This policy is fully in line with the proposed principles of INSPIRE.

BRGM is involved in the development of added value products and services that will complement this offer.

BRGM, with InfoTerre, applies various ISO/TC211 and OGC specifications to improve the interoperability usage, from a user point of view, but also as a data and services provider. InfoTerre displays geoscientific data from BRGM servers and maps from OGC compliant servers and provides specific services (for example: borehole viewer or underground water data viewer). A testbed with the BGS (British Geological Survey) has demonstrated the combination of two separate WMS and WFS services supplying XMML (eXploration and Mining Markup Language) borehole location and log data to a single client and plotting logs and sections with a BRGM viewer.

At the end of 2004, BRGM decided to continue on the interoperability way by the creation of a new data and services catalogue based on the OGC Catalog services specifications. This component enables to publish and access catalogues of metadata for geospatial data and services. Catalog services support the discovery of registered resources between communities to share information.

Thanks to this standardisation, many resources provided by BRGM are now discovered by a unique search: to a user who wants information about earthquakes, the portal will propose data on seismic epicentres but also reports on studies, books, photos … on the same theme. The metadata populated into the catalogue are described with the ISO 19155/19139 standards. This Catalogue will be opened and available on the Web, and other providers could access to BRGM resources.

To provide a better response to user needs, and based on the standardisation of the access to its own datasets, and on the development of the SDI, BRGM is developing new products,.

The “géo-rapports” gather information from different servers on an area defined by the user,. The information coming from BRGM or its parners is processed (for example selected according to criteria or completed if necessary), formatted and delivered as a report (in a PDF format which is downloadable). Using the infrastructure defined by ISO and OGC, enables to easily add new sources (from map or features servers) to improve the quality of the response.

New tools using Virtual Reality equipments have also been developed to help the end user to better understand the complex 3D models that are developed for instance in natural risks assessment and mitigation. These tools take full advantage of the SDI with the possibility to access remote data sources through OGC WFS and display and use them into a 3D scene. A video has been produced to illustrate this new application.

World Meteorological Organisation Operational Meteorology

G. H. Ross[1], A. Rubli[2], A. Broad[1],
[1]*Met Office, Exeter U.K.*
[2]*MeteoSwiss, Zurich, Switzerland and Office of the WMO RAVI President*

The WMO is a United Nations organisation with a membership of 187 Member States and Territories. It originated from the International Meteorological Organization (IMO), which was founded in 1873. Established in 1950, WMO became the specialized agency of the United Nations for meteorology (weather and climate), operational hydrology and related geophysical sciences.

As well as sponsoring international cooperation on a global scale, it facilitates the free and unrestricted exchange of data and information, products and services in real- or near-real time on matters relating to safety and security of society, economic well being and the prevention of harm to the environment.

WMO organises a private communications system (the Global Telecommunications System GTS) used for international and regional data exchange which has existed since 1950. This is a highly developed, reliable and robust system which is used for operational (daily, hourly and more frequent) weather related and health and safety bulletins. It is a globally interoperable system of metadata, data, protocols, formats which is operated and maintained through existing formal WMO processes.

In a similar manner, observations are collected through the Global Observing System (GOS), and processed into forecasts and services through the Global Data Processing System (GDPS). WMO coordinates standards, protocols and processes which underly these systems. These operate in cooperation with many other international agencies, such as the International Civil Aviation Organisation (ICAO) and the International Oceanographic Commission (IOC).

WMO is grouped into 8 Technical Commissions, covering subjects such as instrumentation and basic systems through to aviation and agriculture. These Commissions operate through working groups of voluntary experts known as Expert Teams. Expert Teams conduct scientific investigations, develop data formats, network processes and metadata standards (recently to ISO19115), and are at the heart of international cooperation.

The concepts of INSPIRE are very similar to the aims of WMO. Cooperation and the enhancement of interoperability in spatial data is a significant and highly important aim. However there are concerns that the INSPIRE might require constraints on data and metadata formats which are disruptive to this global system. The origins of INSPIRE are in the geographical interoperability of relatively static data, which are very different from the conditions necessary for the real-time interoperability of meteorological data.

This paper gives the background to WMO activities and processes. It illustrates the work of WMO members using examples of real-time operations, formats and metadata.

Reference data in the internet – implementation of SDI-services as part of e-Government

Heinz Brüggemann, Jens Riecken
Surveying and Mapping Agency NRW, Bonn, Germany

As the key service provider for reference data the Surveying and Mapping Agency of North-Rhine Westphalia, Germany, (NMA NRW) has a central charge for building up the Spatial Data Infrastructure of NRW (GDI.NRW). It is the role of GDI.NRW to be the spatial component for e-Government (services) and to support the modernisation of the administration. In October 2004 the key SDI-service "TIM-online", which stands for Topographic Information Management, was introduced (www.tim-online.nrw.de). The authors want to focus on several aspects of SDI-services and their influences on administrative acting. These aspects will be discussed in the context of the INSPIRE developments.
TIM-online has a tremendous success and handles approximately 1,000,000 requests for reference data each month. TIM-online is conform to the OGC WMS specification and to the locally created GDI.NRW WMS profile. It provides access to all topographic maps and digital orthophotos of North-Rhine Westphalia free, for private use. Users can view reference data in different scales or locate a target via its address and merge other thematic data available via WMS services which support the GDI.NRW WMS profile. Commercial users are required to develop an agreement with the Surveying and Mapping Agency to use the service or to bind in different WMS-services "behind" TIM-online into their applications. A second goal of TIM-online is to allow users to provide information about errors in the data via the TIM-online website via text and graphics. Within TIM-online the user notifies errors using mark up tools and by adding text, both sent via email to the Surveying and Mapping Agency. There the topographers verify the suggested changes and start the updating process of the data.

With TIM-online the NMA NRW uses the key technology "SDI" to fulfil a change of several paradigms:
A reengineering of the production process starts introducing a continuos updating of data by replacing step by step the periodic updating.
TIM-online supports the interactive communication between administration (NMA NRW) and public. For the first time the public can participate at the administrative work.
The service approach is consequently introduced into business. The first experiences clearly show that the demand for services will replace (partly) the demand for data in the future.
Especially the last point reflects the INSPIRE directive and proves the benefit of a SDI.

Currently the SDI developments in the NMA NRW focus on the following topics:
creating additional services: for 2005 gazetteer services are planed
developing business models, as far as possible in co-operation with the users
putting SDI-applications on the internet, several projects are under development and will be published during the next months.

During the presentation the authors want to give an impression about new developments in a regional spatial data infrastructure.

The Environmental Information Systems *UDK*, *gein*®, and *Portal-U* as Part of the National German SDI

T. Vögele, M. Klenke, F. Kruse
Coordination Centre UDK/Gein (KUG), Hannover, Germany

One of the main purposes of digital maps, areal photos, and other spatial data is to transport information about features on the earth's surface in an comprehensible and user-friendly way. Consequently, geospatial data do always have a thematic as well as a geographic component. While the number of thematic contexts of geospatial data is almost unlimited, the INSPIRE initiative is focused on the topic of environmental information as one of the most common thematic contexts of geospatial data. The three annexes of the proposed INSPIRE directive list a number of environmental topics that are to be covered by the future European Geodata Infrastructure (ESDI).

But where will the environmental data come from? Unlike "basic" geospatial data, which are compiled mainly by the national and regional mapping agencies, environmental information is gathered by a diverse number of national, regional and local government agencies, as well as by private and semi-private organizations. It is obvious that, together with the mapping agencies, these organizations will have to be included as data providers in any successful regional, national, or European SDI.

Metainformation Systems for Environmental Data: In Germany, the management of environmental information with the help of metadata catalogs and environmental information systems has a long-standing and successful tradition. Since the early 1990's, the German federal and state environment agencies do jointly maintain an environmental metainformation system. This Environmental Data Catalog (Umweltdatenkatalog – UDK) builds on an architecture of distributed databases that are made accessible over the Internet by an online information broker under http://www.umweltdatenkatalog.de (Swoboda1999, Karschnick2003). Almost every german state and the federal environmental agencies maintain individual UDK metadata catalogs. The system is well established within the organizational structures of the participating agencies. All participants have committed to funding the organizational structures necessary to ensure long-term metadata collection and quality control, as well as the technical maintenance and development of the necessary software.

The UDK uses a metadata model that is compatible with international standards (e.g., Dublin Core, ISO), but was tailored to meet the specific needs of the environmental community. Within the more than 10 years of it's existence, the UDK metadata model has evolved into a quasi-standard for environmental metadata in Germany. In the latest version of the UDK, which was released in September 2004, the UDK metadata model has been adjusted to the ISO 19115 and ISO 19119 standards for geospatial data and services. Metadata descriptions of digital maps and geo-services are now available in ISO-compatible format. This enhancement will strengthen the position of the UDK as the german metainformation system for geospatially encoded environmental information. The UDK already plays an important role in the emerging German SDI (Geodateninfrasruktur Deutschland, GDI-DE) as the main source of metadata for government-owned environmental information. To further improve the integration of the UDK in the GDI-DE, the UDK was equipped with a catalog interface that conforms to the OGC CS-W 2.0 specification. This interface implements an application profile that was developed by a national working group (AK Metadaten) of experts in the field of environmental and geospatial metadata (OGC2004). The application profile is intended to serve as a standard guideline for the technical implementation of geometadata catalogs in Germany.

Information Brokers and Portals: While the UDK offers tools to manage metadata descriptions of data sets, the German Environmental Information Network gein® provides additional access to environmental information that is online but not described by metadata. The gein® portal (http://www.gein.de) features extensive search mechanisms that do cover not only a number of databases and online information systems (including the UDK), but also the web-pages of most environment agencies and related organizations in Germany. gein® was initiated by the Federal Environmental Agency and the Federal Ministry of the Environment, Nature Conservation and Nuclear Safety in 1998, but since 2003 has been financed and controlled through an administrative agreement between the German federal government and the governments of the German states, represented by the respective environment ministries (Bilo2000, Kruse2003, Vögele2004).

In 2003, it was decided to merge both the UDK and gein® into a new and comprehensive environmental information system, Portal-U. The planning phase for Portal-U has been completed and the system is expected to be released by 2006. The new system will combine the main features of both the UDK and gein®, i.e. it will provide access to environmental metadata, online information, and information in databases. Driven by the EU-Directive 2003/4/EC on public access to environmental information (EU2003), it is planned to integrate as information providers all holders of environmental information on the federal, the state (and eventually also the community) level of the administrative hierarchy. Eventually, the new system will offer a comprehensive coverage of government-held environmental information in Germany.

Like the latest release of the UDK, the new information system will support the relevant ISO standards and OGC specifications for metadata, catalog and web map interfaces. Through it's OGC compliance, the system will provide access not only to digital maps and other "standard" geospatial data, but also to web-pages and text documents. The necessary spatial reference information will be automatically assigned based on a semantic analysis of the data. Equipped with OGC compliant input and output interfaces, the system will be able to work as a portal for other OGC catalog services as well as to become a source of geo-referenced information for catalogs and metainformation systems like the GeoPortal.Bund (the metainformation broker of the German national SDI) or any future ESDI metainformation broker.

Summary and Conclusions: The proposed INSPIRE directive identifies environmental information as one of the main topics to be covered by the future ESDI. Environmental information and data are typically produced by a large and heterogeneous group of government agencies and private organizations. With the Environmmental Data Catalog, (UDK), the German Environmental Information Network (gein®), and Portal-U, Germany can contribute a number of well established and successful environmental (meta)information systems that provide access to government-owned environmental information and data. Maintenance and development of these systems are supported by a long-term commitment of federal and state environment agencies. As the most comprehensive providers of geo-referenced environmental information in Germany, the systems can be expected to play an important role for the implementation of the German national SDI, as well as the European SDI.

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EuroGeoNames – Integration of geographical names data in a European Spatial Data Infrastructure (ESDI)

P.-G. Zaccheddu, Dr. J. Sievers
Federal Agency for Cartography and Geodesy (BKG), Frankfurt am Main, Germany
E-Mail: pier.Zaccheddu@bkg.bund.de , joern.sievers@bkg.bund.de

Abstract:
EuroGeoNames (EGN) is aiming at better integrating geographical names data in a European Spatial Data Infrastructure (ESDI).

Geographical names are geobasic reference data of all spatially related topographic data sets. In general, they serve as the first access to geoinformation. Its clear and consistent use is important for administrative tasks in EC itself and in all European countries, for economy, for postal services, telecommunication, health, risk management, safety and rescue services, transportation, tourism as well as for the purpose of popular education or for the use in the mass media.

In the context of the current INSPIRE initiative resulting in a European Spatial Data Infrastructure (ESDI), geographical names are considered to be one of the three most important data components (priority common basic data) [1]. EuroSpec is the Eurogeographics[1] programme that will prepare, influence, and contribute to the implementation of INSPIRE, from the member organisations perspective [2]. EuroSpec, with its related projects, such as EuroRoadS, RISE, etc. is already addressing a number of the INSPIRE reference information priority components, such as roads, elevation, hydrography, direct referencing systems. The Eighth United Nations Conference on the Standardization of Geographical Names (Berlin, 2002) recommends that standardized geographical names data shall be considered in the establishment of national and regional spatial data infrastructures and included in their design, development and implementation [3]. However geographical names have not been given attentive focus yet.

Presumably, in some countries databases are already including geographical names data. They are mainly used by surveying and mapping authorities supporting processes in cartographic map production and they mainly consider national linguistic specifics. But, in some cases various feature categories of geographical names (e.g. populated places, administrative units, etc.) are very often not yet based on the same data model and are therefore not yet compatible with each other. Additional toponymic attributes to geographical names, e.g. exonyms[2], the pronunciation, the language or script of geographical names are currently very rarely available [4].

Therefore, the Dutch- and German-speaking Division of the United Nations Group of Experts on Geographical Names (UNGEGN) and the German Federal Agency for Cartography and Geodesy (BKG) initiated the project EuroGeoNames (EGN), the vision of integrated geographical names data within a European SDI [5]. EGN shall ultimately be a Internet service linking geographical names official sources across Europe. Names searches shall be possible for all official European languages including the officially recognized minority languages. In countries, where official sources are not yet available other data repositories (e.g. the US

[1] Association of the European National Mapping and Cadastral Agencies (NMCA)
[2] Example for exonyms: a German could prefer to start his Internet search by entering the German name “Prag” (German exonym) instead of the Czech name “Praha” (endonym). E.g. the Italian exonym would be “Praga” and so on.

GEOnet Names Server (GNS), http://earth-info.nima.mil/gns/html/, etc.) could be considered to be taken into account [6],[7].

As a recently accepted project of EuroGeographics, EGN will also be linked with the EuroGeographics products EuroGlobalMap(EGM), EuroRegionalMap (ERM) and Seamless Administrative Boundaries of Europe (SABE). By that measure also the access to nationally held public sector information data (PSI) and their geo-refencing will be improved significantly.

A prerequisite to set up EGN is a detailed European survey/inventory on geographical names data (SI-EGN) investigating the availability, quality, accessibility and responsibility for national official geographical names data. It is currently being carried out for all EU25, EFTA and candidate countries as well as for further European countries.

The SI-EGN Consortium, consisting of the BKG, as project coordinator, together with the National Mapping and Cadastral Agencies (NMCAs) from Austria and Slovenia as well as with the Eurogeographics Head Office (EGHO) and ESRI Germany, has started actions for SI-EGN in January 2005. A detailed questionnaire has been sent out, both to all NMCAs being members of EuroGeographics as well as directly to experts nominated by the NMCAs as a national expert to the EuroGeoNames project. Additional interviews with the EuroGeographics VARs, distributors and main customers as well as with further GI stakeholders have also been prepared in March 2005 for an initial assessment of the market potential of the future EGN service. First results of the evaluation and assessment of SI-EGN are expected in Mid-2005. As its main outcome it shall provide the draft content for the future EGN service [8],[9]. This includes the decision on mandatory geographical names attributes for EGN as well as a selection of additional toponymic attributes required for EGN.

The presentation gives an overview on the concept for EuroGeoNames (EGN) as well as on the current status of survey/inventory on European geographical names data (SI-EGN). Furthermore the future plans for setting up EuroGeoNames will be touched.

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Session: SDI Technical Developments

Thursday 30th June 11:00 – 12:30

Hotel Carlos V

Development of the KNMI Operational Data Center (KODAC)

Wim Som de Cerff, Frans van der Wel, John van de Vegte, Ian van der Neut and Maarten van der Hoeven
Royal Netherlands Meteorological Institute (KNMI), De Bilt, The Netherlands

KNMI provides weather, climate and seismological datasets to a varied group of customers. The number and size of the data volumes is increasing rapidly, with satellite data as important contributor. Currently, only part of the datasets are directly available via the Internet, although their number will grow given new (inter) national regulations that require easy and standardized access to a range of environmental data.

KODAC is the main strategy for the future spatial data infrastructure for all KNMI data, linking up with national and international efforts. It incorporates efficient data delivery to customers, both bulk data transfer and interactive data exploration and retrieval. For bulk data delivery, the Family of Operational Data Services (FORDS) will be developed. This paper deals with the development of the interactive data search and retrieval part of KODAC.

KNMI has the disposal of several successful solutions for interactively searching and accessing datasets, but none of these systems can browse through all available datasets.
Uniform and secure access to heterogeneous, distributed data sources improve the visibility of the KNMI data and contributes to an optimal exploitation of available data. Customers can easily find datasets of interest and might even explore data they did not think of before.

KODAC benefits from knowledge and skills gained during the development of existing data retrieval systems (NL-SCIA-DC[1)], TEMIS[2)], ECA&D[3)]). Information systems such as KODAC need to be accepted by and embedded in the entire organization. A phased approach is used to accomplish this. KODAC-I is the first phase in which a working end-to-end system for one dataset will be implemented, demonstrating technical solutions and organizational benefits.

Users

Essential when building an information system is the correct translation from user demands and wishes into verifiable and specific user requirements. The users of the KODAC system can be divided into three groups: the end-users, the KNMI data providers and the system administrators. The group of end-users of KODAC is potentially very large and, in fact, includes all people interested in the interactive use of data from KNMI. As such KODAC will substantiate the open data policy of KNMI, in line with the KNMI law and EU regulations. Within KODAC the end-users are represented by the KNMI data providers as they are assumed to be in regular contact with the users of their datasets. One of the means that has been developed for direct interaction with the end-users is the organization of KODAC symposia.

Stakeholders from all user groups, together with the system developers, have performed an in-depth analysis on the user requirements for KODAC. The document contains both functional requirements (e.g.,'KODAC shall present KNMI data as a unity from the end-users point of view') as well as non-functional requirements. The latter include, among others, the 'look-and-feel' requirements concerning the user interface (web-pages) in relation to the KNMI internetsite, the system usability (publish (upload), catalogue, browse, query, download, help, etc), as well as the system performance (e.g. peaks in data requests, number of concurrent users, waiting times, etc.).

The user requirements document has served as framework for the development of the prototype system of KODAC-I and it provides a firm base for follow-up projects, even though information system requirements are not static. New insights may change requirements or priorities and new requirements may surface. In fact, flexibility to incorporate future user needs is one of the essential requirements to the design of an information system like KODAC.

Architecture

The KODAC system needs to be able to retrieve data from a myriad of current and future sources. These can include tape archives, internal and external FTP and HTTP sites and so on. The KODAC architecture facilitates this by using flexible backend services feeding the data products to the web frontend. By keeping properties (metadata) of the various data products in a database, the KODAC system can determine which backend service it needs to call on to obtain a requested data product. KODAC communicates with its backend services by using SOAP (Simple Object Access Protocol), also known as the "Web Services" protocol.

KODAC's frontend is built using the state of the art Java Enterprise paradigms to ensure maximum scalability and code maintainability. The Apache TOMCAT[6)] application server and Apache Struts[7)] web application framework are used to facilitate a modular application that can be expanded with new services as their need arises. Dynamic discovery of product specific webforms, product pages and backend services are implemented using proven Design Patterns.

The KODAC system follows the Model-View-Controller design pattern, which ensures that the model (actual application logic) can be separated from the view (user interface). The controller component routes user requests to the core application. The core application, after discovering the appropriate backend service and associated view, returns this data to the view component.

Metadata

Metadata is of the utmost importance for archiving and discovering datasets. The structured description of their characteristics should follow de jure standards such that search procedures can be formalized. At KNMI, the ISO-19115 metadata standard has been accepted for assessing the contents of the metadata database for the KODAC system. This is in accordance with developments within WMO and the European Union (INSPIRE[4)]).

At first, core metadata will be collected at dataset level to answer questions concerning the “what, where, when and who”: what theme, what geographic coverage, which time span and who is the point of contact for more background information. It will require discipline to describe all data according to a standard, but the advantage is an increased chance of “findability” on the web: KODAC will offer more than a collection of links to datasets.

Standardized metadata supports the idea of a service-oriented architecture in which dedicated metadata services are able to exchange information in a seamless way. This will be the basis for dedicated portals, like UNIDART[5)]. As KODAC has aspirations to establish a Dutch node in an international framework, the ISO metadata is essential.

Implementation plans

To proof the conceptual design of KODAC, the EDOW (the daily delivery of customized climatological reports to paying customers) is used as a pilot. Until recently, these daily reports are distributed to paying customer by means of fax machines. Because of degraded hardware, and changing demands of the paying customers, a new approach is taken to deliver the daily report by means of account-based web access.

The KODAC pilot will provide core functionality as specified in the requirements. It will implement the core features and will take care of user authentication and authorisation, as well as presenting the customized climatological reports to the users. One of the reasons of taking the climatological reports as pilot is that it will yield relevant knowledge and proof that the design concept is feasible within a general KNMI scope.

The proof of concept, consisting of a fully functional system, will be made available in an operational environment, thus embedding the system in the KNMI infrastructure. After this, more datasets and more functionality will be added to the KODAC system.

Figures

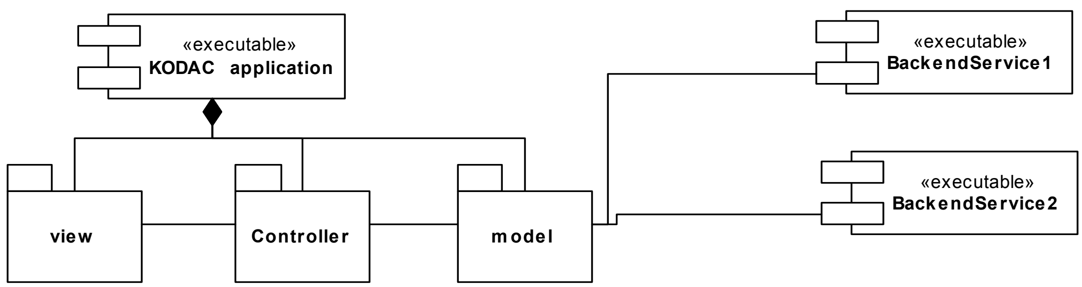

Figure 2: KODAC architecture

Figure 1 depicts the architecture in the Unified Modeling Language (UML). The KODAC application interacts with the user through the view. User requests are routed to the model by the controller. The model uses backend services that may reside on remote machines to fetch products.

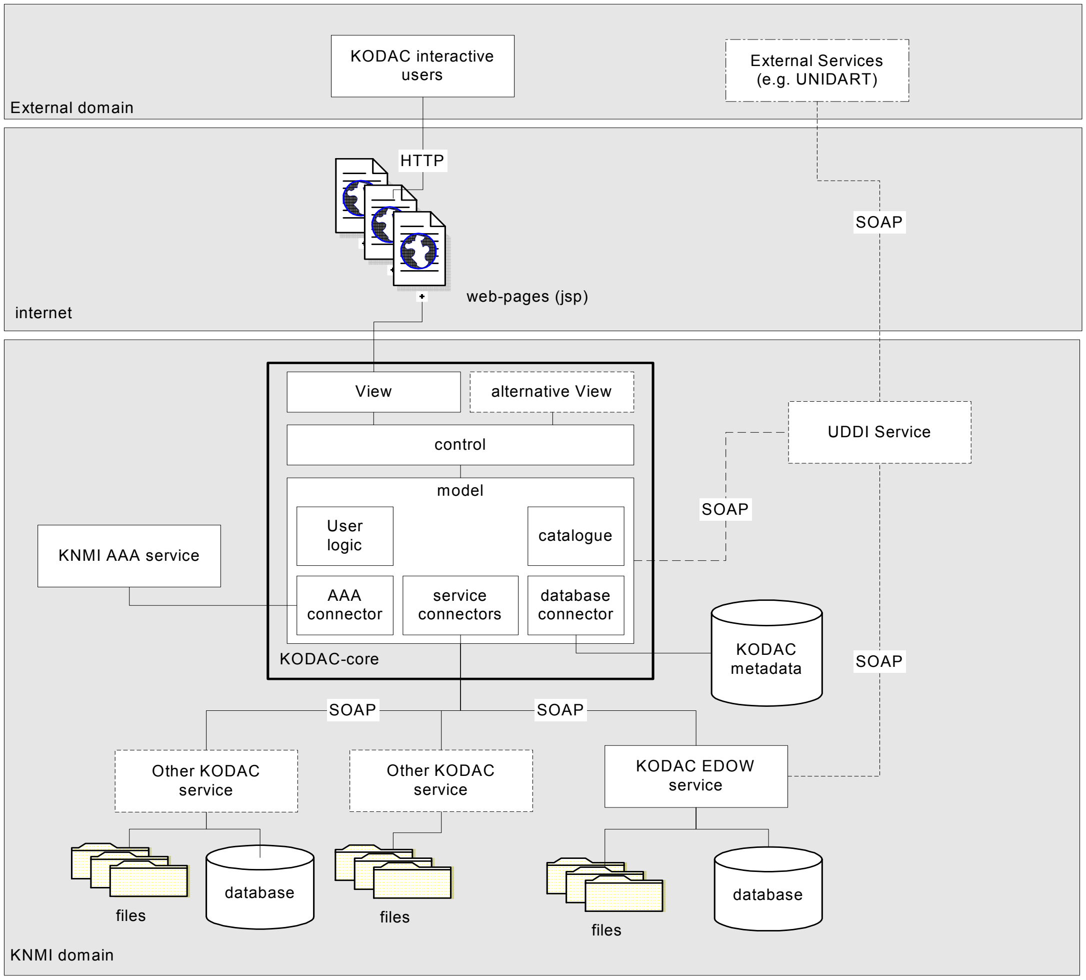

Figure 3: KODAC system overview

Figure 3: KODAC system overview gives a schematic overview. On top the external domain with our customers is shown. Interactive users interact with the system using a web browser. The UDDI[8)] Service will be used by KODAC to discover KNMI data services. Also External Services can interact and discover KODAC data services using this service. The KODAC core shows the Model View Controller (MVC) pattern in use, the model part shows the main parts of the business logic, among which the connection to the KNMI Authentication, Authorization and Accounting (AAA) Service. The bottom of the picture shows the data services. Here the actual data is retrieved, which can be in file (systems), database records or in online tape archive systems.

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Adaptation Method of Stratigraphy Data to INSPIRE Standards

J. Chełmiński[1], M. Rossa[2]
[1]*Polish Geological Institute, Warsaw, Poland*
[2]*Polish Geological Institute, Warsaw, Poland*

Polish Geological Institute (PGI) – as geological survey in Poland – began adaptation of Polish Geological Spatial Data Infrastructure (PGSDI) to requirements of European Spatial Data Infrastructure (ESDI) according to European Commission Initiative –INSPIRE. This concerns geological time, too. This paper presents the PGI project: Adaptation method of stratigraphy data to INSPIRE standards – CEN/ISO norms and Open Geospatial Consortium (OGC) specifications.

Geological time it is very important problem in INSPIRE because development in geology cause frequently changes of stratigraphy chart. Every European State has his own national stratigraphy charts. Also each particular geological survey modificate national stratigraphy charts for many different projects – for example: there are about twenty stratigraphy charts in PGI which are used for geological, hydrogeological and environmental cartography (GIS). However all stratigraphy data should be homogenous and interoperabilitional in accordance with INSPIRE.

Up to now information systems based on relation data base (RDBMS) did not consider frequently changes of stratigraphy chart. Each modification of stratigraphy chart meant sustained and costly operations often connected with full modification of data bases structure. Besides inflexible hierarchy of classification stratigtraphy units required in RDBMS was a big impediment in implementation of “percolating” and not precise temporal boundary.

PGI elaborate project of stratigraphy data homogenisation by interoperability application creation which will be standard interface agreed with INSPIRE. This interface will be able to “interpret” geological time and this way homogenisation stratigraphy data will be possible.
This project will be composed by four stages:

1. elaborate conceptual model in UML;
2. export UML model to XMI;
3. export XMI to XML Schema;
4. implementation of XML Schema in interface and structure data base.

In this project will be used International Standards CEN/ISO – series 19100 Geographic Information and OpenGIS Specification (OGC) – both abstract specifications and implementation specifications.

At the moment some works of first stage are starting. There is elaborated UML schema of prototype conceptual model for geological time (including every stratigraphy charts used in PGI) based on EN ISO 19108 – Temporal Schema norm.

This project can enable easy homogenization of polish geological data bases and assure quick interoperability of PGSDI in ESDI in near future. Moreover it becomes a contribution for implementation of hybrid data base (relation-object) and object data base in PGI.

eArth: the International Multilingual Borehole Database Framework

A. Tchistiakov[1], B. Cannell[2], J. Passmore[2], H. Preuss[3], T. Hernandez Diaz[3], J. Jellema[1], D. Capova[4], J. Belickas[5], V. Rapsevicius[5], T. Mardal[6], P. Peroni[7].

1 - TNO-NITG, P.O.Box 80015, 3508 TA, Utrecht, NL, alexei.tchistiakov@tno.nl;

2 - British Geological Survey, UK; 3-Bundesanstalt für Geowissenschaften und Rohstoffe (GE);

4 - Geofond, CZ; 5 - Lithuanian Geological Survey, LT, 6 - Polish Geological Institute, PL; 7 - Golder Associates, IT.

INTRODUCTION

The national geo-scientific databases are the key elements of the national policies on the sustainable and environmental use of the subsurface. Till recently access to geo-data repositories in Europe has been effectively limited by national boundaries. The EC-funded project Electronic Access to the Earth through Boreholes (eEarth) has developed a framework for multilingual cross-border geo-data exchange between six EU countries. The new web services include: a central web portal to the national geo-database applications, multilingual user interfaces to the national databases, "on-the-fly" translation facilities for standardised geo-scientific terms, GIS functions, access to geo-data via mobile devices, on-line data ordering and payment (http://eearth.nitg.tno.nl/).

The project consortium consists of the Netherlands Institute of Applied Geoscience (TNO-NITG, NL), British Geological Survey (BGS, UK), German Geological Survey (Bundesanstalt für Geowissenschaften und Rohstoffe, BGR), Lithuanian Geological Survey (LTG, LT), Polish Geological Institute (PGI, PL), Geofond (CZ), Geodan Mobile Solutions (NL), and Golder Associates (IT).

NATIONAL AND EU REGULATIONS ON GEO-DATA DISSEMINATION

In order to ensure that the eEarth cross border services comply with the legislations of the participating countries, an extensive study of the national and EU regulations on geo-data dissemination was completed (http://eearth.nitg.tno.nl). The research shows that no legal obstacles to cross-border dissemination of geo-scientific data exists in the participating countries, although sometimes the formal procedure for obtaining access to data is quite complicated. The national regulations concerning geo-data dissemination have many common features. This creates a good basis for harmonisation of national legislation in the future.

Analysis of the EU legal initiatives confirms that the cross-border services provided by the eEarth system are in line with overall EC policy regarding dissemination of geological data and provision of access to public data holdings, using electronic means of data distribution (e.g. INSPIRE program).

XML-STANDARD FOR CROSS-BORDER EXCHANGE OF BOREHOLE DATA

Although many partners offer comparable services, the national borehole databases differ significantly in terms of data structure, coding standard, database software, hardware, and operating system. In order to overcome the problems related with the data structure differences a new XML-based borehole data exchange format has been developed (http://eearth.nitg.tno.nl/schema/e_earth.xsd). The selection of some forty fields, included in the standard, has been made against the background of the six national databases.

EEARTH SYSTEM DESIGN AND SERVICES

eEarth Web portal

- A central web portal is the start point to eEarth services. The portal is multilingual, encompassing the partners' European languages. The current version includes the Czech, Dutch, English, German, Lithuanian and Polish languages. This could easily be extended to incorporate additional languages in the future.
- The start page provides links to national survey's own database applications, where visitors could browse for the information required. It is important to emphasise that although the interfaces to the national databases were developed by means of different technologies they have very similar layouts that makes the system easy to use for a new user.

Search and delivery of borehole information

When a user accesses a national eEarth web page he is able to search for data in the national database via a web-based GIS interface (Fig. 1).

To enable the integration of GIS functions we had two lines of implementation for the web map server: 1) based on open source applications (i.e. UMN MapServer), and 2) based on a commercial software (i.e. ArcIMS by ESRI). Under both implementation scenarios, the GIS page includes a standard set of GIS functions, allowing geographic selection of boreholes from the national databases. A user can select a single borehole via info-click or a number of boreholes by defining a selection area on the map. Subsequently borehole metadata can be displayed for the selected set.

Based on the metadata list, a user is able to order descriptions of borehole layers along the borehole profile (interval data), when available. In some of the national database applications the interval data can be immediately displayed, in others the data is delivered either by post or e-mail.

Translation service

The translation service provides on-the-fly translation of the user interfaces, borehole metadata and interval data (lithology, etc). The borehole data translation service is a quite complicated tool, which needs to translate coded geological data according to standardized geo-science dictionaries or thesauri. The main challenge results from the fact the translated meanings of many terms only partly overlap with their original definitions. In other words, "similar" terms can have quite different interpretations in different languages.

In order to provide multilingual services, a 6-lingual thesaurus stored in a database and software tools for data translation have been developed. The concept of a "distributed thesaurus" presumes that one of the partners (i.e. Geofond) will maintain the central 'master' multilingual thesaurus (MMT) stored in its database. At the same time each partner geological organisation (PGO) will have individual (distributed) multilingual thesauruses (DMT) stored in translation tables within their national databases. Input and editing of individual terms in the MMT is made by the partners by means of a special web application. Update of the translation tables in the national databases will be done via an export XML file that is generated by the MMT application.

The advantages of this concept are: 1) each PGO can implement the eEarth services using its own technology; 2) if the structure of the MMT changes, this does not directly affect the distributed thesauruses (DMTs) at the other PGOs.

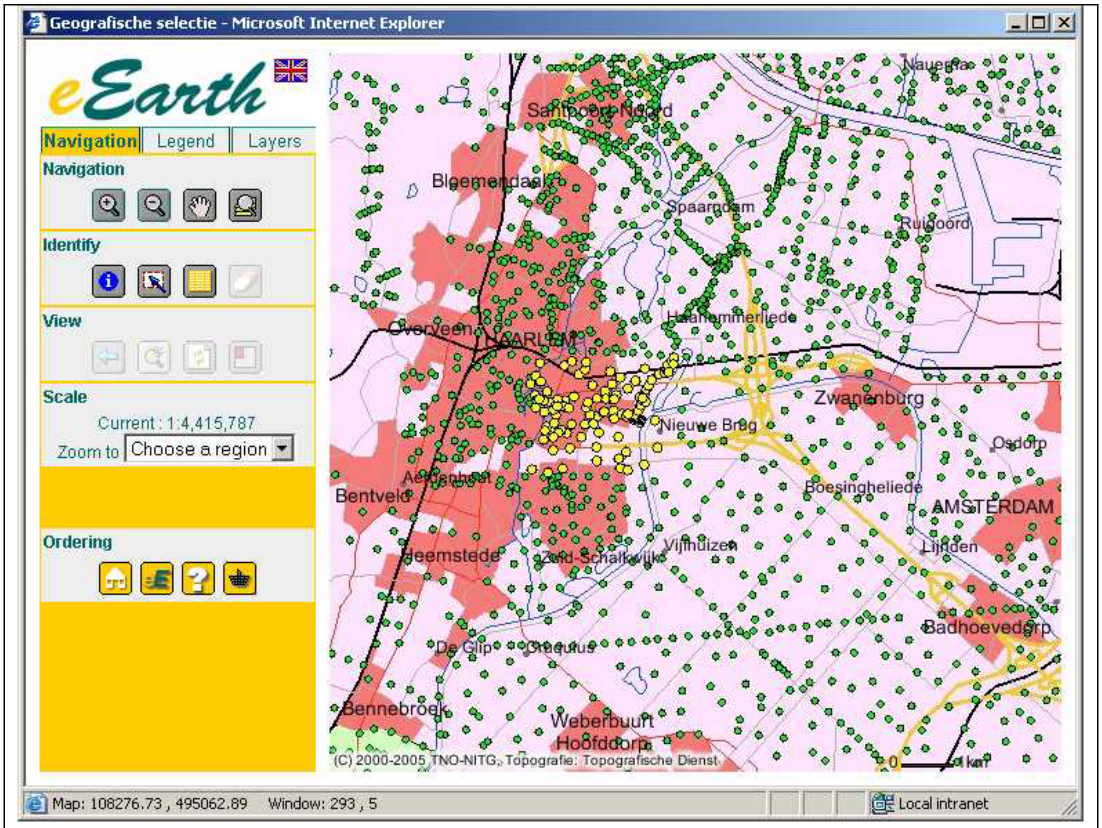

Figure 1: "English" interface to the Dutch borehole database

Mobile service

The project provides an engineer, operating in the field, with access to a national geo-database by means of a mobile handset (PDA). A "mobile" user will is able to visualize his location and order geo-data from the boreholes located in the area of interest. The borehole are selected by means of a GIS application developed particularly for a mobile handset.

The mobile services require special additions to the system design:

a) to serve mobile systems (special output and controls of the eEarth web pages) and
b) to accept locations of mobile systems (as an input to the borehole selection function).

Both additions are included into the system, where (b) is supported by a position server at the national level only. It is assumed that mobile devices are able to send coordinates of their location in exact form so that the country selection of the start page can be omitted.

CONCLUSIONS

The new XML standard, developed by the project for exchange of borehole meta and interval data, will contribute to further harmonisation of geo-data in Europe. Data standardisation is a precondition for combining the national geo-data in a single pan European repository, which may be considered as an option for further unification of the geo-information in EU.
The national geo-databases contain some 80% of the borehole data in the participating countries. Multilingual access to the national repositories via the Internet will significantly increase their added value, particularly for cross border projects. Access to the geo-information

through mobile equipment will stimulate the use of the data by geotechnical and environmental specialists operating in the field.

Considering the implementation and maintenance issues the eEarth system has opted for a distributed structure. The eEarth conceptual design includes three main components:

- A central multilingual web portal containing language selection and links to the national database applications
- Master Multilingual Thesaurus (MMT) of geological terms maintained at one organisation and used by all the others for updating the dictionaries in their national geo-databases.
- Distributed national multilingual Web applications, independent from each other but having similar interfaces and functions.

This design allows a new partner easily join the multilingual services via the eEarth Web and access the MMT in order to include a new language. The national surveys that join the portal at a later stage will be required to purchase the associated training and support, thereby generating additional income for the project.

ACKNOWLEDGMENTS

We would like to acknowledge the EC eContent program for funding the eEarth project. Also we acknowledge the support given by the European geological surveys and institutes in sharing their knowledge and IT experience with the project.

European Sustainable Development related policies and legislation, INSPIRE and geoscientific data

P. Christmann[1], K. Asch[2], Rafaelle Pignone[3], Iain Jackson[4], F. Robida[5], P. Ryghaug[6], R. Tomas[7], L. Persson[8]
[1]*EuroGeoSurveys, Brussels, Belgium*
[2] *German Federal Institute for Geosciences and Raw Materials (BGR), Hannover, Germany*
[3]*Geological Survey of the Region Emilia Romagna, Bologna, Italy*
[4]*British Geological Survey (BGS), Nottingham, United Kingdom*
[5]*French Geological Survey(BRGM), Orléans, France*
[6] *Geological Survey of Norway, Trondheim, Norway*
[7]*Czech Geological Survey, Prague, Czech Republic*
[8]*Geological Survey of Sweden, Uppsala, Sweden*

Abstract

The purpose of this paper is to highlight some important issues as well as the linkages between:

EU Sustainable Development related policies and legislation, existing or under development on one hand;

- geoscientific spatial data, information and knowledge at the other hand

- with respect to the draft INSPIRE Directive, from the perspective of Europe's major Geoscientific Spatial Data Interest Community: National and Regional Geological Surveys.

The paper also presents the EuroGeosurveys views on the linkages existing between the current and forthcoming[1] EU policies and legislation and geoscientific data.

The draft INSPIRE Directive is one of the very important European legislative developments in support of the EU Sustainable Development Policy. The first sentence of the draft Directive's Explanatory Memorandum states that "*Good policy depends on high-quality information and informed public participation*"[2]. Its focus, stated in article 1 of the Draft Directive, is on "*spatial information in the Community, for the purposes of Community environmental policies and policies or activities which may have a direct or indirect impact on the environment"*[2].

Our natural environment has numerous interlinked components, including mankind. Sustainable Development depends much on the availability and accessibility of the biotic and abiotic resources the present and future generations will need, on mitigating the pressures we exert on our environment and the impacts of a wide range of natural hazards.

Geoscientific data are an important component of an environmental information system. Therefore, they are mentioned in several of the spatial data themes listed in Annex 1 (Aquifers) and 3 (Geology, geomorphology, soil and subsoil; prospecting and mining permit areas, mining

[1] Such as the seven Thematic Strategies called for by the 6th European Environment Action Programme (EAP6, http://europa.eu.int/comm/environment/newprg/)

sites; nitrate vulnerable zones; vulnerable areas characterised according to natural hazards such as seismic or volcanic phenomena, landslides) to the draft Directive. However, they omit to list some geoscientific data of considerable importance for Sustainable Development, such as the location of energy and mineral resources and reserves. This information is needed, for instance, for proper land-use planning.

Geoscientific data, derived information and knowledge are indispensable for a wide range of sustainable development issues to:

- identify and manage vital resources such as energy (including the renewable, clean geothermal energy), minerals, soils and water;
- identify the baseline condition of environmental components (soils, water …) and monitor the changes over time;
- identify hazards and mitigate their impacts. Some hazards are spectacular and well-know by the public (earthquakes, volcanic eruptions, landslides, tsunamis), while some others are more difficult to observe (land heave and subsidence, shrinking and swelling clays, gaseous emanations, lack or excess of trace elements in bedrock, soils and water) but nevertheless can represent threats to health and/or to economic assets;
- conceive policies, legislation; land-use plans and specific actions, monitor their impacts and evaluate their efficiency at all levels, from the European to the local level;
- for educational and research purposes.

Geoscientific data acquisition, archival, processing and dissemination require not only requires technologies, equipment and funding over extended periods, but also the well-organised stable human expertise necessary to conceive and manage the data acquisition, and the transformation of data into information and knowledge needed by a wide range of end-users.

Numerous categories of end users need geoscientific data:

- public institutions at all levels, from the European to the local institutions and authorities;
- economic agents such as industry, investors, banks, insurance, consultancy and engineering firms;
- research and academia;
- NGOs
- citizens.

A recent report [3], produced for the European Commission, titled "*Building an Information Capacity for Environmental Protection and Security*" highlights a series of important issues of relevance to geoscientific data and Sustainable Development "*Despite undoubted strengths in environmental data acquisition from remote sensing, from in situ monitoring and from field surveillance, there is both scope and need for investment in improved monitoring and survey in Europe. This should take the form of cooperative action at the level of individual monitoring systems and surveys and coordination activities at the EU level. There is evidence of shortcomings and, in some cases, of significant decline in existing ground-based in situ networks in Europe. This results in poor geographic coverage, lack of continuity in observations and lack of consistency between different networks".*

Within the framework of projects co-financed by the European Union the European or using their own resources, Geological Surveys implemented several INSPIRE relevant European or national/ regional projects aiming at developing multilingual thesauri, metadata catalogues or at progressing on data harmonisation and interoperability:

+ **European Scale projects:**

- GEIXS (the European geological data catalogue[2]) is the first European geoscientific meta-database for on-shore data developed in the mid-nineties. This application would require a significative overhaul;
- EU-SEASED is the metadata catalogue on the European sea-floor sediment samples and drilling cores as well as on offshore seismic data[3];
- The soon to be published "European Geochemical Baseline Atlas and Database" is the result of a cooperation between 26 European Geological Surveys to develop standardised data acquisition, processing and representation procedures for geochemical data from top soil, sub soil and soil organic layer samples;
- The 1: 5,000,000 International Geological Map of Europe and Adjacent Areas (IGME 5000) [4] is the first harmonised GIS based digital database on the geology of 48 European and circum-European countries and of their off-shore areas.
- The EC-funded project electronic Access to
- *e*Earth[5] is a project financed by the European *e*content Programme, aiming at providing standardised access to the borehole data from eight participating European Geological Surveys. It is developing advanced software tools which will entail multilingual access to the European national borehole data, an important move on the road towards an Europe-wide harmonised geoscientific database.

+ **Examples of INSPIRE relevant National or Regional Projects**:

- Multi-thematic National or GIS based geoscientific databases and related meta-databases from the Czech Republic[6]; France[7], Norway[8], the Netherlands[9] or the UK[10];
- -do-, developed by Regional Geological Surveys such as the Geological Surveys of the Regions Bavaria (Germany)[11] or Emilia-Romagna (Italy)[12]

These lists are not comprehensive, and many other European Geological Surveys developed, or are in the process of developing geoscientific metadata and data portals. Access to all the websites of these Surveys is available via the EuroGeoSurveys website: www.eurogeosurveys.org

The purposes, technical specifications and contents of the available "discovery", "view" and "download" services are very variable, reflecting differing national and regional technical standards and policies.

To the contrary of the situation existing in the United States, where the United States Geological Surveys (USGS[13]) provides a harmonised geoscientific data coverage of the country, there so far is no European Geological Agency with a mandate of developing the harmonised, interoperable European Geoscientific Information System providing the geoscientific data and information

2 http://geixs.brgm.fr/
3 http://www.eu-seased.net/welcome_flash.html
4 http://www.bgr.de/index.html?/karten/IGME5000/igme5000.htm
5 http://eearth.nitg.tno.nl/
6 http://nts2.cgu.cz/servlet/page?_pageid=677,687,683&_dad=portal30&_schema=PORTAL30
7 http://infoterre.brgm.fr/
8 http://www.ngu.no/ (expand the "Geology for Society" menu)
9 http://dinolks01.nitg.tno.nl/dinoLks/DINOMap.jsp
10 http://www.bgs.ac.uk/britainbeneath/guide.html
11
12 http://geo.regione.emilia-romagna.it/
13 http://ngmdb.usgs.gov/

that Europe would need in support of its Sustainable Development Policy and the related policies and legislation.

The know-how and the data archive available in European Geological Surveys are also considerable assets to support the development of similar capacities in the developing world, where resources and environmental issues are some of the most important obstacles on the way to development.

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Issues Of Multilinguality In Creating A European SDI – The Perspective For Spatial Data Interoperability

Joanna Nowak, Javier Nogueras Iso, Stephen Peedell
Joint Research Centre, Institute for Environment and Sustainability
I-21020 Ispra, IT
{joanna.nowak | javier.nogueras | stephen.peedell}@jrc.it

Keywords: European Spatial Data Infrastructure (ESDI), Infrastructure for Spatial Information in Europe (INSPIRE), mulitilingualism, common sharing terminology, ontology.

In July 2004, the INSPIRE Proposal for a Directive was adopted by the Commission, aiming to establish an INfrastructure for Spatial InfoRmation in Europe [EC, 2004]. The provisions of the proposed Directive cover metadata, spatial data sets and services, network services, agreements on sharing, access and use, coordination and monitoring mechanisms processes and procedures. The ESDI Action of the European Commission Joint Research Centre (JRC) has the task to technically co-ordinate the INSPIRE initiative and the various steps working towards the realization of a European Spatial Data Infrastructure.

The first thematic application domain that INSPIRE will address is environment. In such a context an efficient implementation and monitoring of environmental policies require interoperable spatial information across national borders and streamlined access and use of this information by all concerned stakeholders.

Independently developed geospatial databases applications have different world views, different representations, different schemas and hence different semantics [Bishr, Y., 1997]. The proficient retrieval and exchange of distributed information desire its shared understanding. Unambiguous and plain definitions of categories and class intensions are necessary to provide interoperability at the semantic level.

The use of a common terminology is a complex task since each specialized field or theme has a terminology of its own and each country works in its own language. Moreover, some countries such as Spain or Belgium must deal with several different national languages. A true terminology harmonization is needed to enable the transparency of terms and a common understanding of terms in transdisciplinary and transcultural discourse.

The terminology and mulitilinguality issues are inseparable from the huge cultural differentiation within Europe on every level from local to national and international. The efficient retrieval and proper use of the spatial information stored in distributed data bases is hindered by the heterogeneous terminology in a variety of languages.

However, it is not sufficient to directly translate each word or name of objects that are the result of the information retrieval. Language and culture cannot be separated when you are dealing with communications and understanding. In the European melting pot, the possible confusions in terminology concern local, regional or national nomenclature, vocabulary, peculiarities that are the outcome of culture diversity and different traditions. Moreover, in many of the cases the differences are not obvious. Small nuances can be enough to prevent information access.

Thus, the significant key element for interoperation and seamless information sharing at the cross-national level is the establishment of a common sharing terminology. In the framework of the INSPIRE initiative a common sharing environmental terminology is to be used first to describe and search data based on metadata and then to understand attribute information and process data appropriately. Regarding the first aspect, [Bernard et al, 2005] state that multilingual aspects of metadata should be considered within the European context. Member states are not expected to provide translation for each metadata record they produce. However, a European SDI catalogue must tackle the problem of finding resources independently of the language used for metadata and data creation. Introducing equivalent relationships between concepts in different languages and achieving reusable ontologies [Gruber, T., 1993] (across alternative tasks or applications) could be worthwhile concepts in knowledge representation since they enable querying across data systems without incurring the cost of restructuring existing data systems or building new ones.

The final version of this review paper will be organized as follows. We will explain our motivation presenting how multilinguality is addressed in the INSPIRE directive. Then the concepts of multilingualism and information exchange will be presented as well as the review of related approaches, work in terminology projects and initiatives dealing with multilinguality issues.

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Session: National/Regional SDI 1

Thursday 30th June 14:00 – 15:30

Meeting Room Hotel Calabona

Organizational topics for the creation of an ESDI framework

Bas C. Kok,
Secretary General Ravi.
Amersfoort, the Netherlands

The INSPIRE Directive is in preparation now. The European Commission has adopted the Directive in summer last year. My paper deals with the organizational issues for the creation of the ESDI framework

Three important strategic initiatives need to be set up in parallel.

- First lobbying in the decision making process is crucial for the agenda setting of the draft Directive in the Council of Ministers and the European Parliament. After approval of the Directive legislation need to be developed on National level. It is important that this legislation will be developed in close cooperation with the Dutch GI and international GI community at the one hand and the Pan European institution at the other hand.
- Second the importance of the use of the INSPIRE Directive on Commission level need to be discussed with the main stakeholders to demonstrate the benefits of the use European Spatial Infrastructure in Europe.
- Third on national level initiatives need to be taken, such as the preparation and the execution of actions for making the Dutch National Geo Information Infrastructure suitable as a part of the infrastructure for spatial information in Europe.

In my presentation will be explained how the GI community in the Netherlands will work on these three parallel lines for the creation of the right framework for the ESDI.

On European level the lobby function of the GI community needs to be increased. During the Dutch presidency of the European Union between in the second half of 2004 actions and initiatives had been started to bring the importance of INSPIRE under the attention of the Dutch responsible politicians. A positive result was that the draft Directive came on the agenda of the Environmental Council of Ministers in December last year. At this moment in the Netherlands preparations have been made to start with a lobby showing the positive impact of the draft Directive to the Members of the European Parliament. In addition an inventory will be made which actions are needed on Commission level for lobbying. Discussions have to be started to show how the common interests of the GI producers on European level can be strengthened, which contribute to an effective ESDI framework. A permanent discussion forum at European level between the producers, decision makers and politicians has to be set up.

The second parallel line is the necessity of the creation of an innovative network on European level to show the benefits of the use of the draft Directive. Different initiatives have been taken on European level in the Water sector, in the Transportation area, in the Environmental area, in the Agriculture sector, in the Leisure sector and in the Security area. Results need to be discussed on pan European level and on National level.

The third line are the national initiatives for the actions making the National Geo Information Suitable as a part of the infrastructure for spatial information in Europe.

The elements of the infrastructure include metadata, spatial data sets as described in Annexes I, II and III, spatial data services, network services and technologies, agreements on sharing, access and use, coordination and monitoring mechanisms and process and procedures.

In the Netherlands four national projects are in preparation to organize the real national conditions for the implementation of the NGII as a part of the INSPIRE vision

The first project is a standardization project for the creation of meta data for spatial data, spatial data specifications and harmonisation and a set of definitions for network services and the creation of a Dutch INSPIRE portal. In the Netherlands we are working on the implementation of a coherent Dutch semantic general and sector model based on the ISO approach. We are preparing a proposal being member of the drafting team for the definition of data standard specifications. The second project demonstrates the cross border exchange of Geo Data between Germany, Belgium and the Netherlands. In the third project the technical context of the core data sets and the portal building will be carried out and the fourth project is based on communication of the INSPIRE vision in the Netherlands.

In these projects emphasis will be given on implementation of standards, web services and portal building at the one hand.

An extra impulse will be given on organisational issues at the other hand. The organizational issues need to be worked out nationally.

First a forum with the data producers need to be set up on how the data policy can be harmonized in accordance with the requirements of the PSI Directive, how the service provision to citizens can be improved, and monitored.

From government site incentives need to be formulated how these improvements can be stimulated, and pilot projects initiated to show the benefit of this approach.

National lobby actions has to be started on how the government can stimulate a continuous contribution in the creation of the Dutch national node for INSPIRE.

Totally 31 core registrations as part of INSPIRE has to be set up. Organizational procedures has to be set up on how these registration can be linked with each other at national level and at international level. A priority list has to be made how the definition, the implementation and the monitoring have to be set up, and which organisations are responsible for the actions and who organizes the funding.

1. In my presentation new initiatives in the Netherlands on INSPIRE in 2005 will be illustrated:
2. The initiative for the integration of the activities of Ravi and the Dutch National Clearinghouse for Geo Information initiated on December 15th 2004
3. The work program 2005 and the design of meta standards, web services and design and implementation of a special NL INSPIRE portal
4. The initiative to undertake more common strategic actions from the GI supplier site on European level
5. The initiative for the creation of a permanent and increasing lobbying and networking mechanism for the INSPIRE environment on political and decision making level
6. The relationship between INSPIRE and the Space for Geo Information Program
7. The data policy initiatives on improving access, the harmonisation of licensing facilities, the pricing policy in special and the funding in general.
8. The organisational framework in which the core datasets will be set up and prioritized.
9. The communication policy to the Dutch stakeholders

NSDI Croatia – The Roadmap

A. Wytzisk[1], A. Remke[2], Z. Bačić[3]
[1]Enschede, The Netherlands, [2]Münster, Germany, [3]Zagreb, Croatia

Introduction

The Republic of Croatia (ROC) is on its way to joining the European information society. Forming the basis for the provision of public sector information in a wide range of application fields within an emerging geoinformation market, Croatia started initialising a National Spatial Data Infrastructure (NSDI). To meet the criteria for Croatia's accession to the European Union (EU), policies, technical standards and operational facilities have to be harmonised with European standards so as to be in line with the Infrastructure for Spatial Information in Europe (INSPIRE) (EC 2004).

Against this background a roadmap has been developed, which identifies and describes establishment procedures and – for sustainability reasons – takes the evolutionary character of spatial data infrastructures into account (Williamson et al. 2003, Wytzisk & Sliwinski 2004).

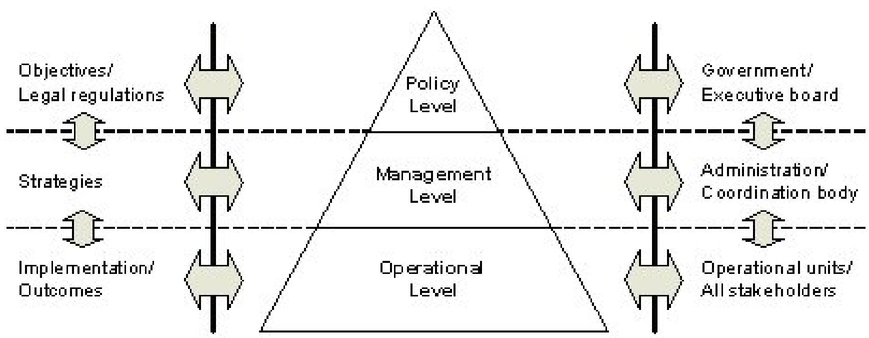

Figure 4: Organisational levels of an SDI (Steudler 2003)

According to the three interrelated organisational levels of an SDI as proposed by Steudler (2003), and shown in Figure 4, the NSDI roadmap for ROC comprises three major parts, each addressing the NSDI at the following levels:

- Policy level: pointing to the overall objectives and legal regulations,
- Management level: addressing organisational aspects, concepts and standards,
- Operational level: dealing with actual implementation procedures.

The NSDI development is, by its nature, a complex change process, which will affect all or most parts of the heterogeneous information society (governmental authorities, organisations, private industry, private individuals). It will result in significant alterations to the status quo by addressing legal, organisational, technical and implementation realities. Therefore the roadmap is based on a comprehensive analysis of the status quo and the existing boundary conditions and requirements, especially European and national policies, the resultant legal limitations, relevant technical standards and locally available data and technology.

The following sections briefly presents key issues of the NSDI ROC roadmap. The full paper will give a comprehensive overview of the roadmap development process and the roadmap itself.

Policy Level
Analysing the expectations of Croatia's major stakeholders within the GI community (amongst others the State Geodetic Administration, the Croatian Geodetic Institute, the Ministry of Environmental Protection, Physical Planning and Construction, a number of private companies), the NSDI developments in Croatia is striving for three independent major goals:

- Fulfilment of the criteria for accessing the European Union,
- Improvement of the basis for good governance,
- Supporting the national economy's growth.

Based on these top-level objectives a draft vision statement was derived that captures the intended final state of the initiated change process. The vision statement focuses on two aspects:

- The market aspect: announcing an open market for the trading of spatial information products, with the increased provision and use of spatial information.
- The networking and community aspects as prerequisites of a reliable and sustainable establishment of the NSDI ROC: announcing an open network by connecting the public sector to the spatial information network through integrating the NSDI ROC in eGovernment processes and structures, and having an open spatial information community by introducing consensus-based public-private-academic partnerships.

To make first steps towards these final aims the Croatian legal framework has to be disburdened from a number of obstacles, which hinder the establishment of an NSDI significantly. Besides the necessity of bringing national laws in line with GI-related EU directives and regulations, particularly INSPIRE, it has to be ensured, that the copyright of spatial information is sufficiently protected. Nowadays a missing copyright leads to an increasing black market for spatial information products, which impedes investments and slows down the distribution of already existing spatial data sets. An appropriate legal basis has to be established to reduce the restrictions to accessing public sector spatial information and to increase the sharing and re-use of information products between public authorities.

Another prerequisite for providing public sector information in an open geoinformation market is the availability of an applicable pricing policy. Since pricing is always – in the private as well as in the public sector – part of a comprehensive organisation-specific and product-specific business model, it is not possible to derive a general purpose pricing policy. It always depends on the business objectives (e.g. maximizing profits, providing spatial data as a public service, accelerating the NSDI development process), the product definition (e.g. horizontally or vertically integrated products) and the chosen revenue/expenses model (e.g. full cost recovery model, partial return on investment model or marginal cost of distribution recovery model).

Management Level
The development of a National Spatial Data Infrastructure is, by its nature, not a sequential and straightforward process but a complex change process which essentially requires the involvement of a large number of institutions and individuals. A dedicated institutional framework is intended to support the GI community in Croatia by providing change management capacity in terms of communication, coordination and quality management.

The analysis of a number of national and regional institutional frameworks (e.g. CeGi 2004, Kok 2005, van Loenen & Kok 2004, Williamson 2003) has led to an institutional framework scenario which is designed to fulfil these tasks. The basic requirements, which have to be met, are:

- It has to provide the openness and dynamics of an open membership organisation to all stakeholders.
- It has to provide a certain capacity which is essential for the professional support of communication and coordination within the NSDI community.
- It has to guarantee the conformity of all activities to national policies and decisions.

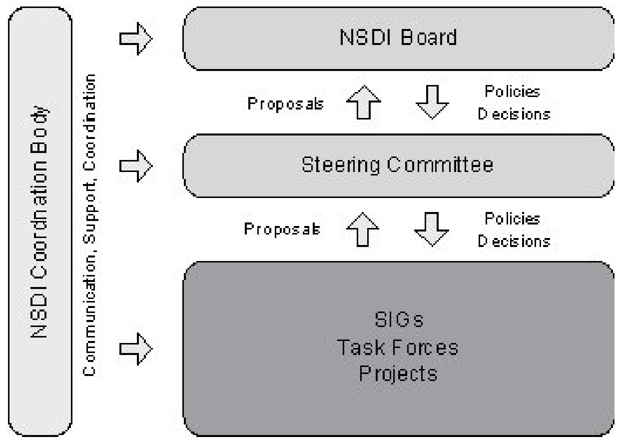

Figure 5: Proposed NSDI ROC institutional framework

The proposed institutional framework contains four elements which correspond directly with the core requirements stated above (Figure 5):

- *NSDI Board*: board of state level public authorities responsible for strategies/policies,
- *Steering Committee*: permanent steering group bringing together the leaders of all working group leaders, leaders of the NSDI Board and the NSDI Coordination body,
- *SIGs, Task Forces and Projects*: either temporary or permanent working groups dealing with conceptual or implementation aspects,

NSDI Coordination Body: autonomously working institution with permanent staff dedicated to supporting the NSDI development process.

Besides the institutional framework, the management level also has to address standardization issues. To achieve interoperability among distributed geospatial information resources accessible over the Internet a reference model is proposed which is in line with the proposed INSPIRE architecture as defined by Smits (2002). However, the short list of standards referenced by Smits mandatorily does not ensure interoperability by providing a sufficient set of shared agreements governing essential geospatial concepts and their embodiment in communication protocols, software interfaces, and data formats. Therefore, the sketched reference model proposes a significantly extended set of standards and specifications based on the FGDC Geospatial Interoperability Reference Model (G.I.R.M) (FGDC 2003). Which of the referenced standards will become obligatory within the NSDI ROC will need to be elaborated in a consensus process in a further stage.

Operational Level
To initialise the NSDI ROC technically, it is intended to develop and set up a number of initial building blocks, which have to be in line with the above mentioned reference model:

- A *Geospatial Portal* to provide single point access to the geospatial information provided within the NSDI ROC. One of the key overall goals of the Geospatial Portal is that it will create an Application Integration Framework (AIF). This AIF will provide an operational

environment that will have the ability to dynamically integrate an ever expanding set of geospatial content and services into the Portal (OGC 2004).
- *Metadata access and management services* to provide a common mechanism for registering, describing, searching, maintaining and accessing information about resources (data and services) available on a network.
- *Spatial data access services* to actually provide access to geospatial content.
- *Map portrayal services* support the visualisation of geospatial information.

The initialization of a first set of NSDI ROC nodes does not only provide the operational basis for professional use but also boost the NSDI development process by providing means to bring together a first group of motivated stakeholders (community building), propagate the upcoming technology change and raise awareness for NSDI ROC in general as well as to present show cases to practically demonstrate fundamental NSDI principles (education).

Conclusion

The Republic of Croatia has started the initialization process of its National Spatial Data Infrastructure by developing a roadmap which identifies and describes core establishment procedures and provides a sound basis for guiding the government on its way towards an NSDI ROC. However, SDI development cannot be seen as a top-down driven process. It needs a strong involvement of a broad community of stakeholders who support and maintain the process. Although the roadmap development already brought together a group of first movers, it is crucial to intensify the awareness raising and community building process and make the initiative visible by organizing joint projects to set up the operational core of the NSDI ROC.

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IDEZar: an example of user needs, technological aspects and the institutional framework of a local SDI

D. Portolés-Rodríguez, P. Álvarez, R.Béjar, P.R. Muro-Medrano
Computer Science and Systems Engineering Department, University of Zaragoza
Zaragoza, Spain

The IDEZar Project (http://idezar.unizar.es) is the result of a collaboration agreement signed in March 2004 between the City Council and the University of Zaragoza (Spain). Its main targets are an in-depth analysis of the spatial data assets of the City Council and their uses, a technological proposal for the development of a local Spatial Data Infrastructure (SDI), the creation of two committees (governmental and technical) in order to promote the implantation of the new SDI and advise on technical aspects of this implantation (data, models, standards, processes, uses, etc.) respectively, and finally, the implementation of policies of spatial data access and acquisition. The ultimate aim is to facilitate and coordinate the exchange and sharing of spatial assets between stakeholders from the City Council for improving their internal workflows and for building a Web-accessible information city able to offer a range of online services to its citizens.

In this framework, this paper presents and discusses the key issues of the IDEZar-SDI that have been highlighted according to user needs, spatial data (availability, accessibility and applicability), SDI development technical aspects, inter-institutional relationship, constrains and policies. Moreover, the authors intend to show how this experience has been useful to consolidate their SDI software technology and to create knowhow and procedures that allow them a future and successful implantation of a new local SDI in another council.

The first steps are always difficult within the local administration. There is an increasing awareness of the important role played by the spatial data today, but the situation is still very complex. The development of a local SDI is a long-term process that must tackle a wide variety of critical issues: 1) it is desirable to have good quality data, but their quality is relative (compatibility and homogeneity problems between data produced by different internal o external providers that promote its duplication and uncertainty, the responsibilities about their creation and maintenance are not defined, the quality of the data models, a low inversion on spatial assets, a severe lack on trained staff, etc.); 2) the design of a technological proposal based on existing SDI access models, policies and standards for the development of an infrastructure that supports Web-based and ubiquitous applications; 3) the required inter-institutional and organisational relationship and the coordination and communication between involved agents (data producers, internal users, citizens, etc.); 4) the necessary legislation for formalising policies involved in data creation, maintenance, sharing, open access or privacy; and finally, 5) a stable investment beyond the period of elected mayors (under institutional instability it is difficult to carry out the project successfully).

Despite this complexity, in these authors opinion, the return on the investment is guaranteed by the growing importance of the role of spatial data in local decision support and citizen services. This importance is increased for directives and initiatives promoted by the European Commission, such as INSPIRE, Local Agenda21 (European Cities & Towns Towards Sustainability) and the directive relating to the assessment and management of environmental noise (2002/49/EC), that require the human and technological capabilities to access and use available spatial data to support decision making. As a whole, a wide range of spatial use cases and applications have been found, for example, for managing the urban environment (surveillance of the urban environment for detection of new construction activity, monitoring current land use according to the Master Urban Plans –MUP–, the decision support for the management of urban infrastructures, etc.), for controlling the environmental impact and for promoting sustainable development (the elaboration of the urban noise maps, the periodic updating and continuous evaluation of the local environmental indicators, etc.), or for providing on line services to the citizens (for consulting cadastral survey information and the MUP, a street map with advanced functionality for planning tourist and natural routes, a street nomenclator, a bird's-eye view application, a ubiquitous access to cultural tourism portals using mobile devices, etc.). As a result of the previous analysis, these SDI use cases have been identified and functionally described, and are explained in detail in this paper for offering an interesting knowledge to the spatial data interest communities.

On the other hand, in the first steps of this project we have also focused our effort in the development of the key components of the IDEZar SDI. From a technical perspective, this SDI is based on the service-oriented computing model [Graham et al. 2002] and the Open Geospatial Consortium (OGC) Web Services Architecture [OGC-WSA 2003]. Conceptually speaking, the underlying SDI architecture has been organized according to two orthogonal criteria: firstly, by means of a functional point of view (data, services, and internal and external applications); and secondly, according to the institutional organization of the City Council. Its core is composed by a series of OGC and ISO compliant services that provide the required functionality to discover, access, analyze, and visualize spatial data (Data and Service Catalogs, Web Map Servers, Web Feature Servers, Web Coverage Servers, etc.). These services have been implemented according to the Web service paradigm as reusable software components that can be accessed via ubiquitous Web protocols and data formats, such as HTTP, XML, or SOAP, with no need to worry about how each service is implemented. This choice based on standard, open and interoperable services has allowed us to tackle the inherent complexity of this SDI and the implementation of the previously mentioned applications and new SDI-based tools for creating and maintaining the existing spatial data.

However, this paper intends to stress the importance of the OGC standards and Web service paradigm to resolve some integration problems that appears in the development of a local SDI, for example, problems related to the integration into a SDI hierarchy (in this project, the relationship has been at regional and national levels), into the legacy system used in the council workflows, or into heterogeneous tools used by data providers for submitting new spatial information (recently, the technical committee has approved the joint of the IDEZar initiative to the GMES Urban Services project from the European Space Agency, http://www.gmes-urbanservices.com/). Moreover, it is planned the development and starting of a tourism application that lets wireless mobile users access to Web-based information –tourism, cultural, and urban resources contents– provided by the local SDI. This type of proposals requires the integration of the SDI core services into heterogeneous software and hardware platforms (communications, positioning and mobile platforms) for supporting new applications with device-independent, time-aware, and location-aware.

Finally, the governmental committee has established an institutional framework for the definition of responsibilities, policies and administrative arrangements according to the technical committee's advices in terms of data (formats, precision, and quality), procedures (data creation, acquisition, maintenance, sharing, accessing, and security), technical standards, and technologies (hardware, software and ubiquitous platforms). In an overview, this work tries to facilitate the interaction between the people component (citizens, council technicians, decision makers, data and services providers, etc.) and the SDI technological framework [Rajabifard 2001].

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SIGMATER: a project to create an infrastructure for exchanging and integrating regional cadastral information.

Giovanni Ciardi[1], Nicola Cracchi Bianchi[2], Luigi Zanella[3]
[1]*Regione Emilia-Romagna,* *gciardi@regione.emilia-romagna.it*
[2]*Ervet,* *cen@ervet.it*[3] *CORE,* *luigi.zanella@corenet.it*

SIGMATER is a Community involving 25 local authorities (Region Emilia-Romagna as coordinator) to create an infrastructure for exchanging and integrating regional cadastral information. This infrastructure is designed to enable the development of new services for private citizens and businesses and to provide support in the use of local property registers and the management of local property taxation.

It is widely known, in fact, that the combined use of different spatial data in the management of the territory has an impact on widening the access to public information, enabling a better targeting of policies and services, reducing the costs of data collection and management and freeing resources for a wider service catalogue.

This process started spontaneously at different extents in a number of territories all over Europe and dramatically increased in recent years thanks to the diffusion of reliable technologies based on Internet enabling a better interoperability and integration between information systems.

Despite that the process is still at the beginning as the technical and socio-economic characteristics of the spatial information make the problems of co-ordination, information gaps, undefined quality and barriers to accessing and using the information particularly acute. In fact the problem regarding the availability, quality, organisation and accessibility of spatial information involves and is common to a large number of policy and information themes and is experienced across the various level of public authority.

The strategic relevance of the process and its widespread diffusion prompted for the identification of an European framework for spatial data management through the INfrastructure for SPatial InfoRmation in Europe initiative (INSPIRE) aiming at making available relevant, harmonised and quality geographic information for the purpose of formulation, implementation, monitoring and evaluation of Community policy-making. The services based on the INSPIRE vision should allow the 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 inter-operable way for a variety of uses.

Members of SIGMA TER have already gained experience that can be useful for the future INSPIRE implementation, in particular on the following issues:

- the development of a specific multi-platform infrastructure, based on existing land information systems, between different administrative levels;
- the implementation and publishing of services to access geographic information;
- the open management of metadata.

SIGMA TER is a national leader on the use of international standards related to GI (ISO19100 serie) and services (W3C, OGC) that allows the cooperation and interoperability between different systems ands data. (The community is also involved into CEN-TC287 Working Group 5 activity - European SDI, through the participation of some members)

The SIGMA TER project grew out of a need to facilitate the decentralisation of cadastres in accordance with Law no. 59 of 1997 and as defined in the law D. Lgs. no. 112 of 31/3/1998. The purpose of the project is improve the planning, administrative and management capabilities in matters concerning property and property taxation.

The project will also improve the quality of services to private citizens and businesses that need to match cadastre information (managed by regional agencies) with regional information (handled by regional and local authorities).

The project developers are: the regional governments of Emilia-Romagna (project co-ordinator), Abruzzo, Liguria, Toscana, Valle d'Aosta; the Cadastral Agency; the provincial local authorities of Bologna, Genova, Parma, Piacenza, Pisa; the mountain communities of Alta Val Polcevera and Garfagnana; the municipalities of Bologna, Cesena, Collesalvetti, Faenza, Ferrara, Genova, La Spezia, Livorno, Lugo, Modena, Reggio Emilia and Rimini.

In addition to these local authorities there are a further 150 authorities who have put their names forward as re-users of the solutions and experiences which will be developed during the project.

The National Associations of Municipalities, Provinces and rural areas also support the project.

As seen before, the SIGMA TER project is in the framework of the decentralisation process that will transfer the responsibility on the cadastral data from the national administration level to the local level and in particular to the Municipality. The process that is huge and complex truly re-shape the relations between the two administrative levels and pave the way for the identification and provision of a great deal of new services based on the joint exploitation of cadastral information and of administrative data. In fact the Regions and the local administrations uses the cadastral data in their everyday activity (provision of services in agriculture, toponomastics, tax collection etc.) and they are able to amend them in case errors. So far there has not been yet any consolidated telematic infrastructure that enabled the utilisation of updated cadastral data, the improvement of the quality of the data and their integration with the administrative data in charge of the local administration.

Data are in fact produced by different public authorities, from global (Europe, Nations) to local (Regions, Provinces, Municipalities) level, and is particularly relevant the possibility to integrate all resources. To make it possible is necessary to project and realize an infrastructure that allows the sharing of information in respect of national and international standards.

The SIGMA TER project meets the requirements set in the framework of the National INTESA GIS (www.intesagis.it) protocol that states the general criteria for the implementation of geographical information of general interest and includes the framework for the realization of the geographic information systems with reference to the large scale database creation and the small scale databases and the e-government national plan setting the services that should be provided. The INTESA GIS protocol and the e-government plan are fully in line with the INSPIRE provisions.

In particular in the design of DBTI (Territorial Integrated DataBase) that will contain the territorial information coming from the different administrative levels, both national and international standard have been met as:

- ISO19107 Spatial Schema and ISO14825 (GDF) as base of National Topographic db design implementation specifications (IntesaGIS - GIS National Agreement);
- Metadata: DIS19115:2003 revised (EN ISO 19115) in accordance to candidate European profile and to candidate Italian extension (CNIPA).

All applications have been and will be developed using:

- XML for the interchanges among different system layers
- Web services on SOAP protocol (Xml technology)
- XSD (Xml schema) for the documentation of the interchanges;
- J2EE to build up all applications;
- GML, CML (special Xml for geographical cadastral data from "Agenzia del Territorio"), Shape and PDF for the interchange of geographical data;
- W3C standard for the web-based interface.

Concerning the communication among public administrations SIGMA TER is completely compliant with the technical detailed lists of cooperation and interoperability of National Centre for IT in Government (CNIPA - Centro Nazionale per l'Informatica nella Pubblica Amministrazione), that give to this kind of communication among public administration legal and administrative value.

Session: Data Quality and Exchange

Thursday 30th June 14:00 – 15:30

Hotel Carlos V

Data Quality and Scale in Context of Data Harmonisation

Katalin Tóth, Vanda de Lima,
European Commission Joint Research Centre, Ispra, Italy

The proposal for a Directive of the European Parliament and of the Council establishing an Infrastructure for Spatial Information in Europe (INSPIRE) sets out a legislative framework for the implementing of the components of a European Spatial Data Infrastructure. The third chapter of the proposal deals with interoperability of spatial data sets and services, stating the aspects of the data harmonisation. According to the directive the implementing rules "shall be designed to ensure consistency as between items of the information which refer to the same location or between items of information which refer to the same object represented at different scales", as well as "information derived from different spatial datasets is comparable" as regards the aspects of classification and spatial representation of different objects.

As INSPIRE foresees the European Spatial Data Infrastructure as built on the existing national infrastructures of the Member States, the quality concept is pivotial not only in the documentation (metadata), but also in the of the data harmonisation. In addition to the elaboration of a common conceptual model and arrangements for the exchange of spatial data the research agenda of the data harmonisation should also clarify the role that scale and data quality play in it.

Data quality is a pillar in any GIS implementation and application as reliable data are indispensable to allow the user obtaining meaningful results. Data transfer, sharing and integration are common practices by many users. Only trustworthy and reliable data is useful *to improve* the decision of the user. In GIS applications, data from different sources and with different levels of accuracy and precision can be combined. To ensure that existing digital data be appropriately used, the data producer must provide documentation about the "history" of spatial data. In addition to spatial data documentation, data developers and users should document and implement data quality measurements, which allow judgment to be made about spatial data. Spatial data is frequently relied upon as factual data. Good data quality measures and documentation may eliminate liability law suits against data developers and users. Data producers must be aware of the implications involved with carelessly or non-documented data. On the other hand, the data user must also be responsible for understanding the limitations of that spatial data.

Spatial data relate information about three aspects of a geographic feature: typology (the type of geographic feature), location, and spatial dependence (the spatial relations hip with other features). Because such attributes change over time, geographic data are very complex and difficult to manage. Geographic reality often cannot be measured exhaustively because it is nearly impossible to obtain measurements for every point across an entire landscape. Accurate measurements are also difficult to obtain because of continuous (slow or rapid) variation of the landscape over time and because of the limitations of instruments, financial budgets, and human capacity. Thus, when geographic data are developed, they are merely approximations of geographic reality. Therefore, a fundamental discrepancy exists between geographic data and the reality that they are intended to represent. This discrepancy, or uncertainty is propagated through, and may be further amplified by, data management and analyses in a GIS environment. The basic GIS schemes (Couclelis 1992) for representing geographic data are not dynamic but record only a static, invariable view of the world. They do not depict complex objects that consist of interacting parts, nor do they display variation at many levels of detail over space and over time. Thus, uncertainty must be recognized as a basic element in all GIS results. Uncertainty analysis assesses the discrepancy between geographic data in GIS, and the geographic reality that the data are intended to represent. The current state of GIS technology in dealing with uncertainty falls short of the goals described by Goodchild (1993, p. 98): (1) each object in a GIS database would carry information describing its accuracy; (2) every operation or process within a GIS would track and report error; and (3) accuracy measures would be a standard feature of every product generated by a GIS.

According to ISO two components of data quality are identified. Data quality overview elements providing informative non-quantitative information and data quality elements providing quantitative quality information that reports how well a data set meets the criteria set forth in its product specification. Data quality elements include the quality components of completeness, logical consistency, positional accuracy, temporal accuracy, thematic accuracy and allow for the creation of additional user defined components. Each component is comprised of several aspects called data quality sub-elements. Data quality information for each sub-element is reported in several parts, including a data quality scope, data quality measure, data quality evaluation procedure, data quality results, value domain and date. According to ISO, the metadata schema given in 19115 is the mandatory method for reporting data quality information.

The data quality in the Geographic Information Systems is often understood only as metadata, as an a posteriori report about the purpose, use, lineage, completeness, logical consistency, precision, positional, temporal and thematic accuracy of the data. These reports are usually stored separately from the data. This risks on the one hand that they are not maintained according to the data updates, while on the other hand, in case when data come from different sources, are inconvenient for the user to deal with. Moreover, the well known “fitness for use” (Veregin 1989) criterion varies from user to user and is difficult to quantify. Never the less its perception is fully dependant on the scale, accuracy, and extent of the data set, as well as the quality of other data sets to be integrated.

In traditional mapping the end product, the printed map of a defined scale and thematic content fixes the applicable technology together with the quality requirements. Strict technological regulations prescribe the real world objects to be represented together with their way of representation on the map. The legally mandated levels of accuracy are achieved through the allowed measuring methods; the integrity of the product is maintained by the (practically) non-alterable base, by the paper. Finally. metadata is documented on the information carrier itself. According to McGlamery (2001) when information is transferred to digital format the issues of integrity and authenticity are overlooked.

The similar well-established system for data digital data collection has lagged behind the technology. In many cases the analogue map compilation procedures have been adopted in the application schemas for different products, paying more attention to the spatial than to the quality schema. As soon as the data is taken out of the initial context, the integrity of the quality and the intended use is not guaranteed any more. The readily available functions like zooming in a dataset, resampling, or the relatively easy way of attaching attribute from other datasets may tempt the user to freely merge datasets of divers conceptualisation.

In spite of the fact that data may stem from various sources for a single application, data and metadata integration is not an everyday practice in the recent GIS. However the users should know how “good” the data is. Naturally, the strict solution is when quality information is attached to each entity. The modelling process can open towards the metadata integration as well. Depending on where metadata reside, e.g. dataset, theme of feature level (Langaas 1995) they can be integrated especially in the object oriented data model, which is highly desirable in distributed client-server environment.

On the other hand, in the most of the cases not single features, but whole data layers or datasets of similar origin and lineage are to be integrated, thus the quality can be referred to them as a whole. In case of the INSPIRE, where data harmonisation seems to be application driven, the users can be sufficiently informed about the data quality if consistent data are cross-referred. For this solution, again, a reference model is required. The advantage of this approach is that not only the calssical data quality characteristics can be taken in the account, but also the scale and the purpose of the creation of the datasets that are crucial for the conceptualisation.

The INSPIRE foresees harmonisation of 31 strongly application driven datasets of the Member States. Moreover, even for a single theme there are several potential data sources that differ in conceptualisation, spatial representation and quality. Consequently, there is a clear need for a reference model, or, as it seems to be reasonable for a series of models linked through the rules of model generalisation. The differences between their modelling concepts should be defined by the scale, which on its turn define other quality parameters as well. This approach guarantees the inclusiveness of the process, enabling each Member State to join the harmonisation according to the quality and availability of data. The interaction between the different Spatial Data Interest Groups (SDICs) may yield the necessary use cases and the appropriate data models.

All data sources and spatial data entry methods present errors into the created information and used for display and analysis. The type, severity and implications of these errors inherent in a GIS database determine the quality of spatial data. These errors should be recognised and properly dealt with. Identifying and assessing data errors are not the only factors which determine data quality. Data quality includes all of the processes involved with cceptualisation, developing, utilizing and maintaining a spatial database. In our full paper we shall show that quality is an instrument for data harmonisation, comparison, and documentation.

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Data exchange and interoperability in support of the implementation of the Common Agriculture Policy

Armin Burger, Paul Hasenohr
Joint Research Centre, Ispra, Italy
armin.burger@jrc.it, paul.hasenohr@jrc.it

The latest reform of the European Common Agriculture Policy (CAP) aims at promoting sustainable development of agriculture. The farmers have to fulfil different requirements with regard to environment protection, that are defined at European, national and regional levels. CAP regulations require that data are exchanged for various controls and checks between farmers, Member States and the European Commission. These regulations strengthen the need for horizontal data access improvements between administrations, as well as they provide EU citizens and businesses with better services for implementing EU policy (rural development, respect of environmental regulations, etc.).

An important area for data exchange and interoperability arises in the context of cross-compliance as a key element of the CAP reform. Cross-compliance consists in checking that a farmer fulfills several requirements (farmer and site specific) issued at a European, national, and regional level. Thus, cross-compliance requires an analysis of data coming from different stakeholders.

National administrations in the Member States have to check that information submitted in aid applications is reliable. These checks are performed via the "Integrated Administration and Control System" (IACS). Geographical Information Systems are used to manage the spatial databases included in the IACSs. These systems address internal and local needs. They include data and information from different stakeholders at national and European level. The incompatibility of the proprietary interfaces of these systems is a major restriction for data exchange and remote access to IACS databases.

The Agriculture and Fisheries Unit at the Joint Research Centre initiated in 2004 the project 'Remote Access to IACS Databases' (RAID) in the framework of the IDABC programme (http://europa.eu.int/idabc). This project shall develop and provide efficient mechanisms and services for remote access to IACS databases and data exchange between all stakeholders involved in agriculture payment schemes. These services shall allow for real-time identification of all relevant information related to agricultural parcels included in any CAP scheme a farmer takes part in. The project focuses on the development of open interfaces – compliant to ISO and OGC standards – that could be used for data exchange.

The project covers several domains for data access and data exchange:

- Data exchange for cross-compliance issues via a web portal.
- Mobile access to IACS databases based on a field decision support toolkit.
- Serving of satellite imagery for control campaigns.

Cross-compliance GeoPortal

Cross-compliance evaluation shall integrate the Good Farming Practices, Good Agricultural and Environmental Conditions and Statutory Management Requirements. The information exchange and data interoperability are crucial factors to establish a clear common framework for cross-compliance issues.

A cross-compliance GeoPortal for data exchange and access mechanisms shall facilitate and improve the way of how data exchange is handled. This web portal will focus on the integration of environmental and other information needed for carrying out cross-compliance evaluations, avoiding as much as possible copying of datasets (CD or DVD). Instead, several services will be put in place in order to access data over the web including all meta-information required. This will drastically change the way of working and will be in line with the principles of the INSPIRE proposal for a EU Directive.

The benefits of the cross-compliance GeoPortal will result in a harmonized approach for data interoperability at EU level and common application of EU rules for cross-compliance. It will give administrations access to up-to-date and documented data necessary for carrying out cross-compliance evaluation. But also farmers would have access to environmental information that allows them to bring agricultural practices in line with needs from other sectors. Future Farm Advisory Services could also integrate the core of the GeoPortal.

Field decision support (FDS) toolkit
In the context of the CAP controlling process, all Member States face the same objective of improving the level of quality and efficiency of field controls for the relevant schemes. Today, the CAP controlling process is still mainly a manual (manual encoding) and paper (use of paper forms and paper maps) work.

The FDS toolkit will provide Member States with modular framework of client/server components for accessing all relevant information during field inspections. This includes

- the remote access to the IACS database, based on open standards (ISO, OGC)
- the wireless connection (GPRS) between the mobile client and the server, based on open and secure protocols (e.g. HTTPS/SOAP)
- the retrieve of data (i.e. reference parcels, ortho-photos) from the IACS database to a mobile or desktop client
- the update/insert of data from a mobile or desktop client to the IACS database

The field decision support tools shall improve and speed up field controls. But they will also provide farmers with better, more transparent and nearly real-time information about the status of an application or a field control.

Serving satellite images for control purposes
Member States are obliged to comprehensively control the aid applications over several sites. This is performed both via classical field inspections as well as via controls with remote sensing. For the latter, satellite images are widely used. These images are purchased and archived by JRC on behalf of Member States in a system called ImageServer.

The ImageServer is set up as an online distribution and archiving system (image portal) for satellite images of CAP control campaigns. This system shall allow identification, dissemination, archiving and retrieval of imagery via open protocols. The implementation will be provided as part of general support through Commission services to Member States in this control programme.

The goal is to directly provide national administrations and contractors with data for control purposes already during the control phase, avoiding exchange of satellite imagery via CD's and DVD's . This way it will very much improve and facilitate the workflow of data handling compared to the currently existing data exchange mechanisms.

Data exchange and data interoperability are becoming an important issue also in the context of the implementation of the Common Agriculture Policy. The outlined RAID project follows INSPIRE principles as they have been defined by the broad geo-user community. It will allow implementation and testing of the organisational and technical components needed for carrying out the activities described earlier, but also to become part of the European and National Spatial Data Infrastructures as they are currently under development. This project is willing to contribute to these important developments.

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A standardised Geo-Identifier in the context of Geo-Traceability and Common Agricultural Policy

D. Buffet[1], R. Oger[1]
[1]*Walloon Agricultural Research Centre, Gembloux, Belgium*

The identification of the origin of feed and food ingredients is of prime importance for the protection of consumers. In this perspective, the Council Regulation EC/178/2002 [ref. 1] laid down general principles and requirements applicable to all food legislation in order to ensure a high level of health protection. Traceability is a key element of this regulation which defines it as the ability to trace and follow food, feed and ingredients through all stages of production, processing and distribution; from primary production, at the parcel level, to the consumer.

In addition to these traceability needs and in the context of the new Common Agricultural Policy (CAP), the Council Regulation EC/1593/00 [ref. 2] compels member States of the European Community to implement an Integrated Administration and Control System (IACS) which form the basis for managing subsidies allocated to producers. The Land Parcel Identification Systems (LPIS) is an essential element of this IACS and must be fully digital, according to Article 18 of the Council Regulation EC/1782/2003 [ref. 3]. The reference object is the agricultural parcel which is a geographically delimited area registered each year in the IACS/GIS with an unique identification number (Article 2, Regulation EC/796/2004, [ref. 4]).

In this context, the European GeoTraceAgri project (IST-2001-34281, [ref. 5]) and more particularly the European GTIS-CAP project (SSP-006468, [ref. 6]) have been involved in the development of a thematic SDI for Geo-Traceability and for the new CAP. One of the objectives is "to implement a Geo-Traceability Integrated System for the control and the management of the Common Agricultural Policy with geo-referenced traceability data and indicators". This is done in order to extend the IACS GIS/LPIS capacities and to promote its use to facilitate the withdrawal of agricultural productions and enables consumers to be provided with targeted and accurate information concerning products.

Following INSPIRE and IDA-RAID[1] recommendations, the GTIS-CAP project defined a standardized Geo-Identifier for spatial objects that could be associated to specific topics of the new CAP (objects in relation with the agri-environmental measures) and to agricultural products along all the agro-food chain. In the frame of traceability, the main objective of this Geo-Identifier associated with geo-traceability is to allow identifying quickly and in a sufficiently precise way the geographical localisation of the production parcels when a given lot is found to be none conform. This geo-identifier must have a common structure that can be integrated in different information systems, geographic or not, without being directly related to them. Furthermore, it must be able to carry core information on the spatial object useful for geo-traceability. These objects must be easily identifiable and localisable in space and time on orthophotoplans or high precision satellite images.

In addition to these constraints, the geo-identifier must contain geographical and non-geographical information that characterise objects allowing basic operations without having the original vectorial parcel delineation. Objects can be very variable, in their form (rectangular, circle or specific forms), their size (from few meters to several hectares) and their type (line, polygon, point and combination of them). The Geo-Identifier must contain a limited number of digits while being sufficiently accurate to allow a unique identification of the object. By this

[1] RAID (Remote Access to IACS Data), which aims to facilitate access to CAP geographical information data for all those involved in the management of EU agricultural subsidies.

way, a food safety authority can easily and quickly control if a given product is localised in a contaminated area without needing to identify and to get all the traceability information relative to the raw product.

Depending on the agro-food chain, the composition of a lot of products can be very complex and can be based on a mixture of sub-lots. The geo-identifier must be able to aggregate the initial geo-identifier information to ensure the consumer to get all the essential information as regards the origin of the product. By this way, it is possible to determine if a product is composed only with a mixture of regional productions or not.

The challenge is to identify the different core elements that compose this geo-identifier with sufficient geographical accuracy and with a limited number of characters allowing the sharing, the exchanging and the interpreting of it, by a wide range of actors across the agro-food chain. Moreover, it must be universal, according to different traceability systems and the choices of member states for reference objects that can be agricultural parcels, farmer blocks, cadastral parcels or combinations of these entities.

Different scenarios were investigated and tested on several situations and data sets allowing to define standardised Geo-Identifier specifications. The components of this geo-identifier include two types of coded information. On the one hand, information relative to characteristics of the spatial object, like its geographic coordinates, its spatial coverage and its object category, and on the other hand, additional information like the editor organism and the date of creation. The geographic information is the public part of the geo-identifier, administrative bodies or consumers can easily exploit this information for their general purposes. The second part of the geo-identifier is restricted to specific organisms; e.g. national or European bodies or specific actors in the agro-food chain. It provides basic information to easily identify targeted actors which keep the traceability information relative to the product.

One objective of the GTIS-CAP project is to draft the implementation rules that describe the content and the structure of a standardized Geo-Identifier generated for spatial CAP objects. This reference identifier linked to geo-traceability provides an interoperable way to certify the origin of products and the traceability from farm to fork. More generally, the geo-identifier represents an added value especially for Food labelling and certification of products; e.g. designation of origin, geographical indication. GTIS-CAP partnership comprised the “Centre de Commerce et d’Industrie” of Gers, SPOT-IMAGE, ACTA-Informatique, CDER-Informatique, the “Centre Interprofessionnel pour la Gestion en Agriculture” (CIGEST), the University of Liège (ULg), and the Walloon Agricultural Research Centre (CRA-W).

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A centralized Spatial Database for accessing Natura2000 data, overview of design and current status

Tomas De Leus[1], Petra Michiels[1], Jan De Belder[1], Danny Vandenbroucke[1]
[1]*SADL KUL Research & Development, Leuven, Belgium*

Abstract

In January 2000, the European Commission launched a project called *"GIS for NATURA 2000"*. The aim is to bring together all the spatial and related information on the NATURA 2000 sites of Europe in one single information system. The resulting database and system should make it possible for Commission staff - and in the long run for a larger public - to consult information on the geographical extent of the NATURA 2000 network and its characteristics. The NATURA 2000 ecological network will in the end include around 19000 Sites of Community Importance (Habitat Directive) and around 3,500 Special Protection Areas (Bird Directive). The network will cover between 12 and 15% of the territory of the European Union[1].

The presentation gives an overview of the different components that build up the Natura2000 information system, will highlight some important design and technical issues and propose some options for exploring the vast amount of data that the project will make available.

The Natura2000 information system starts with providing to the Member States an internet based application to upload their digital data for verification, parallel to the existing official delivery to the Commission of paper maps and a paper copy of descriptive data for each site. The digital uploading of data allows a faster flow of information between the Member States and parties responsible for validating data. It avoids discussion about the latest version available and allows direct access to this version. This can shorten considerably the validation process.

After validation, data is loaded in a central spatial database, where spatial data and descriptive data are joined together. Two versions exist: a production and a dissemination database. The production database is the one were original validated spatial and descriptive data from the different countries will be uploaded, joined together, documented and tested. Data will be posted after testing on the dissemination database where it will be available throughout the Commission in a read-only SDE environment. Accessing the dissemination database for Natura2000 data ensures any officer to access the latest official data concerning Natura2000.

Officers that need Natura2000 information are not always GIS experts and it might be difficult for them to find their way in the complex structure of the database. Nor does every officer have the possibility to install specific GIS software on his or her desktop. Therefore the Natura2000 information system provides an intranet-based application that gives any officers with a standard internet browser an interface to Natura2000 data. This allows to view and print overview maps, provides an intuitive query interface to select Natura2000 sites on specific criteria and print the standard data form with all relevant information of selected sites.

The dissemination data can be used for more advanced and broader use. Advanced GIS analysis is possible on European scale, and creating an internet access to a broader public can be considered by means of web map services or web feature services, which could be integrated with other available services.

[1] These figures refer to the 25 Member States.

The design of the complete system involves a mix of technologies and experts from different areas. Experts in the different fields need to work together to make a working system, overcoming several problems. It shows that, although a lot of data is available, bringing all data together and present this to a broader public in a meaningful way is not an easy task. It shows the need of cooperation between different institutes and clear rules and standards. Following these rules and standard and the driving force of the Commission, complex data from over the whole of the European Union can be brought together and presented to a broad non-technical public, making their daily tasks easier.

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Session: National/Regional SDI 2

Thursday 30th June 16:00 – 17:30

Meeting Room Hotel Calabona

Rebuilding a SDI – The Portuguese Experience

R. P. Julião
Instituto Geográfico Português, Lisboa, Portugal

Portugal was one of the first countries in the world to start the development of a Spatial Data Infrastructure (SDI) that is known as Sistema Nacional de Informação Geográfica (SNIG). This project that started with a working group in 1986, was brought to day light in 1990 and opened to the Internet in 1995, is now going through a major change on its philosophy, its contents and its technology.

If creating a SDI is not an easy job, rebuilding an infrastructure is even more dificult. Besides the traditional issues that must be considered when you start a SDI, there are also very strong expectations from users created by the existing services and contents. Not only the ones already provided by the SDI, but also those existing in other countries and offered by international organizations.

Making or renewing a SDI is a difficult task that involves much more than technological issues. Putting apart the external issues, like INSPIRE and other EC directives, because those are generally a broad framework for the internal issues, it is possible to say that, like a regular business there are demand and supply topics that one must take care of.

Regarding demand we can subdivide them into individual and collective. Each type has different expectations regarding the SDI support to their activities. Individuals are more interested in discovery and exploration services available online, like for instance: metadata services, viewing and interactive manipulation, etc. Organizations, collective demand, can have a two-way relation with the SDI. As users, they normally add to the individuals' requirements the download facilities for re-use of geoinformation. As producers, some of them are also very interested in using the SDI as a support to promote and market their data and applications.

On the supply side you have different roles. We have the promoter / co-ordinator, an individual role that can be played by an organization or a collective body, who is responsible for all general activities related with the SDI development, typically assured by the public administration and the content providers, who can be both from the public and private sector. Of course the data and application providers, either public or private, are one of the most important groups related with supply.

This is the overall internal context that surrounds the development of a SDI project.

This paper will present the Portuguese strategy for the renewing of the SDI, addressing and justifying the options that are being made. By doing this we hope to improve the awareness of all SDI developers, as Portugal can be proud of having almost 20 years of experience in this field.

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Coordination of the national SDI in Germany

Martin Lenk
Administration Office of the Interministerial Committee for Geo Information, Frankfurt, Germany &
Coordination Office of the GDI-DE (SDI-Germany), Frankfurt, Germany

Relevance of Geo-Information for modern society

The beginning of the 21st century saw the growth in importance of geo-information and it is now recognised as an important component in the world of science and its society as a whole. It provides an important basis for the planning and decision-making of citizens, economists, scientists and public administrators.

Federal Coordination - IMAGI

The Federal Government of Germany recognized its relevance to the national economy and established a governmental commission in 1998, called the IMAGI (Interministerial Committee for Geo Information). The IMAGI has taken appropriate measures to promote the development of a German National Spatial Data-infrastructure (Geodateninfrastruktur Deutschland: GDI-DE®), which will enable non specialists to use geoinformation and will have a strong impact on the growing geodata market.

The IMAGI includes 10 ministries of the central government in Germany. The head of the IMAGI is the state secretary of the Ministry of the Interior. He is also the authorised national representative for Geo-Information in Germany and the head for the E-Government initiative of the Federal Government. The administrative office of the IMAGI is situated in the Federal Agency for Cartography and Geodesy (BKG) in Frankfurt am Main, Germany. In cooperation with experts and working groups the administrative office is coordinating the core projects of the Federal Government of the National SDI. All projects (e.g. Geodatasearch Engine GeoMIS.Bund, GeoPortal.Bund and pilot projects like the German Disaster Information System deNIS) follow the major strategy of the german SDI:

- To establish a nationwide catalogue system based on international standards
- To harmonize geo data sets, including technical and semantical issues, as well as establishing internet services
- To implement harmonized data sets in an interoperable network, including users and providers

Coordination between administration levels including Federation, States and municapilities

The responsibility of the IMAGI includes the administration body of the Federation. To improve the necessary cooperation with the States and the Municipalities in Germany a new organisational structure, called GDI-DE, including all different administration levels was created in 2004. The structure also includes a consulting body of the private sector (see figure 1).

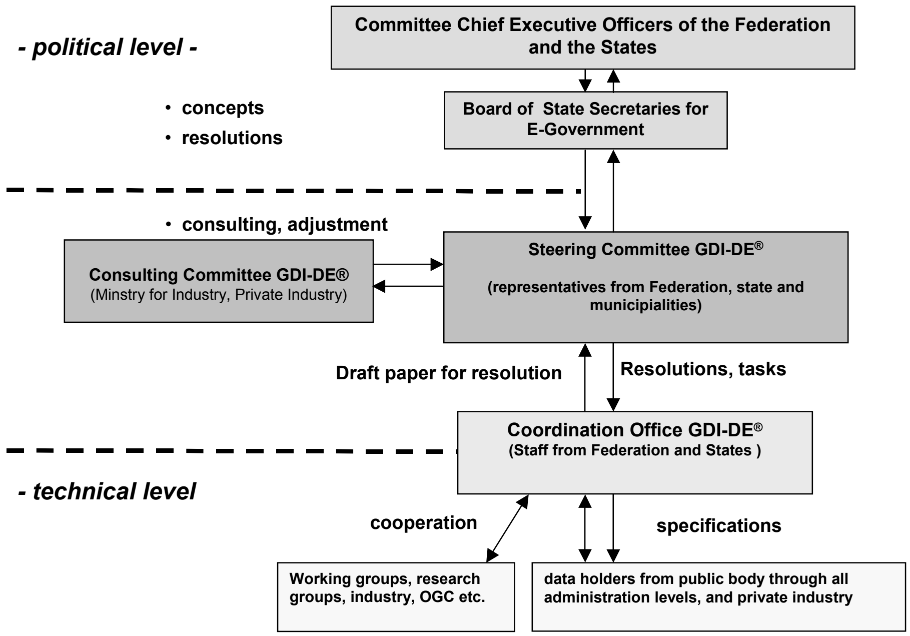

Figure 1: Organisational structure of the GDI-DE to integrate different administration levels (Federation, States municipalities) and private sector

The **GDI-DE Organisation** is working in the responsibility of the **Board of State Secretaries for E-Government**. This responsibility clearly shows the expected impact of the working SDI for E-Government services like Internet Mapping, interdisciplinary data integration or space analysis.

A S**teering Committee** of representatives of the Federal Government, the State Governments and of Representatives of the Associations of the Municipalities is responsible for the necessary adjustment between the involved public authorities. The steering committee is also attended by a Committee with representatives of the Federal Ministry for Industry and private industry associations. The steering committee meets as often as it is necessary. Once a year it is reporting towards the Board of State Secretaries for E-Government to declare general progress, problems and statements about costs and benefits.

The **Coordination Office** of the GDI-DE is the interface between deciding level and topical and technical executives. It is responsible for communication between these levels as well as for the project management. To ensure that existing structures of Federation and States are being used from the new GDI-DE organisation, the Coordination Office is built by the staff of the present IMAGI office inside the Federal Agency of Cartography and Geodesy supplemented by specialists from the states. In addition there are point of contacts in each single state to communicate and organise SDI projects. Very important is the integrated operation of the Coordination office. This means to consolidate and integrate single projects with topical, technical or regional background in the context of the national SDI.

Present Development of the GDI-DE
The Steering Committee and the Coordination Office are operating with the beginning of the present year 2005. Some key projects were defined at the 2nd Steering Committee meeting in April 2005 including:

- The coordination of the review process between the European Commission and Germany concerning the development of the implementing rules
- The nationwide adjustment of various application profiles in the context of OGC and ISO standards (e.g. CSW, WMS, WPOS).
- The nationwide inquiry for pilot projects in the context of SDI, to identify key projects for the SDI.
- The adjusted development of a nationwide architecture including international standards, internet services and models of geo data.

With the institutional framework of the GDI-DE and the existing technical architecture, Germany will be able to deliver multidisciplinary data sets to the European Commission as it is foreseen by the INSPIRE Directive (draft version 2004).

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The Geoinformation Infrastructure in the Czech Republic: The Key Role of Metadata

B. Horakova[1], P.Kubicek[2], J.Horak[1],
[1]*Czech Association for Geoinformation, Ostrava, Czech Republic*
[2] *Czech Association for Geoinformation, Prague, Czech Republic*

The geoinformation technologies utilization and the development of spatial orientated information systems have achieved high degree of progress in the Czech Republic and have accomplished resounding success in public administration and commercial sphere. This progress has been increasingly promoted both – by the increasing social need of public sector to work with more accurate geodata and geoinformation, which will correspond to relevant issues, and by the needs of private sector subjects at their activities development, where the spatial aspects and linkages consideration brings preferable position on the market. Withal the development has been enabled by the accessibility and the control of the information technologies and by the relatively substantial growth of data funds of individual information systems. This data funds scale and their utilization in other areas, than which they have been created for initially, led to providing this data funds to other needs and other users. So the data and information provision became the individual problem area. In spite of some positive steps the situation of accessibility and usage of geodata, that have been gained and administered by the bodies and authorities of public administration in the Czech Republic, is relatively unsatisfactory even though many of positive aspects were brought e.g. by the new conditions of geodata and geoinformation provision in the resort of the Czech office for surveying, mapping and cadastre (COSMC, see www.cuzk.cz for details).

In the Czech Republic, there is the whole functional range of important elements of National Geoinformation Infrastructure (below as NGII), but they demand the uniform conceptual framework, which would ensure the coordinated continuous development. The current NGII environment has been created by individually evolved activities within the scope of individual bodies of public administration and other subjects.

The first impulse of coordination was the program document prepared by the Czech Association for Geoinformation in co-operation with Nemoforum and officially published in 2001 - „The Program of the National Geoinformation Infrastructure Development in the Czech Republic in the years 2001 – 2005“. This document has been further discussed by the former Government Board of National Information Policy in the Czech Republic and has been accepted as a basis for updating of Action Plan of National Information Policy Realization.

The document defines 10 basic areas at NGII construction:
1. The existence of NGII Development Program and its general acceptance by bodies of public administration and professional authority,
2. The NGII creation linked with related European and World initiatives,
3. Coordination and cooperation of subjects acting in geomatics and geoinformation,
4. Technical conditions for processing and accessing of geodata and geoinformation,
5. Organizational, legislative, financial and other conditions for geodata and geoinformation accessibility,
6. Basic geodata data funds (databases),
7. Acquaintance with available geodata data funds, their source locations and accessibility conditions,
8. Standard geodata transmission formats and their sets, standard description of data
9. funds, terminology in the area of geomatics and geoinformation,
10. Skilled worker qualification in the field of geomatics and geoinformation,

11. General public user’s knowledge level, which enables the usage of new possibilities and of geodata and geoinformation accessibility.

This Program contains the whole range of so-called projects or actions, whose implementation should significantly help the desirable NGII development in the Czech Republic.

The article is a recapitulation, where the authors will, above all, focused on the state-of-the-art achieved in the area of geodata source documentation in the Czech Republic and will share their own experiences from the realized projects (MIDAS, GINIE-WebCastle, COSMC's Geo-Portal, etc.) and outline following intentions of active participation in relation to INSPIRE.

One Scotland – One Geography: A Small Country with Big Ideas

Cameron Easton
Head of Geographic Information Services
Scottish Executive
Scotland
United Kingdom

The INSPIRE initiative is being negotiated at national (United Kingdom) level. It will have significant implications for the GI infrastructure at country (Scotland) level, but there is little awareness or interest among our politicians and public administrators, an apathy made worse by the absence of a UK GI Strategy/NSDI.

I am responsible for implementing Scotland's government's Geographic Information Strategy, "One Scotland – One Geography". This must fit into an uncertain "top-down" structure, act as a building block for any future UK GI Strategy, ensure implementation of INSPIRE in Scotland, deliver an ambitious but deliverable "bottom-up" based SDI that overcomes limited political and public administrator buy-in, break down the jealously guarded Departmental and sectoral "data domains", take account of the UK Government's policies on commercial trading of publicly funded data, empower the private sector and deliver responsive and relevant services to our citizens. Meanwhile it must also clearly define benefits to all sectors.

In Scotland most of our Key Geographies are maintained by central and local government. Therefore by targeting government's data management processes, we can quickly deliver the main elements of our SDI. Because of our "low level" start, we have decided against reaching for the utopian dream of an SDI that delivers everything for everyone from a single spatial data and information "warehouse". Rather we have concentrated on pragmatic and deliverable targets that recognise the weaknesses and build on the strengths of our existing processes, rationalise the management of our Key Geographies by central and local government, ensure that data moves seamlessly from provider to all users and provide information easily and comprehensively to our citizens. Potential benefits are being defined from the start of the process.

These are big ideas for a small country; we aim to deliver our vision over the next 2 – 5 years. What we have done over the last year, and will do over the next six months will be crucial to this process. Our report to the Workshop will be an important milestone in measuring our progress.

Digital South-East Europe – A Regional distributed GIS and Geo-Portal

Ulrich Boes
URSIT Ltd., Sofia, Bulgaria

INSPIRE will provide a legal framework for policy, data, technology to implement spatial data infrastructures in the European Union. INSPIRE includes the possibility for service providers and foresees licensing arrangements for use of spatial data by third parties with specific objectives as for example research and education, or those who add value. One important part of INSPIRE is the geo-portal, which is being realized at the Joint Research Centre of the European Commission.

Different countries however have different requirements and starting conditions. This is particularly true for the candidate countries and the Western Balkan states. These countries have still to implement a large part of the "acquis communautaire", although they are in some parts well advanced. There is a clear need to include these countries into activities related to INSPIRE: the Association for Geospatial Information in South-East Europe (AGISEE) has declared as one of their goals to introduce INSPIRE into the candidate countries Bulgaria, Romania, Turkey and the Western Balkan States. AGISEE has the vision to achieve organizational, social, economic and political unity in the region via the creation of spatial data infrastructures. The association creates a dialog between all stakeholders in GI and carries the message of GI outside of its realm. Interest in the region is high, and member benefits are demonstrated by the rich web site of the association. AGISEE creates a link to government activities, in particular to e-government programs, acknowledging that environmental programmes as well as cadastre and land reform belong to the priority areas of the countries considered.

Technical and business aspects of INSPIRE are pushed forward by the project "Digital-SEE", which intends to realize a geo-portal for the region, based on distributed access to data holdings in all countries of the region. Digital SEE is named after Digital Earth, which is conceived as a multi-resolution, three-dimensional representation of the planet, into which vast quantities of geo-referenced data can be embedded. Possible applications combined with broad and easy access to global spatial information will be, in the words of the former Vice-President of the USA, Al Gore, in 1998, limited only by imagination.

Digital SEE, also called the "Spatial Data Warehouse of South-East Europe" will allow wide data sharing across the region of South East Europe, and provide general access world-wide to data from this region. It is conceived as a distributed inter-regional Geographic Information System (GIS) allowing access to any kind of data in the countries of South East Europe; it includes services to integrate data from heterogeneous sources or databases and to present them to a layman user in a seamless way. This spatial data warehouse would not store any data itself, but access and make available different data sources based on meta data and on user requests and queries, for which a clickable map will be designed. The spatial data warehouse is thus an interregional distributed GIS, build on open standards and using new technology such as the Internet, web services, GIS web services, web mapping, GML, Geo-Web, open distributed processing (ODP), and its integration.

The realization of "Digital SEE" is facing several challenges and obstacles. These are partially technical, related to the real-time integration of data of different quality and origin, resulting in research issues still to be solved. Technology will be based on web services and open standards, in particular those of the Open Geospatial Consortium. The spatial data warehouse would:

- access data of different type and quality, harmonize these data in real time, respect different revenue models and afterwards bill the customer;
- offer access to data as a distributed and integrated information system, consisting of a multi tier architecture. No data would be stored in any central server (except meta data), and all data/information would be accessed directly and in real time from the original data provider in whatever country, considering also the business and revenue model of this specific data provider. Methods of pricing and billing would be included;
- integrate other, additional information necessary for some applications such as environmental information, statistical information, tourist information or others, in the form of text, images or movies;
- be designed to be used by a layman user, similar to an atlas information system. Applications of the spatial data warehouse would be in the sectors environment, tourism, demographics, real estate, transport, disaster management or education;

Data integration and harmonization would include functions such as coordinate transformation, generalization, vectorization, rasterization, data transformation, mapping functions, Gazetteer, GIS functions, image processing functions, map or cartographic symbols, Statistical and analysis functions.

The Spatial Data Warehouse would be the technical base for a service to deliver spatial data to clients in a seamless way. Commercially, this would be taken up by an application service provider (ASP) or a broker for spatial data. Participants in the service are the data providers, the broker(s) and the users or clients. The user can browse the catalogue, request data, compose maps, and order datasets. The broker or clearing-house:

- converts data descriptions into standardized meta data descriptions;
- publishes the meta data catalogue;
- implements and offers value added functions;
- manages the site, in particular archives data and caches data.

There are also challenges of organizational nature, since organizations will have to collaborate and share data across several countries. This concerns in particular data owners providing data to Digital SEE.

The Spatial Data Warehouse is an information system that would render various applications possible, like human development, combat of disasters, protection of the environment, land registry, fight against crime and terrorism, tourism, mobile services, health etc., for the sake of the whole population. Since it is considered to be the information system of the regional spatial data infrastructure, it will stimulate its establishment, and influence national spatial data infrastructures. It can furthermore stimulate the use of geographic information in the region, by donors, governments, or the private sector, and contribute to the creation of a GI marketplace. It will also influence the adoption of GIS standards, (OSI or OGC) in the region.

The Spatial Data Warehouse will offer access to the spatial data available, including all data that are location relevant. Potential users will be able to integrate these data into their applications, and thus they will work more efficiently, duplication of data generation and data storage will be avoided. The Spatial Data Warehouse will offer services on top of the national data, in particular harmonization of data. Such integrated data access will be an invaluable tool for a multitude of users and stimulate new commercial applications, and create new jobs.

Digital SEE is funded by the e-Content programme as a feasibility study, and results will be available at the end of 2005. Results will be the technical architecture and design of a spatial data warehouse, along with a prototype for selected applications. It would be used to demonstrate the technical feasibility; a business plan would demonstrate the commercial feasibility. If successful, Digital SEE will also prove the commercial viability of spatial data infrastructures. The proposed paper and presentation will in its main part report on the realization of Digital SEE as a distributed GIS and geo-portal in South-East Europe, and how the challenges faced will be solved.

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Session: Components and Structures

Thursday 30th June 16:00 – 17:30

Hotel Carlos V

Open Source components to build a GeoPortal

M.A. Manso, M.A. Bernabé
Department of Topography and Cartographic Engineering
Polytechnic University of Madrid
Campus Sur, Carretera de Valencia, km 7. 28031- Madrid (Spain)
m.manso@upm.es, ma.bernabe@upm.es

From a technological point of view, the Open Geospatial Consortium (OGC) [17] has been the main agent behind these advances as it has led the consensus of the specifications and their diffusion. This is the case of Web map servers (WMS) which enable the visualization of GI, Web feature servers (WFS), of Web coverage servers (WCS) etc. All this causes the need for organizations that deal with geographical information to have catalogues that register description about their services and the data available in order to enhance finding and using task.

The Open Source movement has become an alternative to monopolies and "black boxes" of the commercial software world. In the SDI arena, the Open Source is gaining special significance owing to various reasons such as: (a) the existence of open and public specifications of Web Geo-services, (b) the explicit objective of SDI of sharing and not duplicating information, (c) the increasing transparency of administrations through the web, (d) the relevance of SDI as a helpful tool in decision making, (e) the growing access of citizens to certain types of geographical information, etc. As a result of this, there is a growth of initiatives of services, applications, tools, data, etc. of the Open Source or Free Open Source type.

The main objective of this document is to analyse the degree of development of Open Source type software projects related to the OGC specification implementation. This allows searching of and accessing to Geospatial information (Geo-Portal). Thereby the functional requirements proposed by the U.S. Geospatial One-Stop (GOS) initiative will be adopted as a reference model [6].

The remainder of the document is structured as follows: in the first place the Web services as defined by OGC are enumerated and briefly described. In the second place the functional design requirements defined by GOS are enumerated, described and analysed, with the purpose of identifying the components standardized by OGC that shall be used in the design of the Geo-Portal.

In the third place the different widely known Open Source projects implementing specifications agreed on by OGC for the previously identified components are analysed and described. Since the aim is to meet those requirements, different components are analysed belonging to different Open Source projects offering Web Map Servers (WMS), such as MapServer [15] of the University of Minnesota, Web Feature Servers (WFS) such as GeoServer [5], Web Feature Search by name or Gazetteer (WFS-G), such as Deegree [2] and dataset or service search in metadata repositories (Web Catalogue Search, WCAS), such as GeoNetwork [4]. This will be done by outlining the different implemented Service Versions, the types of data stores that can be managed, the tools available for management as well as the accompanying utilities for Geographic Information handling. Documentation availability and existence of prototypes proving and/or certifying their correct functioning will be borne in mind.

Next several tables are shown defining the degree of compliance of the functional requirements proposed by GOS for the different priority service implementations concerning Open Source projects. As a result of this analysis, several conclusions related to compliance identifiers are drawn. Finally, the acknowledgements and the references are shown.

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Reengineering the Geoportal Applying HCI and Geovisualization Disciplines

T. Aditya, MJ. Kraak
ITC, Enschede, The Netherlands

Introduction

To enable a Geospatial Data Infrastructure (GDI) as a core infrastructure furthering economic development, social life, and environmental sustainability, a geoportal – a gateway to access data and information available within a GDI framework - has been considered as a central component in the current literature. This is required to enable access to data providers and put the GDI as a sharing initiative in practice. Unfortunately, the supports for task completion and users' understanding are far from usable. This paper explores the usability deficiencies that geoportals might have. To repair these deficiencies, the use of selected techniques from the field of human computer interaction (HCI) and geovisualization arguably can be useful. The goal of using these two theories is to set up a useful scientific foundation to critically redesign geoportals. The research questions this paper deals with are: What roles can HCI and geovisualization disciplines play to reengineer the geoportal concept? How can methods from both disciplines be applied to improve the usability of geoportal?

Reengineering the geoportal: from technology centric towards user centric

Most of the geoportal's owners (GDI administers) pay more attention to the functionality **(technology centric)**, rather than to the usability of its interface **(user centric)**. For example, the functionality for searching the matching-metadata across the nodes is available in most of geoportals. However, mechanisms regarding how search results are presented to assist users' needs are not considered seriously.

Usability issues should be considered at the first place in developing geoportals. This does not assert that technological challenges for instance syntactic and semantic interoperability, reference systems' diversity, customized stylesheets' conformity [1 p. 25 - 29] in web-mapping should be sidelined per se. The rationale for considering usability issues is that the technology advancement does not necessarily ensure the success of the sharing mechanism. In contrary, developing systems allowing usable interaction to the GDI that really fit to the users' tasks and requirements can potentially enable (data) sharing in practice. In designing such human-computer interface, Shedroff [2] argues that three design components must be involved: information, sensorial, and interaction design. The information design is about how to get meaningful information out of metadata, data, and processing services available. Here sensorial design refers to (geo)visualization techniques to effectively transmit information. Interaction design contends with how to understand users and providing interfaces supporting their tasks. This paper suggests shifting the geoportal development from being technology centric towards a user centric web-application, with applying HCI and geovisualization methods. The HCI centered on understanding users' mental models, experiences, and acceptance in the interface development, meanwhile geovisualization promises the effectiveness of the geoportal in supporting users' tasks.

Regarding users' involvement in the geoportal development, the literature exposes limited findings regarding users acceptance [e.g. 3]. Other fundamental user aspects, e.g.: GDI users' mental model and behavior, tasks analysis of data discovery have not been elaborated extensively. Guidelines for providing usable interaction interface in the access to the GDI are inadequate.

Regarding effectiveness of the existing geoportals, supports to assist perceptual and cognitive limits of the users are lacking. In most of geoportals developed, visual cues to assist tasks of discovering data are not readily presented. They require users to browse results thoroughly with limited opportunities to link to contextual information regarding each item of the results. Adding to this deficient, they do not provide interaction scheme to enable users accomplishing their tasks effectively. As an example, regarding "reviewing the search results", they limit users interaction with no dynamic queries available, and even lack of navigation tools to control the searching (e.g. sorting and comparing items).

The HCI roles

The HCI study is "concerned with understanding how people make use of systems that embed computation, and how such systems can be more useful and usable" [4]. In this context, people refer to GDI users accessing the GDI services (limited to data), while the system refers to the geoportal.

Three important aspects in advancing the usability of geoportals are: establishing requirements, facilitating users' tasks, and iterative design process. In establishing requirements, data-gathering techniques such as observation (studying the literature and reports as well as experiencing directly to the interface), users profiling, and interviews, can be useful. Regarding the second aspect, for discovering data via the geoportal, the type of task can range from a tightly defined to a loosely defined task. With a tightly defined task, the purpose of users' actions is to locate and access *specific* geospatial data fulfilling their needs. The terminology refers to the task for solving "well-defined information seeking problems" [5, p. 165]. To exemplify this, consider a task to get a land use dataset with already explicit requirements on its scale, format, and administrative boundary. Meanwhile, the loosely defined task aims at locating *proper* data in which the fitness for use is not simply depending on matching values of certain elements in metadata. Properness can be determined by the purposes of data discovery. This can be of for instance for *study*, *planning* or *crisis management* purposes with no detail requirements given at the start of the interaction to the geoportal. A contextual inquiry has been done to test participants in completing those two types of tasks using the current Dutch Geoportal (http://www.ncgi.nl). This activity gives useful inputs to design tools and interfaces required in the prototype for facilitating users tasks. The third aspect, the iterative design, emphasizes the improvement of the prototype through usability testing and processing test results.

The Geovisualization roles

The boundaries delimiting HCI and geovisualization are very subtle. Geovisualization discipline itself recognizes user-centred design as an important research agenda [6]. Geovisualization here is focused on the methods of generating interactive techniques for visualizing geospatial metadata and information based on the requirements defined using HCI techniques previously.

The GDI is about facilitating the access to geospatial data. Most geoportals were utilized geospatial cues for indicating geographic extent of metadata. More uses of geospatial cues for either formulating questions or assessing the fitness-of-use have not been used a lot. Here geoportal definition should be extended not only as gateways to locate the data, but interface to support decision-making using GDI resources. With this argument, a map-based search interface can logically provide effectiveness in accessing geospatial data and information.

The prototype explained in this paper utilizes the atlas as metaphor. Through this metaphor, themes of GDI can be juxtaposed with thematic maps. As a geoportal, the atlas provides cognitive suitability as a search interface for its familiarity and understandability to users. Additionally it has at least three important aspects conforming to some of search principles defined by Shneiderman et al. [7]. It provides consistent and easy navigation means (relevant to strive for consistency and permit easy reversal of actions), it extends possibilities to access to the relevant data and links (relevant to offer informative feedback), and it enables users to build comparisons (relevant to support user control).

For enabling the completion of tightly defined tasks, the search results can be presented as a table or graphic view offering a linkage to the map and the complete metadata for each item selected. The prototype permits users to compare the items selected. For facilitating loosely defined tasks, it offers functionalities for browsing by area or topic, mapping metadata, and exploring maps plus metadata storyteller. Methods from the notion of visual search and attention, map design, and interactive visualization are implemented for this prototype.

Concluding remarks

The geoportal should be seen as a potential medium to explore the GDI resources, mediating both loosely and tightly defined inquiries for supporting decision-making. In developing such interface, multidiscipline studies involving HCI and geovisualization can give a significant contribution to attain a usable geoportal.

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Multi-Source Framework for Seamlessly Exploiting and Leveraging Disparate Spatial Data Catalogues

Oscar Cantán [1], F. Javier Zarazaga-Soria[1], Javier Nogueras-Iso[2]

[1]*Computer Science and Systems Engineering Department*
University of Zaragoza, Zaragoza, Spain
[2]*Joint Research Centre - European Commission*

According to the Directive of the European Parliament and of the Council establishing an infrastructure for spatial information in the Community (INSPIRE) [CEC, 2004], one of the main objectives of a Spatial Data Infrastructure (SDI) is to promote the broad dissemination and use of spatial data, not by means of collecting, as has been done until now, but by exploiting the data that is already available. Sadly enough, there is an important problem hindering this objective: incompatible standards, protocols and interfaces.

Since 1994 the Open Geospatial Consortium (OGC) has been working in the promotion and adoption of open standards and interfaces in the GIS field. Though great progress has been achieved due to these initiatives, the fact is that at present there are far too many catalogue services' implementation profiles and standards available, even inside OGC –for example Z39.50, CORBA-IIOP, CSW or SRW [OGC, 2004]. And that without even taking into consideration the work of private vendors promoting their own proprietary interfaces. Even the INSPIRE initiative, aimed at setting the legal framework for the gradual creation of a spatial information infrastructure, recognises the fact that most of the quality spatial information is available at local and regional level and that this information is difficult to exploit in a broader context for a variety of reasons. Interoperability is one of the most relevant among these causes.

According with the model proposed in [Rajabifard et al., 2000], SDIs should be built by levels, providing interoperability services among them. As it can be seen in Figure 1, there are so many actors and existing metadata systems as to pretend that a complete harmonisation of standards and protocols in the short run will be widely adopted. Actually, a more realistic step-wise approach involves providing for translational frameworks in order to make metadata accessible as soon as possible. Otherwise the local level may find resistance to adopt new models and continue instead operating as usual with their partners and customers.

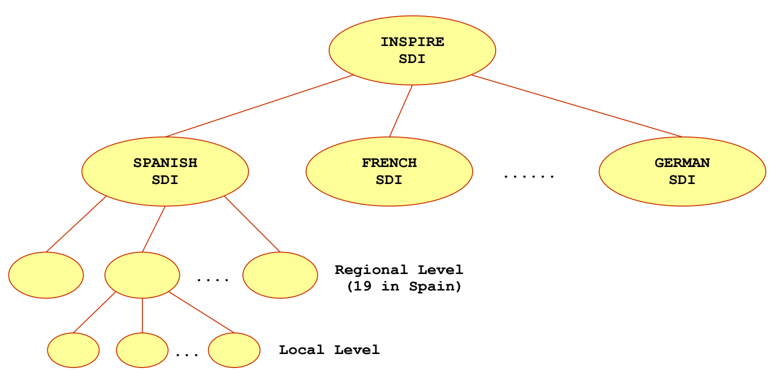

Figure 1: Hierarchical structure of SDI nodes

One of our first projects in the SDI field presented a basic three-tier architecture for the resource discovery and evaluation subsystem, as can be seen in Figure 2 [Cantán et al., 2003]. In addition to the typical web client and server, the system relayed on our catalogue server, named CatServer [Tolosana et al. 2005], reachable through a RMI connector.

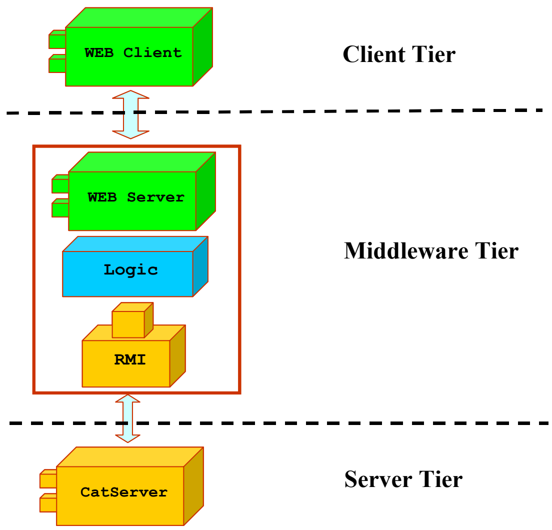

Figure 2: Basic architecture

Nonetheless for each application domain and organization the basic architecture of Figure 2 had to be replicated. New clients implied new ways of interaction, logic, connectors and servers, Figure 3.

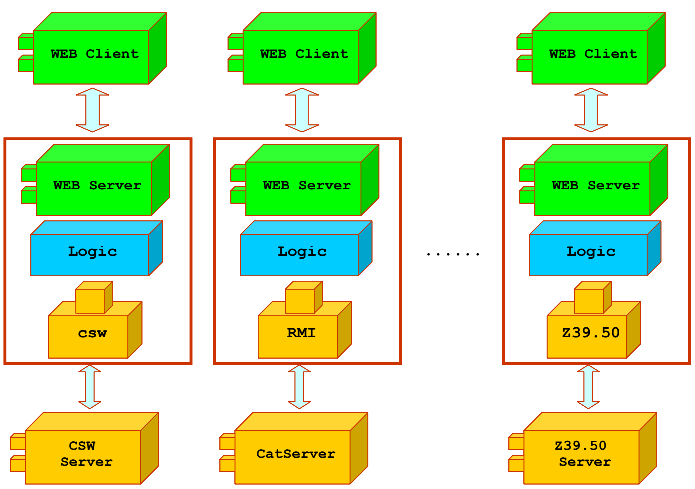

Figure 3: Basic architecture replication as new clients are added

The problems with the architecture depicted in Figure 3 are manifold: it is difficult to maintain, it is effort and time demanding to support new clients and it isolates rather than integrates the functionalities. Thankfully enough, in spite of each client's particularities there is an important deal of functionality that can be factored out. This gives rise to the architecture of Figure 4.

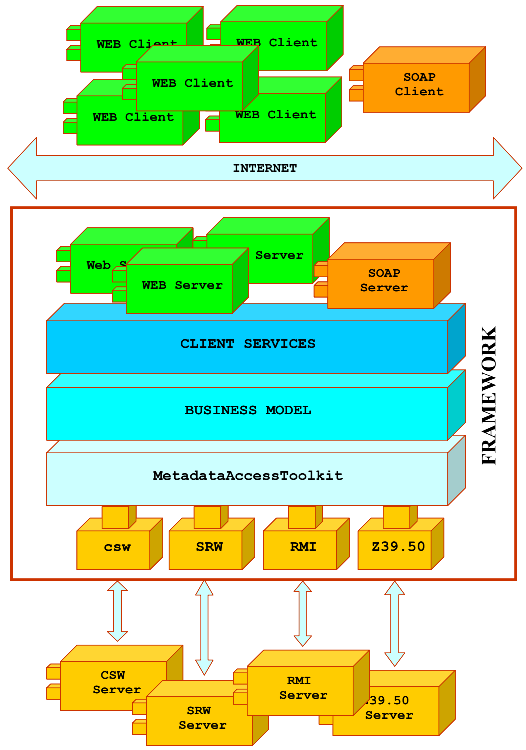

Figure 4: Search Framework

If by middleware in Figure 2 we meant any programming glue that serves to mediate between two separate entities, in Figure 4 the term framework is used to refer to a defined support structure in which another project can be organized and developed. This framework consists of four main layers named Client Services, Business Model, MetadataAccessToolkit and Connectors. Its objective is to accelerate the construction of new clients and the empowerment of their capabilities as it offers interesting additional functionalities like multi-source querying, high-level services and protocol translation which are very demanded in any SDI-node. In the same vein, we pretend our clients to be written once and be able to access any data source. In the following paragraphs a brief description of each layer is given.

The Client Services Layer is responsible of providing high-level services to the application servers interacting with the clients. These services are derived from the Geospatial Resource Access Paradigm, as described in the GDSI Cookbook [GSDI, 2004], and contain among others those for discovering resources, browsing results and recovering specific information. Moreover this layer offers a series of high-level abstractions for representing client and search contexts and allows for concurrent access by means of an inversion of control pattern.

The Business Model Layer recreates the GSDI Cookbook's paradigm, based on the resource discovery, evaluation and access phases. This layer translates the requests from above into invocations to the lower layer. It also provides for translation among different data representations and query languages. When the responses of the underlying servers are gathered, it is this layer's duty to homogenize them for the Client Services layer's subsequent processing.

The MetadataAccessToolkit layer (MAT for short) acts as a virtual catalogue. It makes accessible an object oriented interface, much alike JDBC in Java, to let the Business Model access uniformly any supported metadata source. Thus, no matter the kind of client sending the requests, the intermediate language is always the same in this layer. In addition to this, the MAT layer provides some capabilities like results caching, sorting, content-specific restrictions and session simulation when appropriate.

Finally, the Connectors layer makes the connection with diverse resource servers possible. As can be seen in Figure 4, this layer consists of a cluster of protocol specific pluggable cartridges. Each one of them implements the MAT's source and protocol specific interfaces. The sources to connect to have to be indicated to the framework in an XML file in order for it to select the adequate connectors at launch time. Adding support for new sources calls for convenient cartridges, the rest of the framework remains the same so existing clients can at once access the new sources using the already provided functionality.

Summing it up, the framework presented in this article not only accelerates the construction of SDIs by factoring out common logic, but it also adds new and interesting capabilities both for clients and developers. One worth mentioning is that which enables the exploitation of underlying sources using any high level protocol. See Figure 5.

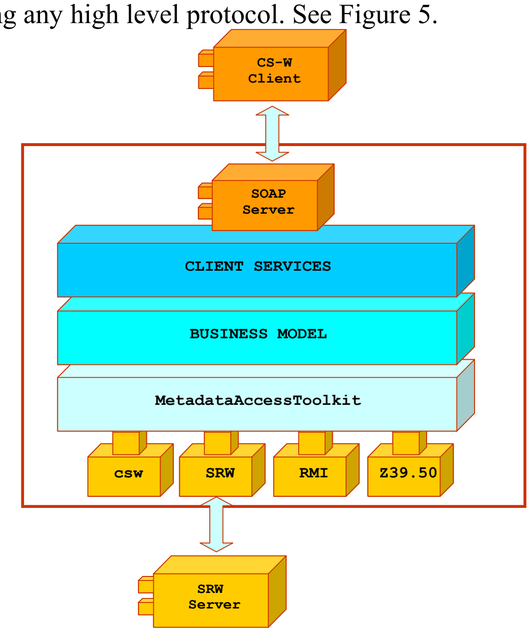

Figure 5: Connection of a CS-W client to a SRW server

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A Hub & Spoke Model for Spatial Infrastructure, using Spatial Data Warehouses

Eamon G. Walsh
CTO eSpatial Solutions, Dublin, Ireland

This presentation derives from eSpatial's experiences in building standard-based web services and spatial data warehouses. An example is a warehouse of approximately 20 spatial data layers with full national coverage at the Department of Agriculture and Food (DAF) in Ireland, including a web portal for environmental assessment.

The architecture for a Spatial Data Infrastructure must be robust and proven, provide for wide access, and interoperate with other SDIs'. Standards should not be adopted if immature, vendor-specific, insufficient to meet user needs, unnecessary for user needs, or unnecessarily complex to implement.

Two architectural approaches are typically distinguished:

- In the **warehouse** model almost all the data is held in one large database.
- In a **distributed system** data resides in many databases, and a portal connects to all databases to retrieve data for any enquiry (typically via Open Geospatial Consortium / ISO-TC211 web services). Data providers retain responsibility for their data. The distributed model is generally recommended.

The technologies and standards exist for the distributed model, but there are practical issues with highly distributed architectures:

- The system is critically dependent on the priority that the data providers give to the reliability, availability, and performance of the data services that they provide to the SDI (against internal users). Funding, Service Level Agreements, Access Rights increase in complexity with more data providers.
- Current SDI standards do not provide for queries spanning multiple data sources - important for the types of analysis which are a fundamental benefit of a SDI.
- In highly distributed systems security is more difficult to implement and guarantee.
- Performance can be impacted by excessive distribution of the execution of common requests
- In a distributed architecture with large numbers of components, upgrades to interfaces (e.g. to a new version) are difficult, costly, and with significant 'down-time', as all components must be updated.

We recommend a "**Hub and Spoke**" model in which a single 'Spatial Data Hub' consolidates data to the greatest extent practicable, with 'spoke' connections from this to other SDIs and to such data stores as are impractical to consolidate in the Hub. (e.g. for private data, or infrequently used data). The key advantages of this are:

- A consolidated database allows for queries across multiple data-sets, including linking of spatial data to other tabular data that originally had no spatial component (e.g. economic statistics). This enables powerful analyses to be carried out.
- A common security model can be enforced at the Hub.
- Reliability, availability, and performance are superior to a highly distributed model.
- Maintenance & upgrade is much easier .

A refinement of this worth considering is **Distributed Databases** – using spatial relational database management systems (RDBMS) to access a number of databases from a central system, using industry standards that provide for:

- Security
- Queries / analysis across multiple databases
- Distributed transactions
- Use of common business intelligence tools for analysis

Identifying Infrastructure Components – Fundamental Data Sets and Services

Morten Lind,
Special Advisor, Agency for Enterprise and Construction, Copenhagen, Denmark and National Survey and Cadastre, Copenhagen, Denmark

According to the INSPIRE proposal[1], the component elements of a spatial data infrastructure shall include metadata, spatial data sets and -services, agreements on sharing, access and use, as well as coordination mechanisms.

Initiated by the Danish Spatial Data Co-operation Committee in 2003, a cross sector working group was formed with the aim of identifying and revising the concepts of spatial fundamental (or base) data. The working group consisted of representatives from the major public stakeholders in the spatial data community, both at government and at local authority level.

In 2004, the working group managed to develop and publish[2]:

- A general yet simple *definition of the concept* of spatial base data and its components
- A set of *generic methods and principles* on how to identify and categorize spatial data as "reference data", "multi sector base data" or "metadata"

The definitions, methods and principles were developed and refined on the basis of the concepts found in the ETeMII and INSPIRE position paper on reference data,[3] as well as on similar work carried out in Norway and Sweden. As a proof of concept the working group used the methods and principles to identify:

- A *list of reference data sets*, corresponding to the Danish public sector reality.

The presentation will deliver the findings of the work to a wider, European audience and explain how the developed definitions and methods have a general value in the efforts directed at building a European and global infrastructure.

We will define the important functional and conceptual difference between "base data" and the much narrower term "reference data" and give concrete examples of how and why a certain geo-identifier, reference system or base map should be regarded as the latter and not as the first.

In the perspective of public information in general, the presentation will propose a *public data extension* of the definitions and methods, enabling us to analyse any dataset (also non-spatial) as base data and/or reference data

1 European Commission, 2004: "INSPIRE Directive", Article 1 (2)
2 Nytænkningsudvalget vedrørende basisdata, Aalborg 2004: "Base data: Concept and general model for analyzing and classification of base data" (in Danish language)
3 EUROSTAT, 2002: "Reference Data and Metadata Position Paper".

Session: SDI

Thursday 30th June 17:45– 19:00

Meeting Room Hotel Calabona

Using SDI-based Public Participation for Conflict Resolution

C. Keßler, M. Wilde, M. Raubal
Institute for Geoinformatics, University of Münster, Germany

Web-based tools for public participation using maps, often referred to as public participation GIS (PPGIS), gain in importance as the Internet becomes a commonly available source of information. Moreover, public participation has been fostered as a main concept for sustainable development by several international agreements throughout the past years, such as the European Commission's Directive 2003/35/EC (European Commission 2003) or the United Nations' Agenda 21 (United Nations 1992). Spatial data infrastructures (SDIs) provide a suitable environment for the integration of PPGIS applications. In the following, we will discuss how public participation can benefit from an SDI (and vice-versa), and delineate our experiences during the setup of a PPGIS application for the EU project MEDIS (http://www.uni-muenster.de/Umweltforschung/medis).

Public Participation GIS

Due to the reasons mentioned in the introduction, a number of PPGIS applications have been developed by different research groups (such as the Centre for Computational Geography, School of Geography at University of Leeds, UK; Fraunhofer AIS in St. Augustin, Germany; or the Department of Geography and Environmental Development, Ben-Gurion University of the Negev, Israel). The topic of PPGIS has been discussed in a wide range of publications (see Sieber 2004 for an overview). Most of the existing PPGIS tools are hardly adaptable to different use cases because they were developed for one specific scenario. This stands in contrast to the standardisation efforts of organisations such as the Open Geospatial Consortium (OGC) or the International Standards Organisation's Geographic Information / Geomatics Committee, which aim at interoperability between web services for geospatial data. For a standards-based PPGIS application, the exchange of the back-end spatial data and hence the use-case would be easily practicable, especially in an SDI-based data environment. Kolbe et al. (2003) present a prototype for collaborative planning of bike tours which allows users to comment on maps. It retrieves its maps from OGC Web Map Servers. Although this tool has not been developed for public participation, it demonstrates how standards-based applications can serve for the exchange of spatially related information, while being easily adaptable to different use-cases and allowing for a seamless integration into SDIs.

Prototype and Case Study

Keßler et al. (2004) present a prototype, which transfers this principle to the field of public participation. It combines a thread-based forum, comparable to Usenet newsgroups, with a map display. Users can select spatial objects on the map and add them as references to their discussion contributions. The prototype implements the Argumentation Map (*ArguMap*) concept introduced by Rinner (1999), which builds upon discussion objects in a structured debate and geographic objects on a map. The focus of Rinner's work is on the relationships between these two kinds of objects, which build a meaningful web of argumentative and geographic objects as a discussion develops.

Technically, the ArguMap prototype is made up of a Java Applet on the client side and a number of Java Servlets on the server side. Discussion contributions and reference objects are written to a server-side database. The prototype's map component is built upon the GeoTools Lite libraries (http://www.geotools.org/Geotools+1.0+Lite+Project). It allows for the combination of raster maps retrieved from map servers compliant with the OGC Web Map Service (WMS) specification, with vector maps built from ESRI Shapefiles. This combination enables content providers to overlay the current state of an area (oftentimes available from one or more WMS) with plan data from a GIS. Support for the integration of vector data from OGC compliant Web Feature Servers (WFS) is planned for the future.

The development of the Argumentation Map prototype is currently continued within the MEDIS project. This EU funded project aims at developing recommendations for a sustainable water management on Mediterranean islands in light of water scarcity problems, increasing tourist numbers and agricultural challenges. Within the project, stakeholder involvement is one important method for gaining knowledge about existing problems on the one hand and for creating widely accepted recommendations on the other.

The lack of water on the Mediterranean islands leads to conflicts among the citizens, especially those with high water consumption, such as for agriculture or in the tourism industry. Moreover, mismanagement and unfair treatment of different groups of consumers (through different pricing models for private and industrial consumers, for instance) add to the conflict potential caused by the natural water shortage. In this scenario, there are two potential usages for the prototype. On the one hand, the prototype's analysis tools can be used to identify potential conflict areas, identifying the areas with the highest number of discussion contributions. On the other hand, the prototype allows for a collaborative elaboration of conflict solutions. Stakeholders can propose and debate new ways of fair water sharing while directly referring to objects on the map.

The outcome of the discussion, which is usually rather a web of discussion contributions and spatial reference objects, than a consensus, can be used as input for a spatial decision support system. Moreover, it gives municipalities and governmental institutions an idea of the citizens' concerns and problems, and concepts for resolutions might be sketched. Beyond that, affected people are given a comfortable, easy-to-use platform to express their difficulties and ideas.

Benefits of SDIs for Public Participation

The setup of the prototype as described above requires a proper, user-friendly implementation, because most of the users will be lay-persons concerning GIS. Beyond that, data retrieval and integration is a crucial point. Within the scope of the MEDIS project, the usefulness of the prototype is closely related to the quality of the data presented in the map component. Data for the different islands are mostly available as parts of datasets which cover a whole country, the whole of Europe or even the whole world. Hence, the data are mostly not detailed enough, because the actual areas of interest are comparatively small. In addition, many providers of free spatial data do not permit users to publish their data in services on the Web, therefore a lot of the data which were actually at hand could not be used due to license restrictions. Data for the sample catchments on the islands either had to be collected by the project partners on site, or they had to be integrated from commonly available sources such as the free services from the geography network.

For applications such as the ArguMap prototype in the MEDIS scenario, a spatial data infrastructure which offers a data catalogue with detailed information on data availability, granularity, license models and pricing can simplify and accelerate the setup of an application for different use cases. Organisations which want to provide a PPGIS tool on the web do not necessarily have to host any data themselves. Respectively, special data required for an application can be shared within the infrastructure (Williamson et al. 2003, p.18). Such a catalogue becomes even more useful when the scenario area goes beyond national borders, and the content provider has to look for adequate data on different national levels. As the standards developed for geospatial data and services form the technical foundation of SDIs, a better reusability of PPGIS tools compliant with these standards can be achieved. A fast and standardized way of accessing spatial data as provided by an SDI could accelerate project accomplishment and hence help to save time and money.

Beyond the benefits of a SDI for public participation outlined above, integrated PPGIS tools can also help to enhance data quality within the SDI. Users of these tools might detect errors in the spatial data. The tool provides them with an interface to mark these errors and comment on them, to describe an error and possibly even the correction, for example. Future PPGIS tools might integrate ways which allow for sending such detected errors directly to the person or organisation responsible for the data. The contact information can be retrieved from the capabilities documents, in the case of OGC compliant services, or from other metadata. This kind of data reviewing can be integrated into the SDI's quality management (Doucette and Paresi 2000).

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Interoperabilities: the "Service Generation" SDI of Sardinia

R.Vinelli[1], G.Pittau[1], M.Salvemini[2], P.Cipriano[3], S.Pezzi[3], L.Zanella[3]
[1] *Regione Autonoma Sardegna, Cagliari, Italy*
[2] *Università La Sapienza, Roma, Italy*
[3] *CORE Soluzioni Informatiche, Bologna, Italy*

Abstract
"A good building is only as good as its foundation. When the building outlasts its foundation, repair or replacement can be extremely expensive and complicated. Furthermore, the rest of the structure can be severely damaged by foundation failures." [1]

Are OGC, ISO, CEN and W3C sufficient "bricks" to build up a fitness-for-use SDI, at regional level, in Italy?
This answer, within the growing importance of the INSPIRE context, is the core of the paper proposed, concerning the Spatial Data Infrastructure of Regione Autonoma Sardegna.
The main issues of the paper are:

- "real" user needs
- "expandable" services

The new-born Sardinian SDI is based on "real" user needs: an on-going activity of user requirements analysis has been carrying on, and technical framework specifications of the SDI have already been defined.
Requirements are managed by UML Use Case model, to fix series of "real" needs, split them into small "blocks" (packages) and then develop geoprocessing services re-usable in other contexts, by other users.
Web services represent the technical "skeleton" of the SDI: users within Local Authority departments access distributed information through them, according with national rules defined by the Government (Centro Nazionale per l'Informatica nella Pubblica Amministrazione – CNIPA).
For these reasons, the Sardinian SDI project (2005-2007) can be seen as a natural INSPIRE SDIC candidate [2], since it will have been building up on interoperable services, within Public Administration departments at different levels.
The Infrastructure has been heavily designed in a Service Oriented Architecture (SOA) approach.
The service components of the Sardinian SDI, are:

- "Simple" services: represent the "wall foundation level" of the Infrastructure, are those services strictly implemented on OGC technical specifications (WMS, WFS, WCS, CAT, GML, …) and ISO19100 series to share and distribute GI; OGC and ISO represent the basic "bricks" of the Infrastructure
- "Qualified" services: this conceptual level represent the "1st and 2nd level building structure", are those expandable set of geoprocessing services, designed on the needs of "real" skilled users.

Actually, OGC and ISO specifications (and W3C) are extremely helpful (!) but are not sufficient to implement and deploy interoperable services within Public Administration departments.
Thus, "Qualified" (or Domain) services are needed: these services are related to legal procedures run by public administration departments for administrative and technical work (e.g. Environmental Assessment, Building permits, Cadastral procedures, Demographics, …)
Standards for data structures (ISO, DGIWG) and services (OGC) have progressed […], but business enterprise and data access standards are now lagging [3].
In this sense OGC, ISO, CEN, W3C papers ("bricks") should be deeply used within Implementating Rules (INSPIRE) to produce "semimanufactured" examples and products such

as services source components, UML diagrams, XML Schemas, profile and extension descriptors, cost-benefit analysis and legal issues documents, … to distribute and reuse in the European panorama.
This goal is extremely important for Public Sector Information: at regional, national and European levels we need to define Domain Specific Standards for both data and service (technical specifications), within INSPIRE Implementing Rules, to achieve harmonisation and "socialization" of service interfaces.
In this direction, some of the "semimanufactured products" are represented by the "Qualified" services discussed in this canditate paper; these "semimanufactured" are finalised to meet aspects and requirements of low costs, fitness-for-use and productivity.
National domain-specific operational scenarios and use cases (like the ones developed within the Sardinian SDI) represent a possible solution to lead requirements gathering and standards testing & demonstration [3].
In the INSPIRE Implementing Rules phase, European SDICs such as the Sardinian SDI could provide a collaborative organisational platform on specific standards development to specific domains such as Environmental Assessment, Building permits, Cadastral procedures, Demographics.

This proposed paper comes together with the presentation "*Technical design aspects and legislative framework of the SDI of RAS (Regione Autonoma della Sardegna) - How to contribute to European Spatial Data Infrastructure (ESDI)*" [4], taken at the 10th EC-GI&GIS Workshop (Warsaw, 2004).

Web References

[1] http://www.ncat.org/greentree/foundation_1.html
[2] http://inspire.jrc.it/sdic_call/index.html
[3] http://www.geoconnections.org/CGDI.cfm/fuseaction/emergDisaster.home/pgm_id/8/gcs.cfm
[4] http://wwwlmu.jrc.it/Workshops/10ec-gis/presentations/24june_salvemini.pdf

The ECDL-GIS programme. The role of skill certification programme to support the development of ESDI.

Mauro Salvemini, Giuseppe Mattiozzi, Laura Berardi, Pasquale Di Donato
LABSITA - University of Rome La Sapienza, Rome, Italy

Abstract

The GI scientific, academic, professional and industrial communities have paid since some five years a duly attention to the issue of recognition of certification of professional skills and to the accreditation of courses and curricula in GIS (Finchum et all., 2001).
Several ideas have been authoritatively expressed, some of them oriented to the recognition of such need and some of them, mainly based on the difficulty of treating the broad GIS applications, less positively oriented to recognize that need.
The major actors in this debate come from the English spoken native community, thus in US, (Kemp, 1997) (Kemp, 2000) (Obermeyer, 1992) (Obermeyer & Pinto, 1994) (Obermeyer, 1997) due to some specific reasons which may be summarized in: the professional societies functioning system for forming the professional rosters, the coordination among schools and universities in the GIS field and some other general but relevant aspects such as the common language, availability of common geodata, the higher education system itself.
In Europe the professional certification in GIS has been slightly explored during some of the previous conferences of AGILE (Johnson, 2002) and in some EUGISES conferences (Petch, 2000) where the issue of the differences within Europe in approaching the higher education in GIS has been addressed, and clusters of different approaches (GIS/informatics, GIS/topography and geodesy, GIS/social science and planning, GIS/ ITC) have been identified.
Nowadays the UNIGIS (Unigis) offers *de facto* an effective solution at EU and worldwide level for the postgraduate curriculum in GIS. Numerous other academic and industrial initiatives are on the way at the present time and demonstrate the great interest in the sector.
The last five years have been largely characterised by the broad pervasion of GI in the public administration sector at EU, National and Local level, widely demonstrated, just to give the legal framework reference, by the set up of INSPIRE (Inspire) proposed directive which, in the work programme preparatory phase 2005-2006 as far as known at the moment, should clearly address the need of adequate training and education in order to achieve the necessary competencies regarding GI. A real must to let the SDI effectively functioning.
Specially at Local level the importance of professional competency has become a major concern within the GIS community, as demonstrated by some specific activities already put in place by local authorities through courses finalised to give to the employees the adequate skills to treat the electronic information.
The competency of public employees in the ITC applications, which is a crucial aspect of the public administration functioning and of e-government programmes and services, has found in the “core level” professional skills certification the powerful tool for avoiding any problem due to the ignorance and/or misinterpretation of the basic knowledge and techniques applied to IT from the side of internal users.
At the mean time it is well known that the basic or core level competency is requested to functionaries for routinely treating the GI and related services, as it is also well known that the presence of not clearly absorbed concepts and the lack of basic technical skills make the manufacturing process of offering services to external users particularly difficult, time wasting and not effective.
Thus even though there is not an unified effort or set of standards regarding GIS certification and course accreditation, it is largely recognised that at the level of public administration and enterprises aiming to the satisfaction of the public needs there is the same need of having core

level certified skill in GIS, similarly to what is happened for using the computer in the office work. The trend is demonstrated by the success of ECDL (European Computer Driving License, Ecdl) in last seven years.
The ECDL has been conceived by the ECDL Foundation with the express purpose of raising IT skills in industry. Its strong social ethos further requires the Foundation to dedicate itself to providing access for all to the Information Society and raising the general level of computer skills in society.
The ECDL-GIS is part of the specialised ECDL programme which at the moment already envisages ECDL Advanced, ECDL for Computer Aided Design (ECDL CAD) and ECDL Certified Training Professional (ECDL CTP).

In order to offer a programme for professional skills recognition in GI the AICA (Aica) and the University of Rome La Sapienza – LABSITA (Labsita) initiated the development of the programme and the syllabus of ECDL-GIS. It intends to be the new independent international standard for certification of core skills in GIS.
According to the previous discussion about the professional recognition and to the specific aspects of the GIS skills it immediately appears that students and professionals seeking an internationally recognised qualification to certify their current core GIS skills should demonstrate a robust knowledge of basic principles governing the GI techniques. This peculiar aspect gives to ECDL-GIS the flavour of a certification aiming to verify the capacity by the student and/or the professional of having the tools for operating on and with the GI and related information.
The basic theoretical knowledge acquisition and certification has also a positive impact on the use of the proprietary software and avoids any conflict with educational and training programmes developed by academicians and vendors finalised to skill users in GI science and techniques and for specific functionalities of proprietary and open source software.
The general structure of the programme has been designed with three major levels: core, advanced and professional. The second and third levels has been planned in order to meet the certification market needs.
The ECDL-GIS Core certification, which is here discussed, can provide the basis towards further studies or professional development in GI&GIS and related fields such as SDI and system design. The aim of the programme is to build a concrete benchmark for GIS user skills based on a vendor neutral certification.
The process of developing such as programme already started with an initial Italian WG formed by experts and professional in GIS and experts in ECDL programmes in order to produce within the first quarterly of 2005 the first draft of the programme with the syllabus and the related documents in order to allow the official launch of the programme at least in Italy within the 2005 first half.
ECDL–GIS will certify that an individual who has successfully completed the qualification has the skills and ability to use and to treat the geographic information and to use a standard software and features of GIS applications.
The programme will span during 2005 in the test-bed phase and final implementation. This will give the opportunity to create the necessary EU dimension and to verify the relationships with some EC initiatives particularly with INSPIRE. Regarding INSPIRE and related actions which will take place at national and EU level it is clear that a relevant effort will need in terms of creating in terms of basic knowledge, vocational training and operational expertise specially in public administration in order too achieve the final tasks of setting up an SDI at EU level and to insure the circulation of data which are rated in the INSPIRE Annexes. It has to be considered that the strength of the ECDL-GIS Core programme and certification is only one of the module in which the ECDL-GIS intends to shape the sustainable future developments of the ECDL-GIS programme which may foresee other certifications finalised to certify specialisations in the GI dominion and in some other application oriented dominions. The path ahead, once the ECDL approach and praxis is accepted , will follow the developments already successfully

experimented. One simple and crucial aspect ECDL-GIS wants to address and solve: to avoid that the intelligent and effective use of GI and related systems, specially in the public administrations, should be inhibited by the absolute lack and/or the imperfect understanding of the basic expertise about data and techniques. Unfortunately how many resources have been wasted for the previously mentioned reasons is largely demonstrated day after day by the analysis conducted on GIS, on GI and e-government applications which find in an insufficient basic expertise of the humans the most relevant gap.

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Unigishttp://www.unigis.org/

Session: Managing GI Objects and Rights

Thursday 30th June 17:45– 19:00

Hotel Carlos V

'NMCA's and the Internet II – eDelivery and Feature Serving' Report on Joint EuroSDR/EuroGeographics Workshop

Peter A. Woodsford[1], Claude Luzet[2], Manfred Endrullis[3] and Graham Vowles[4]
[1]*EuroSDR , Cambridge , UK*
[2]*EuroGeographics , Paris, France*
[3]*BKG, Leipzig , Germany*
[41]*Ordnance Survey , Southampton , UK*

The Workshop, 23-25 February 2005, was jointly organized by EuroSDR and EuroGeographics and held at the Bundesamt für Kartographie und Geodäsie (BKG), Frankfurt, Germany, primarily in support of the EuroSpec project. EuroSpec underpins a move by European National Mapping and Cadastral Agencies (which term includes NMA's, CA's and NMCA's) to focus on 'interoperability', both business and technical. This involves a shift from 'product' to 'service' and from 'centralised' to 'decentralised' infrastructure. EuroSpec will enable NMCA's to play their role in INSPIRE and to meet the requirements of users with pan-European needs.

The aims of the Workshop were to establish the state-of-the-art and near term expectations/plans in electronic delivery of geographical information and to support the EuroSpec project by initiating an in depth survey of practice and plans in contributing NMCA's. Rather than cover all the standards and technologies involved the technical focus was on two key areas that are fundamental to the realisation of EuroSpec and that are currently undergoing rapid development – Digital Rights Management (DRM) and Schema Translation. The work of the OGC GeoDRM Working Group on a conceptual model was described together with the more practical work the Web Pricing & Ordering Service (WPOS) and the XML Configuration & Pricing Format (XCPF). Schema Translation and Translating Feature Servers have moved from the prototyping stage to first release software of industrial strength – one such example was described.

Sessions were also held on current examples of spatial eDelivery services in operation by NMCA's and by related organizations (services to academia, the geosciences, a regional SDI). These covered best practice in the modes (ordering, ftp, map serving, feature serving,...) and forms of delivery (take up of GML, other formats,...) . A session on pilots and plans covered a distributed national metadata service (*geocat.c h*), an Ordnance Survey OS MasterMap project involving 22 partners and the Federal German *GeoPortal.Bund* . More details of these services will be presented in the full paper.

Breakout sessions addressed issues of current practice and 'What does an SDI require of its constituents?' Conclusions arrived at included:

- Big variations exist in underlying business models, esp. between joint NMCA and separate NMA and CA
- Map serving is well established, using proprietary or open technologies
    - How many are readily interoperable?
    - Is there a 'quick win' linking interoperable web mapping services?
- Available screen maps are largely free, for advertising, locating, and as a public service
    - Free as data is there is still the issue of liability and intellectual property ownership
- Gazetteer capabilities are also important for discovery
- Feature serving still in early stages
    - uncertainty over charging
    - different data models

  - feature identity is a key topic, as is feature definition
- Data models - issues in addition to structure are:
  - meaning,
  - agreement over minimum content,
  - quality information
- There is a strong desire to serve data to range of application schema
  - Means of adding value/distinguishing services
  - Schema translation is an important area
- Charging mechanisms and DRM are hot topics
  - Designing charging in as an afterthought would be a mistake
- Crossborder issues are
  - delimitation of boundaries, and edge-matching
  - content
  - level of detail
- Technical infrastructure is a long term investment, business drivers are short term
- Some groups seem to have built distributed architectures successfully others seem to have problems
  - Perhaps the issue is cultural – the will to collaborate?
- Public-private partnerships, do they exist?, do they work?

Finally, in pursuit of the Workshop's key deliverable, Manfred Endrullis presented the framework of the questionnaire under the headings of Services (Metadata Catalogue Service, Web Map Services, Web Feature Services), Digital Rights Management, Data Model, Schema Transformations and Pricing Model. Many suggestions for clarifications, extensions and deletions were offered from the audience, collated and consolidated into a questionnaire that will form a starting point for the work of the EuroSpec Distributed Services Architecture and Information and Data Specifications Expert Groups. The questionnaire is being put to all the NMA's and NMCA's in EuroGeographics – work-in-progress that will be reported in due course. Notwithstanding jokes about 'design by committee', the pooling of the experience and insights of the Workshop participants should provide a firm foundation and hopefully avoid the 'if only we had asked that/ asked it that way' post-questionnaire syndrome.

References:

The full proceedings of the Workshop are available at the Workshop website:
http://www.laser-scan.com/eurosdr/edelivery/ and via EuroSDR at www.eurosdr.org

Managing and Serving Large Volumes of Gridded Spatial Environmental

A. Santokhee[1], C.L. Liu[1], J.D. Blower[1], K. Haines[1], I. Barrodale[2], E. Davies[2]
[1]*Environmental Systems Science Centre (ESSC), University of Reading, United Kingdom*
[2]*Barrodale Computing Services Ltd., Victoria, Canada*

Introduction
Modern computer simulations and satellite observations of the oceans and atmosphere produce large amounts of geospatial data on the terabyte scale. These datasets are very valuable to the community as a whole, for scientific research, directing government policy and operational activities such as aviation, search and rescue at sea and oil spill mitigation. ESSC serves operational Met Office and ECMWF marine forecast data to the UK science community and the EU MERSEA community.

At present, most of these datasets are in the form of files with large four-dimensional spatio-temporal grids containing data about many variables such as temperature, salinity, velocity, sea level and concentration of chlorophyll and nutrients. Our current operational data system contains 2 TB of data stored in a number of common file formats. The data are discretized on a number of different grids including standard lat-lon-depth grids of different resolutions and grids that are rotated relative to the Earth coordinate frame, as used by various marine forecast models. Through Web Service and OPeNDAP interfaces, the data consumer is insulated from this complexity: he or she needs to know very little about the internals of the data store in order to extract just the data that are required, in the desired resolution and file format.

The purpose of this work was to investigate whether we could manage and serve our data more efficiently by storing the underlying data in a database, rather than as a large fileset. This review will compare three systems: the well-known OPeNDAP aggregation server[1], a Web Service system called GADS (Grid Access Data Service[2]) and the Grid DataBlade[3] from Barrodale Computing Services. The Grid DataBlade is a plug-in for the IBM Informix database[4] that allows gridded data to be stored in an object-relational database management system (O-RDBMS), with the capability of performing many common interpolation and transformation operations on the server. The application of database technology to gridded spatial data is relatively new and this work represents one of the first systematic investigations into its merits.

This paper describes the characteristics of the different management systems. It then reports on a controlled set of data extraction comparisons designed to compare performance. Issues of metadata management are also addressed.

File-based systems: GADS and OPeNDAP
One of the primary motivations behind the original development of GADS was the desire to have a SOAP Web Service that could deliver the same capabilities as the popular OPeNDAP system. Therefore the systems are similar in many ways: they both support basic subsetting, resampling (e.g. one can extract every fifth data point to reduce data volume) and aggregation (i.e. multiple source data files are made to look like a single large file). Neither currently support rotation, re-gridding or interpolation on the server side, which was a key motivation behind this comparison with database technology.

Both GADS and OPeNDAP store their data as files in the host file system. For GADS, these files can be in NetCDF, HDF4/5 or GRIB format, whereas our OPeNDAP server only understands NetCDF files. The main difference between GADS and OPeNDAP lies in the interface: GADS provides a SOAP Web Service interface, whereas OPeNDAP provides a URL-based interface.

Database system: The Grid DataBlade

The Grid DataBlade stores gridded data, as well as the metadata associated with each grid, as SmartBLOB objects in the host Informix database. SmartBLOBs can store much larger amounts of data than traditional BLOBs (up to 4TB in theory, but only ~0.5 GB in our particular installation). It is possible to access and modify the content of a SmartBLOB without having to extract the entire BLOB from the database. This property can have a significant impact on the time required for data extraction.

The Grid DataBlade supports a rich feature set. It handles 1D, 2D, 3D and 4D grids and stores data using a tiling scheme, with user control over the tile size. This allows efficient generation of data products that involve only a small portion of the data. Recently-extracted tiles are stored in a cache, so that future queries on the same portion of data are faster. It stores data in, and converts data between, more than 40 different planar mapping projections supported by the IBM Informix Spatial DataBlade. It supports irregularly spaced grids in any or all of the grid dimensions and handles the presence of multiple vector and/or scalar values at each grid point. Importantly, it provides several options for interpolation, including N-Linear, nearest-neighbour or user-supplied schemes. This permits data to be extracted at oblique angles to the original axes. Additionally, data can be rotated in a plane. All of these features can be accessed via C, Java or SQL APIs.

Comparison between the spatial data management systems

There are a large number of ways to evaluate gridded spatial data management systems (GSDMS) and it is impossible to define authoritatively which system is “the best”. Different applications will require different approaches: for example, one application might require the fastest possible data access times, whereas another application might require greater flexibility and server-side functionality.

A key criterion for evaluating GSDMSs is the time required to extract a certain volume of data from an archive and re-package it as a new file, ready for download. We performed test extractions of data from the UK Met Office operational North Atlantic marine forecast dataset, which has a total size of 100 GB. The data are stored under GADS and OPeNDAP as a set of NetCDF files and another copy is held in the Informix database. Our tests involved extracting data from a dataset that spanned a number of source data files; the servers extract the necessary data, then aggregate the data into a single file, ready for download.

We tested many parameters that control the data extraction time, including the size of the extracted data, the number of source files used in the extraction and the shape of the extracted data volume. All of these results will be presented in the full paper. To summarise, we found that in general, for extracted data volumes below 10MB, the database outperformed GADS and OPeNDAP. Above this size, GADS was generally found to be capable of the fastest extractions. The performance of the DataBlade decreased dramatically when attempting to extract more than 100MB of data in a single query. Our OPeNDAP installation was found to be consistently much slower than both GADS and the DataBlade.

The reasons for this wide range in performance are due partly to design and partly to implementation. The Grid DataBlade is optimised to support its entire feature set; in particular, it is optimised to retrieve relatively small (a few tens of megabytes) of data rapidly in the case where multiple users are querying the database simultaneously. According to our tests, its internal logic becomes inefficient for larger data volumes. The marked difference between the performances of GADS and OPeNDAP may be partly attributed to a difference in the version of the underlying Java NetCDF library[5]: the version of the library under GADS is newer and much more performant than the older one used by the latest version (beta) of the OPeNDAP aggregation server.

Metadata management

A key component of any data store is its handling of metadata. Metadata is necessary for the server to locate the source data on its disks, and for external users to discover information about the data holdings. GADS can store its metadata in an XML file or in a relational database; the latter option provides much faster access to metadata for large data holdings. GADS' metadata also provides a mapping to allow the data to be exposed with standard names for variables, even if the source files contain non-standard names, aiding discovery. OPeNDAP stores its data in an XML file that does not allow this mapping. In both systems, the metadata must be updated manually, although an automated tool for GADS is in development.

The Grid DataBlade, by contrast, manages its own metadata automatically. When data are loaded into the database (data are always loaded from GIEF files, which are a special form of NetCDF files), the metadata is automatically read from the GIEF file and loaded into the database. Currently the database does not enforce any compliance with standards, so effort must be made to ensure that the source GIEF file contains the correct (standard) names for variables, axes etc.

Ongoing and future work

We are actively monitoring latest developments in standards for metadata and data serving in order to be interoperable with as many groups as possible. We intend to update the GADS server to be compliant with the OGC Web Coverage Server. Barrodale Computing Services have recently produced a version of the DataBlade that plugs into PostgreSQL[6] (an open-source O-RDBMS) instead of Informix; we shall be evaluating this.

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Management of geographic information and knowledge (research project for ISPIRE implementation in the Czech Republic)

Karel Charvat[1], Stepan Kafka[2], Milan Kocab[3], Milan Konecny[4], Karel Stanek[5]
[1]Help Service – Remote Sensing, Benesov u Prahy, [2]Help Service – Remote Sensing, Benesov u Prahy, [3]VUGTK, Zdiby,[4]Masaryk University, Brno, [5]Masaryk University, Brno

The project "Management of geographic information and knowledge (SPRAVADAT)" is focused on issues related to distribution, integration, extension and commercial exploitation of existing state core geodata resources. To core geodata resources in the Czech Republic belongs Digital real estate cadastre, ZABAGED (geodatabase equivalent of the state map 1:10000) and SM5 (fusion of selected features from previous databases with orthophotomap 1:5000). Main motivation for SPRAVADAT is implementation of INSPIRE principles in design of geodata warehouse of the Czech Office for Surveying, Mapping and Cadastre (CUZK).

SPRAVADAT is composed from three parts which try to find solution for:

1. accessibility – this part is devoted to implementation of service based on OGC standards. To supported services belongs WMS, WFS and WCS. Beside data services is possibility of implementation of analytical services tested. From technological point of view core of the service is created over open source technologies UMN Mapserver, GRASS and PostgreSQL. Already existing geodatabases are stored in heterogeneous environment composed from technologies of ESRI, Intergraph, Bentley and Oracle. Level of an implementation of the OGS standards in various platforms is evaluated inside of the project. Important role in this part play solution of security issues, especially in connection with WFS and WCS services.

2. Interoperability – another crucial point of the INSPIRE implementation is interoperability of geodata. In this part are solved issues of spatial reference transformations, semantic interoperability and data quality description. According spatial reference in the Czech republic is situation complicated by coexistence of three different projection and coordinate systems and recommendation of the Eurogeographics adds to this list three another ones. The semantic interoperability consist from ontological issues and handling with cartographic generalisation impact on geodatabases. A granularity of geodata is strongly connected with quality issues which also includes various aspects of data capture processes. A part of quality management inside of the project is an implementation of ISO standards 19113-15 (includes metadata carrying quality information). The interoperability of core geodatabases is tested against another state databases like forest management geodatabase, Europe-wide geodatabases like CORINE and various commercials geodata product.

3. business model and market evaluation – because main purpose for enable of an access to state geodatabases is to support developing of the information society by spatial oriented services is a market analysis. This market analysis includes an evaluation of public demands on spatial data and services and an evaluation of commercial exploitation of core geodatabases. According to state policy to support maintenance of geodatabases from fees linked to their usage is important to create proper business model for services. Possibility to establish fixed payment tariff linked to time period and type of the service. Results of evaluation and proposed methodology can be

interesting also for commercial vendors of geodata services. SPRAVADAT is now in the middle of the project period. In current stage we have completed:

1. basic analysis of geodatabase status
2. basic market analysis
3. proposal of the business model
4. technological issues
5. implementation of ISO standards

The project following experiences and results reached during ISF projects Wirelessinfo and Premathmod. SPRAVADAT is supported by Academy of Science of the Czech Republic in a frame of programme “Information society”, registration number of the project is T2060300407.

Managing and Protecting Digital Rights within a Network of Geo-spatial Web Services

Roland M. Wagner, G. Vowles

Effective geospatial Digital Rights Management (DRM) is about enabling the geospatial web. It enables content providers to publish geographic information in a positively controlled way, and assures consumers that it comes from a trusted and reliable source. Without effective rights management the geospatial web will be like a machine without oil, and the resulting friction means the whole enterprise will grind to a halt.

Whether you provide data for free or for fee your organisation most probably demands managed access to your data for liability, recognition or tracking purposes. Consumers of your information need the assurance and confidence of the authenticity and reliability of the information on which they will be making business and social decisions. Many content providers are have similar operational requirements and drivers and are in the process of developing their own point solutions to these problems. There is a clear case for a standard way to better manage and protect intellectual property within the geospatial web. The Geospatial Digital Rights Management (GeoDRM) Working Group has been set up by the Open Geospatial Consortium (OGC) to address these business critical issues.

The first part of this paper reviews the work done by the GeoDRM Working Group, including the simplified GeoDRM Abstract Rights Model (ARM) and how this has influenced the design of the GeoDRM Framework. The second part of this paper covers the on-going GeoDRM Working Group Programmes. These topics and the outcomes from the GeoDRM Working Group will have relevance and impact for Spatial Data Infrastructure designers and operators.

The GeoDRM Working Group was established at the OGC Meeting in Southampton, June 2004. Activity within the working group is divided between connected business and technical tracks: The business track covers business models and requirements and contributes to the development of the GeoDRM Reference Model; The technical track covers access control and trading functionalities, implementation specifications and embedding concepts and contributes towards the development of the GeoDRM Framework.

We have initiated three specific Programmes to address immediate GeoDRM needs in 2005:

Programme 1: GeoDRM.Demonstrator (authentication, authorisation, rights)
Programme 2: GeoDRM.OWS3 ("click-through" mechanisms)
Programme 3: GeoDRM.InteroperabilityExperiment (authentication, authorisation, pricing & ordering)

Programme 1: GeoDRM.Demonstrator was initiated to build an expert community, for further education and to demonstrate possible interoperable approaches. The demonstrator used an OGC Web Mapping Service as a content source and added the functionalities for authentication and authorisation to protect the service. A second approach focuses on rights expression languages. The Programme was started at the New York meeting in January 2005 and finalised at the April meeting at the European Space Agency in Frascati.

Programme 2: GeoDRM.OWS3 is for the development of a "click-through" license mechanism within the scope of the OGC OWS3 Interoperability Testbed. This mechanism will show users the license text before access is allowed. The architecture will support cascading and therefore multiple licenses protected sources. Example applications for this capability are a disclaimer of warranty, or the exclusion of data for navigation. The Programme was started in April and will be finalised in October 2005.

Programme 3: GeoDRM.InteroperabilityExperiment to continue the work items of Programme 1 and to add the GeoDRM pricing & ordering functionalities for electronic trading and implement the initial GeoDRM Framework. This Programme is in the initial planning phase and is tentatively scheduled for to run between June and November 2005.

The overall goal for 2005 is to deliver a set of draft implementation specifications for these initial GeoDRM functionalities in a consistent and compatible form to feed into the OGC standards definition process.

Consider the implications for your organisation? How might the emerging GeoDRM framework standard enable you to do new business in new ways? What are the implications for building and operating a sustainable Spatial Data Infrastructure?

Session: SDI Regional/Local

Friday 1st July 09:00 – 10:45

Meeting Room Hotel Calabona

INSPIRE: a driving force to promote the gathering and the use of geographic data within public authorities?

Jonathan Deckmyn[1], Jiri Hiess[2]
[1]*Ancitel Sardegna, Cagliari, Italy*
[2]*Vysocina Region, Jihlava, Czech Republic*

The fact that very few (small) local authorities understand the meaning or the value of a "Spatial data infrastructure" is a problem for the success of the INSPIRE program as one of the principles says that data should be collected at the level where this can happen most efficiently. Various studies show that the value of Geographical Data within the Public Sector Data is very consistent. The data that contributes most to this value on the local level, are probably not the environmental data upon which the INSPIRE work program is focussed – although one can hardly argue about its importance – but are data that regard addresses, public works, traffic information, health services, education, etc.

Although many recognize the importance of these issues which require an integrated and transversal approach regarding the use of geographic data and tools, most local authorities that have adopted GIS solutions are still using it exclusively – probably due to the lack of a geospatial culture in other departments and to organizational problems –in environmental or urbanistic deparments limiting as such the full potential and, as a consequence, the return on investments. INSPIRE aims to stimulate the (re)use of spatial data and/or services and focusses strongly on data definitions (metadata, open formats) and technological issues (spatial data services, network services) as far as it regards spatial (environmental) data. This approach is probably the reason of the limited involvement/interest of local authorities.

Theories about the consumer adoption process teach us that to pass from the « first hearing » to the « final adoption » a customer goes through six stages : unawareness, awareness, interest, evaluation, trial and adoption. Taking an optimistic point of view and considering the high number of requests for information regarding GIS in general (including SDI, INSPIRE, software, etc). one could state that many local authorities are in the phase of awareness, some of them are interested and some are even evaluating the implementation of GIS-based services and/or geospatial databases. The few that reached the « trial » phase are often struggling with the lack or the bad quality of the existing data (which is in many cases NOT geographic). The rule garbage-in-garbage-out becomes a threat to the innovators who in their effort to add or to valorize the spatial component of existing data, often highlight the problems (errors, uncomplete information, etc.) present.

The goal of INSPIRE is to adopt good data management techniques, common specifications and common systems in order to overcome this problem but these regard only geographical data. Unfortunately guidelines about evaluating data quality and about gathering (not spatial) data are often not available (or not known). Without diminishing the importance and the value of the INSPIRE related actions, it is important to stress that the real value of geographic data cannot arise fully without taken the spatial data out of its niche market and bringing it, with the support of « eGovernment architects », into the mainstream which is the public sector data as a whole. Some local authorities are trying to do so and would be happy to be backed by INSPIRE.

Local SDI in France

Yves Riallant
AFIGéO France

The development of the geographic information leans on numerous actors, to begin with regions with a measure of autonomy: municipalities, EPCI, general advices and regional councils. Also services decentralized by the State, in charge of thematic missions (agriculture, environment, health, equipment, security …) are present in regional and local levels. Finally the actors adorned public, consular rooms (chambers), public establishments and trade organizations are particularly present and dynamic actors.

In the current context of the decentralization, the need of animation and exchange is felt even more sharply :

- This current reform is going to transfer new missions to regions with a measure of autonomy, strengthening their weight of local actors and will identify more the production of geographic information which they make through their missions,
- The necessity of dialogue among the local actors, services decentralized by the State and the regions with a measure of autonomy will lean mainly on exchanges of localized information, which will ask for an organization ad hoc to administer as relations among actors as created streams.

The initiatives of assembling of the actors of the geographic information in the regional scale multiply for several years. Configurations and objectives of structures or "dynamics" which appear are strong different. AFIGéO will organize on June 09 and 10 fellow man in Poitiers the 1st seminar of meeting of regional dynamics in Geographic Information This meeting has to allow all what feel concerned to exchange experiments, points of view, doubts and common problems. It will be opened to all those and in all what already participate in a structure in functioning, and in those that think about the question. Better to know his neighbors, to identify forces and weaknesses of existing structures, to work on common problems as many points as it is better to land together.

Our association sees in this action an effective means to go to the sense of the development of the sector of the geographic information. Objective is to offer to the actors of the ground a frame of exchange and debate. The set of regional dynamics is invited to participate in this 1-st seminar: associations, agreements between services of the State, agreements between communities, mixed agreements Etat / communities, structures in the course of assembly … Seminar will be welcomed with the IAAT (Atlantic Institute of Regional development - Poitiers), regional dynamics historically pioneer, who (supports the AFIGéO in the organization of this meeting.

This meeting will take place on two days. A first day intended for the presentation of current steps. On the basis of a common weft but which will leave a wide part with the free description …), every existing structure or in questioning will appear at the others. If several steps(methods) coexist on the same regional space, they will be quite invited. A second day will be dedicated to technical working workshops. Workshops will begin with an intervention of centring assured(insured) by one of the participants according to its appropriate competence, or by an external expert if necessary, followed by a collection of experiences(experiments), reflections, possible demonstrations, lists of questions etc.

Implementing an SDI for Flanders, instruments and concerns

D. Vanderstighelen[1], B. Cosyn[2]
[1]Programmanager SII OC GIS-Vlaanderen, Gent, Belgium
[2]Programmanager SDI OC GIS-Vlaanderen, Gent, Belgium

In 1994 a collaborative framework called "GIS-Flanders" has been setup for the use, the exchange and the collection of geographical data in Flanders. The Support Centre GIS-Flanders (started in 1995) is in charge of the organisational and technical support of the collaborative framework. GIS-Flanders is aware of the international evolution on the use, management and delivery of geographical data. Spatial Data Infrastructures arise at different scales. Many SDI initiatives evolve at different levels at different scales, regional, national and international SDI's but also in cities, communities, provinces and organisations of all kind. But not all organisations working with and building up geographical data feel the need to implement this kind of infrastructure. The Support Centre has a role to play as initiator of similar initiatives within the Flemish GI-community but will also become an "SDI hosting" organisation for members of the collaborative framework without their own SDI.

Besides the setup of a Spatial Data Infrastructure as a technical solution, it is important to make the infrastructure being explored, being used. Customers of the infrastructure must be assisted in their exploration of the infrastructure.

The setup of a Spatial Data Infrastructure for Flanders can count on 3 important instruments: (1) a legal framework, (2) a support centre (3) reference data and metadata.

Since 2000 a legal framework on Geographical Information in Flanders is put in place. It imposes the collaboration between the members of the framework and promotes collaboration with partners. Members of the framework are ministries, public agencies, provinces and communities. A steering committee is put in place to supervise the activities. All members of the collaborative framework are imposed to exchange reference data, thematical data and metadata.

A support centre (GIS-Flanders Support Centre) takes care of the day by day activities and is responsible for the administrative and technical support of the framework. The Support Centre is in charge of the setup of the SDI for Flanders. Based on years of experience one felt the need to take special care of the way members (customers) can or will make use of the infrastructure. The implementation of the infrastructure is the key for the success of the SDI. A clear differentiation is made between the technical solution to come to a Spatial Data Infrastructure and the real use and implementation of the service delivered by the SDI. Therefore a Spatial Information Structure has been set up. The Spatial Information Structure behaves as a shield for the SDI and plays the role of translator for the SDI consumers. It protects the behaviour of the SDI from fragmented information from consumers and filters for the SDI consumers the large amount of information coming out of the SDI. It instructs on how to use the SDI and sets up procedures and regulations so that communicating with the SDI leads to a structured exchange of information. The Support Centre, as agency, is organised similar to this principle of implementing an SDI. One group of collaborators, the SDI programme group, works on the technical solution by focussing on databases and data-models, GI products, services and applications. A second programme group (SII programme) works on the relations between the SDI as a technical solution and the outside world. They focus on research, external relations, implementations by members, agreements with members and the policy on Geographical Information in Flanders.

The SDI will contain reference data such as a large scale dataset and a reference address database (CRAB) that is currently build up. The Large Scale Dataset (Grootschalig Referentie Bestand, GRB) must become the anchor for all kind of activities in the SDI. The collection of the large scale data must be finished in 2013. The reference address database will result in a unique position for an address and must offer to the consumers of the SDI a structured dataset able to add a geographical component to a large amount of address-based databases. Metadata are available and will be restructured in order to fit the ISO19115 standard.

These 3 instruments must facilitate the setup of the SDI for Flanders. On the other hand the setup of the SDI for Flanders will face important concerns or discussion topics: (1) from central to distributed (2) clarification of responsibility on authentication and authorisation

The collaborative framework was setup with the idea of centralizing data, metadata and sharing costs for the collection of digital geographical data. This was the primary objective during the first 10 years. As the amount of data and the amount of know-how increased it appears that this centralisation of data and resources becomes for some of the partners more and more problematic. While for other partners this central system delivers a cost-effective solution for the management of the data. This duality can have an impact on the setup of the SDI because it is difficult to prove in short term the real benefits of a distributed system.

A major issue will be the discussion on who can consult which datasets. Authentication and authorisation is important. The steering committee of the collaborative framework will be in charge of the decisions but due to the enormous differentiation in data and data providers within the framework, this discussion will surely take time. Authentication and authorisation is a major part of the SDI and influences the process of data acquisition. Probably additional legacy should be made to clarify this issue.

IDENA: Spatial Data Infrastructure of Navarre

J.L. Yanguas Urman[1], A. Valentín González[1], M.A. Jiménez de Cisneros y Fonfría[1]
[1]*Government of Navarre, Pamplone, Spain*

Navarre is a Foral Region with roughly 10.500 km^2 and almost 600.000 people which has from long ago a large self-government inside of Spain.

The Government of Navarre has developed a proud effort to produce, integrate, manage and diffuse geographic information which have been a very important infrastructure for social, enviromental, territorial and economic development of the region. In 1975 we have the Topographic Map 1:5.000 with 1498 sheets complet formed and in 1986 it was concluded Cadastral Map 1:5.000 of all region which can apport an idea of development in the past.

The situation became very difficult due to each Department produce a very good geographical information but without coordination nor comunication into each other. In this context, on 19th March 2001 was created the Territorial Information System of Navarre (SITNA, in spanish, Sistema de Información Territorial de NAvarra), conceived to integrate different and scatered territorial information from each Department of the Government, and make them available to users, both users inside the Government and cityzens in general.

SITNA is consolidated now like the territorial component of a corporative information system. Diffusion by Internet (http://sitna.cfnavarra.es) has exceeded two millions guests during past year. Moreover, some other webs have been especially developed for turistic promotion of the Way of St. James (http://www.navarra.es) or to enable management of Comon Agricultural Policy (http://sigpac.navarra.es).

In other hand, Visor SITNA has been developed as the tool with information an profits enough to tasks of management, analysis and reference that is brought in more than 200 units of various Departments with very good results.

Instead of this, we couldn't refer to an Spatial Data Infrastructure understood in the frame of INSPIRE due to:

- A complet catalogue of spatial data and their metadata was not ready.
- SITNA was not configurated in terms of Interoperability.

To resolve these questions, the Permanent of the SITNA's Coordination Commission subscribes the develope of the Spatial Data Infrastructure of Navarre (IDENA, in spanish Infraestructura de Datos Espaciales de NAvarra) in the frame marked by INSPIRE and IDEE (Spatial Data Infrastructure of Spain).

The actual situation of standards and tools for metadata management has allowed us to develope an IDENA profile of metadata which embodies NEM (Spanish Core of Metadata, that is, ISO Core 19115 + Dublin Core + Quality + Aditional elements of NEM) and aditional metadata of IDENA. This profile is used to document all data incorporated in SITNA.

On 9th March 2005, the Vicepresident of the Government of Navarra made a present of IDENA (http://idena.navarra.es) that offers services established by INSPIRE, with the objetive of incorporation during this year data of Annex I and Annex II.

Regione Piemonte SDI (SITAD) faces up to principles and trends in Inspire Proposed Directive and Directive 2003/98

M. Travostino, L.Garretti, S.Griffa,
CSI Piemonte, Turin, Italy
Regione Piemonte, Turin, Italy
CSI Piemonte, Turin, Italy

In the last years Italian national and local public entities have been showing great interest and commitment in developing, collecting and using spatial data and, consequently, the asset of geographic products and services is constantly growing. On the other hand, difficulties arise in harmonizing the different initiatives on technical, organizational and regulatory side: the lack of coordination may lead to duplication of initiatives and economic efforts, non sufficient information, limited diffusion toward citizens and private sector.

SITAD (Sistema Informativo Territoriale Ambientale Diffuso) is the Spatial Data Infrastructure set up by Regione Piemonte. The short paper aims to demonstrate how the main organizational, technical and legislative components and principles of SITAD can be harmonized through a flexible regulatory structure such as the "SITAD General Rules of Use", which may play an essential role in implementing and make effective the general principles of European recent regulations on public sector information and spatial data infrastructure, within the framework of national and local discipline and policies concerning GIS.

Piemonte Spatial Data Infrastructure SITAD is set to collect from public entities geographic and environmental information, products and services in order to put them in an harmonized framework and share them amongst public and private subjects, so that dispersion and duplication of existing spatial data is prevented. SITAD General Rules of Use are the tool which may give a first practical effect to the principles underlying INSPIRE proposed EC Directive, the Directive 2003/98/EC on the re-use of public sector information and Directive 2003/4/CE on public access to environmental information, while the process of implementation in national legislation is on the way.

With regard to proposed INSPIRE Directive we refer, in particular, to: reference and location of existing spatial data, metadata creation and update, quality assessment, integrated services in order to retrieve data, rules concerning access, share and re-use of spatial data, interoperability of spatial data sets and services, establishment of network services for spatial data sets. Concerning Directive 2003/98/CE we evidence in particular: commercial and non-commercial re-use of documents of public entities, setting of assisted techniques for retrieving documents, such electronic lists, Internet websites portal linked to contents databases, use of standardized licensing contracts.
In particular, it will be demonstrated how the SITAD General Rules of Use are useful in order to implement the basic provisions which discipline the operational framework of such spatial data infrastructure, with special regard to agents and activities they may perform within the system.

In conclusion, the Government of Navarre has a large experience with geographic information and now IDENA is the result of the organization and information available in SITNA. IDENA is another way inside of SITNA to diffussion and access to geographical information of Navarre in the frame of culture, standards and interoperability defined by INSPIRE.

MORE: an SDIC on Monitoring and Reporting

M. Salvemini, P. Di Donato, D. Vandenbroucke
1LABSITA University of Rome La Sapienza, Rome, Italy
2Katholieke Universiteit Leuven, Research & Development Office, Spatial Applications Division (SADL), Leuven, Belgium

GI&GIS permeate the Information Society and penetrate on one hand a growing number of academic subjects, on the other hand the mainstream business. Awareness on the crucial role of GI&GIS for the socio-economic and political growth of Europe is by now high. INSPIRE is just one of the latest, but important, demonstration of this situation.

It is also well known that GI&GIS became since some years a common tool in Public Administrations to support their activities especially in terms of territorial and environmental management and planning, and for services provided to the citizens. Local Public Administrations, being among the largest producers and users of GI&GIS, are going to play a crucial role in the development and implementation process of INSPIRE and the ESDI. It will drive the technical and scientific developments, and will help to monitor GI&GIS use and diffusion among the near 100.000 European Local governments.

In order to support the future implementation of INSPIRE, a work programme of preparatory actions has been defined by the Commission which includes the establishment of Spatial Data Interest Communities (SDIC). Spatial Data Interest Communities are expected to bundle the human expertise of users, producers and transformers of spatial information, technical competence, financial resources and policies, with an interest to better use these resources for spatial data management and the development and operation of spatial information services. SDICs are expected to contribute to the drafting, reviewing and testing of the INSPIRE Implementing Rules or any related activity such as monitoring and reporting.

The Spatial Applications Division of Leuven (SADL) from the Research and Development Office of the Katholieke Universiteit Leuven, Belgium and Labsita (Laboratorio di Sistemi Informativi Territoriali ed Ambientali) from the University of Rome La Sapienza, Italy, have proposed jointly an SDIC for monitoring and reporting the implementation of the INSPIRE directive, with the aim to address the already mentioned scientific and technical issues.

The SDIC, named MORE (MOnitoring and REporting) is based on the experience from the activities of both organisations and further developments in close collaboration with all interested organisations and/or experts in this field. SADL started in 2002 to study the State of Play of the National and Regional Spatial Data Infrastructures in 32 countries in Europe. SADL is currently working on the last update of these reports and will give some recommendations to the Commission for the implementation of the Directive. LABSITA, a research laboratory of the Department CAVEA – University of Rome La Sapienza, has been/is active in investigating GI & GIS use and diffusion in Italian local authorities and has proposed in different conferences the idea of a European Observatory to monitor and report GI&GIS use and diffusion in Europe.

The mission of MORE is to help to define implementation rules for Monitoring and Reporting the implementation of the INSPIRE Directive by 2007: in order to fulfill this mission, the State of Play study will be a starting point. The main foreseen activities may be summarised as follows:

- An analysis of existing monitoring and reporting activities will serve to identify possibilities for automated indicator collection and will assess the relevance of some indicators in terms of distance to target.

- On this basis series of indicators and monitoring mechanisms will be drafted and an implementation schema proposed.
- Focusing on various aspects of costs and benefits related to a better sharing of spatial data and services across themes within a region or MS, including cross border effects.
- Close collaboration with EC and INSPIRE Drafting Teams (DTs) in order to tailor activities, indicators, monitoring mechanism to the specification produced "*in itinere*" by the DTs.

The SDIC will organize supporting activities for experts of the drafting teams in the field of monitoring and reporting the implementation of the INSPIRE directive. Activities that will be organized are, amongst others: working meetings with the members of the SDIC and experts of the drafting team, the organization of workshops to bring together stakeholders in this field and to discuss the way common practices and methodologies could be applied, collection of reference material, assisting experts to elaborate indicators for monitoring and the specifications for doing so and training initiatives.

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Session: SDI Architectures

Friday 1st July 09:00 – 10:45

Hotel Carlos V

Developments in Open GIS Standards for Met/Ocean Data

K. Millard (1), A. Woolf (2), G. Ross (3), F. van der Wel (4), R. Longhorn (5)

(1) HR Wallingford Ltd, (2) CCLRC e-Science Centre, , (3) Met Office, (4) Royal Netherlands Meteorological Institute, (5) IDG Ltd.

This paper reviews a number of developments in GIS standards for interoperability of met/ocean data. The timeliness and synergy of these projects indicates a renewed interest in establishing a broad interoperability agenda for the earth system, spurred on by emerging standards for geographic information and services. In particular it emphasises how these impact on the development of INSPIRE:GMES linkages in the marine domain and how these are being addressed as part of the MOTIIVE project.

The objective of MOTIIVE is to examine the cost benefit of using non-proprietary data standards. MOTIIVE addresses the harmonization requirements between the INSPIRE core data component "elevation" (terrestrial, bathymetric and coastal) and INSPIRE marine thematic data for "sea regions", "oceanic spatial features" and "coastal zone management areas". The proposal stresses analysis of the cost-benefit implied by strong harmonisation between "core" and "thematic" INSPIRE data, while fulfilling the infrastructure requirements of the GMES "Ocean and Marine Applications" theme, already being determined by GMES Service Element (GSE) pilot projects. The aims of the project are to produce application
instances of a series of OpenGIS specifications and use this to support a fully qualified business case for creating a formal OGC Working Group for Marine Data

MOTIIVE extends the work of EU-Funded project MarineXML that has investigated the potential for marine data interoperability using XML and GML technologies. In particular it appraised conceptual models and a GML application schema (the Climate Science Modelling Language, CSML) for a range of met/ocean data types have been developed by the UK project, NERC DataGrid. The CSML data model provides an abstraction layer to facilitate delivery through services such as the Open Geospatial Consortium GIS web services. This approach is also deployed across the heterogeneous curated archives of the British Atmospheric Data Centre and British Oceanographic Data Centre.

A WMO (World Meteorological Organisation) expert team with contributors from 5 European countries has been developing a meteorological community profile of the metadata standard ISO 19115. The team is also working on a feature catalogue under ISO 19110 which describes as feature types and coverages, the content of WMO bulletins and forecasts which are distributed in real time around the world. This work is part of WMO's FWIS development (Framework for a WMO Information System).

Finally, COST-719 is an action in the ESF (European Science Foundation) framework aimed at enhancing and broadening the potential of GIS in the fields of climatology and meteorology. One of its Working Groups is concerned with storage and exchange standards for such data. Focus is especially on monitoring developments within WMO-CBS and the OGC consortium, but also on ambitions within the EU.

A Service Oriented Approach for Geographical Data Sharing

L. Vaccari[1], A. Ivanyuckovich[2] and M. Marchese[2]
[1]*Provincia Autonoma di Trento, Trento, Italy*
[2] *Department of Information and Communication Technology, University of Trento, Trento, Italy*

1. Introduction Recently, the domain of geographic information has experienced a rapid growth of both computational power and quantity of information. Moreover, there is an increasing necessity to share this information between different stakeholders (departments in public administration, professionals, citizens, etc) and diverse information systems in order to enable a coherent and contextual use of geographical information. This necessity is at the basis of a number of international and national projects, among which: (1) INSPIRE [1] that list among its main objectives: "*geographical data shall be made available for access and view free of charge by citizen and other users, with delivery, downloading and re-use on harmonized terms and conditions*; (2) the Italian "LABSITA", "Centro Interregionale" and "Intesa Stato Regioni" projects [2], focused on the issue of interoperability among existing geographical databases and related administrative procedures managed by local administrations. Furthermore, at the local level, there are specific projects that have to be coordinated with these higher level projects: for example the internal publication of the geographical data and metadata, the support to the formal exchange of the data with other public administrations within intra-departmental administrative procedures (like the Environmental Evaluation Procedure – "VIA: Valutazione di Impatto Ambientale"). It is important to reach these objectives using both the overall framework developed in European and national project and the most innovative technological framework and software architectures available at present.

In this paper, we propose a service-oriented architecture (SOA) for the interaction of legacy Geographical Information Systems (GIS) and implementation of value added data sharing services based on standard web services protocols. In particular, we base our proposed architecture both on the standardization effort carried out by the Open Geospatial Consortium (OGC) [3] and on current state-of-the-art Web Service middleware infrastructure. We have been experimented with the proposed architecture in the context of GIS application integration in a departmental back-office scenario. The advantages of a service-oriented architecture are twofold: on one hand, it is possible to integrate several GIS application and data sources simply by wrapping their (legacy) services with appropriate interface and registering them in Web Service directories; on the other hand, this new service paradigm can be used to support the creation of completely new cartographic data sharing services.

The remainder of this extended abstract is organized as follows. In Section 2 we review current OCG specification addressing the GIS interoperability problem. In Section 3 we review the Service-Oriented Architectural model. In Section 4 we sketch the functionalities of the integrated GIS applications based on SOA (a more detailed description, presentation of results and discussion of related issues, will be presented in the full paper).

2. OCG standards: The Open Geospatial Consortium [3] has proposed specific and detailed specifications, for the interoperability of the geographical databases that are independent by the Web application technology. In particular, two of these specifications, WMS (Web Map Service) and WFS (Web Feature Service), describe how map images and geospatial data shall be requested by the client and supplied by the server. The basic idea is that an increasing number of organizations will offer their geo-referenced data according to these specifications. As standard specifications become established and commonly used, an user application will be able to request data from different geographical service providers. The

advantage when using standards is that it will be easier to combine data from different suppliers. The user will be able to request specific data and customize his data to perform personalized analysis.
At present OGC is supporting a number of standard specifications. In the present work we focused on:

- Web Map Service (WMS) to produce maps of spatially referenced data dynamically from geographic information. This specification is also an International Standard and defines a "map" to be a representation of geographic information as a digital image file suitable for display on a computer screen. WMS-based maps are generally rendered in a pictorial format such as PNG, GIF or JPEG, or occasionally as vector-based graphical elements in Scalable Vector Graphics (SVG) or Web Computer Graphics Metafile (WebCGM) formats.
- Web Feature Service (WFS) map, where features are modeled as geographic objects, which might be stored in an object-based data format like vector data. The WFS is thus a compact way of distributing geographical features through an application service to an application client or a browser. Moreover the WFS offer the possibility to the users to load vector data for a requested extent whenever the user requires that specific information.

WMS and WFS operations can be invoked using a standard web browser by submitting requests in the form of Uniform Resource Locators (URLs).

3. Service Oriented Architectures (SOA)

Web-Services are a set of protocols to enable communication between independent software modules that offer their functionalities in the form of services. Current Web-Services are based on Services Oriented Architectures (SOA). In a SOA, services are self-contained, modular applications - deployed over standard middleware platforms, e.g., J2EE - that can be described, published, located, and invoked over a network.
To support the realization of the service-oriented software paradigm, Web service need to be based on standardized definitions of an interoperability communication protocol, mechanisms for service description, discovery, and composition as well as a basic set of quality of service (QoS) protocols. The initial trio of Web service specifications, SOAP[4], WSDL[5], and UDDI[6], provided open XML-based mechanisms for application interoperability (SOAP), service description (WSDL), and service discovery (UDDI). SOAP is now a W3C standard, and WSDL and UDDI are being considered by standard bodies. In order to implement this basic framework in real applications, mechanisms for service composition and quality of service protocols are required. Several specifications have been proposed in these areas, most notably the Business Process Execution Language for Web Service (BPEL4WS)[7] for service composition, Web service coordination (WS-Coordination) and Web service transactions (WS-Transaction) to support robust service interactions, Web service security (WS-Security), and Web service reliable messaging (WS-ReliableMessaging)[8]. The descriptive capabilities of WSDL can be enhanced by the Web Service Policy Framework (WS-Policy), which extends WSDL to allow the encoding and attachment of QoS information to services in the form of reusable service “policies.” All these aspects are critical elements for meaningful services interactions. An extended Web Service protocol stack is described in Papazoglou et al. [9]: in the lower level of the stack one finds transport and encoding layers, in the middle level protocols for service description, security, transaction and coordination are located, and, finally, on the top level the protocol stack has the business process composition layer.

4. Proposed framework and case study: We propose to take full advantage of the SOA approach in the context of GIS by implementing the operations offered by WMS and WFS following OpenGIS Web Services initiative [10]. To this end we have tested and used Bea Web Logic Server [11] for creating and publishing our specific Web Service interfaces. In particular

Bea Web Logic Server provides support for the SOAP communication between server and the client.
We have experimented the proposed architecture in the context of integration of GIS legacy services in a back-office scenario: a user that need to navigate in a spatial database (*location search and feature layer selection*), insert a map (*download of dynamically user-specified raster image centered on searched location*), navigate the image (*pan&zoom*), insert related information in a text document (*legend insertion and metadata extraction)* and download locally the selected feature layers in Geographic Markup Language (GML) format. Traditionally the user would ask the assistance of a GIS technician to produce the overall data. Most of the time he/she will not be satisfied by the results and interactions with the GIS technician will be iterated. In our architecture the user can automatically and independently create and insert the current version of the searched geographical data in his/her document using a web service architecture based on OGC specifications.
From the analysis of the results of this preliminary case study we think that several advantages can be obtained by introducing service architectures in GIS environment:

- the interoperability between different system will be enhanced.
- the availability and usability of geographical information will be improved

In future work, we will consider performance issues as well as privacy and security concerns.

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Shared Management of GeoDB among different levels of Public Administrations: Experimental Prototype in Sicily and Sardinia

G. Pittau[1], F. Cilloccu[1], D. Remotti[2], G. Salemi[3]
[1]*Regione Autonoma della Sardegna, Cagliari, Italy*
[2]*Centro interregionale, Roma, Italy*
[3]*Regione Siciliana, Palermo, Italy*

This paper illustrates the main results of an experimental project, currently in its final phase, jointly developed by two Italian regions (Sicily and Sardinia), in cooperation with the GIS Laboratory of the Centro Interregionale.

Several were the purposes of this project:

1. to build-up a prototype geographical database, implemented accordingly to the "common technical specifications" recently published by INTESA-GIS, based on information available in the regional technical maps in 1:10.000 scale.
2. to integrate in this geo-DB further information, with greater details, derived from 1:2.000 scale maps from municipalities administrations
3. to define and implement a prototype architecture for a shared management of this geo-DB, among regional and municipality administrations
4. to define responsibility profiles and updating rules for the shared management of the geo-DB, and to perform an operational experimentation of the whole system.

The project has been jointly carried out by two regional administrations (Sicily and Sardinia), in order to develop significant solutions, independent from a specific local context, but potentially re-usable in a lot of other administrative context.

Concerning the first objective, for the Sicily region a conversion of 32 sections of the regional technical map has been performed, for a rough extension of 1.500 square kilometres; in Sardinia a big project involving the conversion of the regional technical map for the whole territory (2.400.000 sq. km.) is currently on-going, so the project has been carried on with a link to that DB.

For the second objective, two municipalities has been involved, with very different characteristics: in Sicily a medium-size town (Caltagirone) but with a very recently produced technical map in 1:2.000 scale, very similar in its structure to the regional one; in Sardinia instead, the municipality of Cagliari (the major city of the island) has been involved, so that the specific problems of a wide urban area would be taken into account, though the available cartography were very old, and of poor quality. For this reason, an updating activity based on orthoimages, has been also performed, though limited to a little area in the downtown area; in this context, a procedure for the updating of the DB has been defined and tested as well.

The third objective has been pursued, first of all through an analysis of the possible system architecture: in particular a comparison has been performed between a **centralized** architecture and a **distributed** one.
In the former (centralized) the DB is physically implemented within the regional administration and all the involved municipalities are remotely connected, while in the latter (distributed) a unique physical DB does not actually exists, but the complete information content is someway *reconstructed* by software components that would be able to find out and connect information that are physically stored in different local DB: all these DB must obviously adhere to a common logical model.

Following this analysis, a prototipe application has been implemented in Sicily and in Sardinia, with slight differences, using an ESRI-ORACLE environment. This application implement the centralized architecture (the only reason for this choice is the availability of ready-to-use technological instruments) and makes available functionalities for navigation and querying the DB, and also for some kind of updates.

As far as the last objective is concerned, some profiles who may participate in the management (or only in the use) of the geoDB has been analyzed, and the relevant responsibility and actions has been defined in an experimental form; in particular the following profiles has been identified:

- data provider
- data editor
- DB manager
- infrastructure promoter
- user

For each class in the geoDB, and for each specific administration context, the subject who would assume the role and the responsibility of ***data provider*** and ***DB manager***, has been identified.

Finally the two web application has been integrated in the geographic portal of the two regions: within the web application for the shared management of the DB, a specific functionality for the access management has been implemented, in order to regulate all other functions, from visualization to updating, according to each user profile, and the permission granted to any user.

SITR-IDT Project : Using an EAI platform to develop distributed GIS services

M.Buffa, P.Cesaroni
Enterprise Digital Architects S.p.a, Rome, Italy

SITR-IDT's project goals can be summarized in the design & delivery of a Geographic Information System for Sardegna Region (acronym RAS) composed by a regional unique IDT (Infrastructure Data Territorial) and an Information system (IS). The resulting system is able to supply catalog services, advances geoprocessing services and complex macro services for administrative procedure management. Purpose of the system is the correct utilization and development of regional territory.

The system developed inside SITR-IDT project is based upon an open cooperative infrastructure, applying INSPIRE's and PSI's (Public Sector Information) principles, facilitating access to and distribution of geographic information products and services. The system uses a regional network of databases and services integrated through common protocols and standards assuring interoperability.

The federated architecture adopted, based on cooperative applications is built using Web Services technology. The main role of IS in RAS is catalyst and integrator of cartographic and territorial data and services provided by public local authority and private companies. IS allows for change of the regional condition actually made of a number of autonomous unrelated entities to a unified and standardized homogeneous organization.

Services provided by IS are supplied both in RAS's intranet and in internet to be accessed from other national and European organizations (SIGMATER project , National Cartographic Portal, INSPIRE, etc.). IS uses the domain port services conforming to e-government specifications defined by CNIPA (National Center for Administrative Public Information Technology). Access to provided services occurs through the standard interface defined for Web Services architecture as recommended in e-government and OGC documents. In detail, SOAP protocol, WDSL and XML standards are adopted to allow cooperative application and data interchange among heterogeneous architectures.

The main functionalities of SITR-IDT are: PUC Urban Plan for town council, PUL Coast Utilization Plan and PP Landscape Plan. The functionalities are built assembling services components and organizing and managing on line activities and actors around a unique IDT.

The development of complex services based upon interactions among a number of service components has shown the need of a software infrastructure providing the necessary mechanisms to decouple physically and logically the different service components among themselves, from the calling application and from the service steering logic.

This service oriented architectural approach made possible to individually and independently evolve each single service and service component maintaining a centralized and flexible control upon the information flow.

The provided software infrastructure is based upon the EnterpriseDA product MIDDLE®. MIDDLE® is an integration platform utilizing EAI real time, event driven communication approach and is able to efficiently integrate users, applications and communication infrastructure elements. The platform has all the necessary tools to coordinate process flows, to connect the different actors participating in the process and to monitor the processes and the achieved quality of service.

The provided Business Process Management tool allows for a fast and flexible definition of the various macro services logically connecting together the interfaced service components. The BUS infrastructure allows the extension of the system over the different sites and organizations involved in services providing. The centralized access control and management mechanisms assure a high level of control and security.

Furthermore a qualifying aspect of the adopted architecture is the possibility to monitor the provided services through the analysis of the event flow in the platform BUS (Busines Activity Monitoring). Events are analyzed in real time through a specific tool allowing the evaluation of the quality of provided service. In the mean time statistical and analytical reports are made available through the information collected from the BUS and stored in the repository.

New Advances in the Automatic Metadata Retrieval from Geographic Information

M.A. Manso, M.A. Bernabé
Department of Topography and Cartographic Engineering
Polytechnic University of Madrid
Campus Sur, Carretera de Valencia, km 7. 28031- Madrid (Spain)
m.manso@upm.es, ma.bernabe@upm.es

This paper presents the results of studies carried out on a wide range of Geographic Information (GI) storage types and formats, applied to automatic retrieval of metadata.

The stored information and the image storage format used in Photogrammetry and Remote Sensing have been analysed. The formats used to store Digital Models of Elevations have been analysed, as well as the formats used to store associated geometric text information and finally spatial databases have been analysed as stores of objects with geometry and attributes.

These studies have revealed the lack of harmony in the manner of describing the Coordinate System used in different formats. This fact has led us to establish the necessary semantic relationships between the encoding used (either proprietary or standardized) and the numerical encoding defined by the European Petroleum Surveyor Group [1] (EPSG), a reference authority in this subject.

As a practical consequence of this work, a set of libraries and an application have been developed in Java™, allowing automatic retrieval of all those characteristics of GI itself having a potential interest to be described in metadata form. In addition to restoring the Spatial Reference System (SRS) identifier to normalized values by EPSG, it also carries out conversions or transformations of coordinates necessary to provide the spatial extent in the form of latitude/longitude (geographic coordinates). Finally, it should be noted that tool allows export retrieved metadata as XML files under different metadata standards: Dublin Core, ISO19115 [2] and FGDC.

Keywords:
Metadata, Property Retrieval, Spatial Data, Database, Data Stores, Harmonization, Geographic Information, ISO19115, ISO15836, FGDC, CSDGM, Spatial Reference System, SRS, Coordinate Reference System, CRS.

Introduction
Metadata are "data about data". This means that they describe the content, the quality, the conditions and other characteristics of data in order to help locate and understand its information. The creation of metadata has three main objectives [3]. The first one is the organization and the maintenance of a data inventory. The second objective is to provide information to data catalogues and clearinghouses. Applications of Geographic Information Systems (GIS) often require the integration of data from different thematic sources. Only a few organizations can afford the creation of all the data they need. By making metadata available through data catalogues and clearinghouses, organizations will be able to find the information they want by sharing the collected data and maintenance efforts and managing their own data. Finally, the third objective of metadata is to provide information to facilitate data processing technologies. Metadata should accompany the transfer of information. Through metadata, the organization gains in efficiency concerning data transfer and data interpretation. Metadata facilitate the incorporation of information into its holdings and the update of internal catalogues which describe its holding's data.

Nevertheless, maybe the main problem for the implementation of a Spatial Data Infrastructure (SDI) is the absence of appropriate and well-defined contents. Taking into account that the ISO/DIS 19115 standard defines more than 300 metadata elements, it can be assured that the creation of appropriate content for all the different metadata records is a hard and arduous process. Therefore it might be of interest to have a tool that automatically retrieves metadata from data sources. Besides saving time in the cataloguing process, it prevents users from making frequent typing mistakes.

The first part of this paper presents a study carried out in order to facilitate the automatic metadata retrieval from a great variety of geographic data formats used for the storage of geographic information. The remainder of this paper is structured as follows: the first section is a review of the most common GI file formats structured by the type of their contents. The main properties that may be used for the registering process of metadata are described for each category. Finally, a link to some tables that summarize metadata retrieval properties for each file format is presented. The second section presents harmonization studies made with SRS in order to have a normalized description for all file formats. The third section presents software library & tool developed for automatic metadata retrieval from physical G.I stores. Finally, this paper ends with conclusions and future guidelines for work, acknowledgements and bibliographic references used.

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ORCHESTRA: Developing a Unified Open Architecture for Risk Management Applications

David Caballero[1], Borja Izquierdo[2]
[1] *Tecnoma S.A., Madrid, Spain*
[2] *Atos Origin, Madrid, Spain*

Increasing numbers of natural disasters have demonstrated to the European Commission and the Member States of the European Union the paramount importance of the natural hazards subject for the protection of the environment and the citizens. The flooding experienced throughout central Europe in August 2002 is the most recent example of the damage caused by unforeseen weather driven natural hazards. The summer of 2003 clearly showed the growing problem of droughts in Europe including the Forest Fires in Portugal with more than 90,000 ha of burnt areas. There is strong scientific evidence of an increase in mean precipitation and extreme precipitation events on the one hand and water shortages for certain regions on the other hand which implies that weather driven natural hazards may become more frequent.

Due to organizational and technological barriers, actors involved in the management of natural as well as man-made risks cannot cooperate efficiently. In an attempt to solve some of these problems, the European Commission has made "Improving risk management" one of its strategic objectives of the IST programme.

The Integrated Project **ORCHESTRA** (**O**pen A**RCH**it**E**cture and **S**patial Data Infras**TR**ucture for Risk M**A**nagement, www.eu-orchestra.org) is one of the projects in this area. It started in September 2004 and will run until August 2007. The main goal of ORCHESTRA is to design and implement an open service oriented software architecture that will improve the interoperability among actors involved in multi-risk management.

The following organisations are involved in the project:

- Atos Origin, Spain
- European Commission – DG Joint Research Centre, Italy
- Hochschule fuer Technik und Wirtschaft des Saarlandes, Germany
- Open Geospatial Consortium (Europe) Limited, United Kingdom
- BRGM, France
- Ordnance Survey, United Kingdom
- Fraunhofer IITB, Germany
- ARC Seibersdorf research GmbH, Austria
- Eidgenoessische Technische Hochschule Zuerich, Switzerland
- Intecs, Italy
- DATAMAT S.p.A., Italy
- TYPSA, Spain
- BMT Cordah Limited, United Kingdom
- The Alliance of Maritime Regional Interests in Europe, Belgium

The key objectives for ORCHESTRA are the following:

- To design an open service-oriented architecture for risk management that links spatial and non-spatial information services. In this context ORCHESTRA will provide input to INSPIRE and GMES (see below).
- To develop the service infrastructure for deploying risk management services.

- To develop thematic services useful for various multi-risk management applications based on the architecture.
- To validate the ORCHESTRA architecture and thematic services in a multi-risk scenario.
- To provide software standards for risk management applications. In particular, the de facto standards of OGC and the de jure standards of ISO and CEN are envisaged to be influenced.

This paper will describe the goals of ORCHESTRA and explain some of the key characteristics of the project. These are:

- The chosen design process of the ORCHESTRA architecture.
- How to further improve geospatial information and standards for dealing with risks.
- How ontologies will be used to bring interoperability from a syntactical to a semantical level.

Currently the focus of the work is on understanding user needs, system requirements and an assessment of useful technologies. This is considered the necessary input for design decisions for the ORCHESTRA architecture. The paper will focus on explaining the process used to create this architecture, the so-called ORCHESTRA Reference Model.

The paper will end with two examples demonstrating the benefits of the ORCHESTRA Architecture. One is in the area of coastal zone management, and the other is related with managing earthquake risks.
The ORCHESTRA project will work together closely with two other Integrated Projects in the field called WIN (http://www.win-eu.org) and OASIS (http://www.oasis-fp6.org). WIN will concentrate more on organisational issues relevant for improved interoperability in risk management and OASIS focuses on crisis management. The three projects will use the same architectural principles and make their results interoperable. These results will be provided as input to INSPIRE (http://inspire.jrc.it) and to GMES (Global Monitoring for Environment and Security, http://www.gmes.info).

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Session: Practice and Research Opportunities and Constraints

Friday 1st July 11:15 – 13:00

Meeting Room Hotel Calabona

Towards an SDI Research Agenda

Lars Bernard[1], Max Craglia[1], Michael Gould[2], Werner Kuhn[3]
1Joint Research Centre European Commission, Ispra, Italy
2 University Jaume I, Castellón, Spain
3Univerity of Münster, Münster, Germany

Abstract

We ask how research agendas of Geographic Information Science should reflect the ubiquitous discussions and developments on Spatial Data Infrastructures (SDI). Many research issues surrounding geographic information remain unresolved and are equally relevant in SDI settings. More interestingly, however, a host of GI research questions are different in the SDI context or have only arisen in it. The literature has so far discussed them from either technical or social perspectives, but no integrated view exists to our knowledge. We attempt it by combining our specializations in the technology, people, and content dimensions of SDI with a joint perspective on the "science behind SDI", as embodied in the Vespucci initiative.

Introduction

The Brno AGILE conference paper by Gould and Herring (2001) discussed the changes in GIS research since the publication of the NCGIA's 1990 Core Curriculum and how, therefore, teaching should adapt to these changes. It claimed that GIS textbooks were still describing monolithic desktop GIS, rather than heterogeneous, distributed GIS. The authors went as far as defining GIS in the following manner:

> ***Geographic component****: any component of a software system whose process is dependent upon the geographic nature of the data it processes.*
> ***Geographic information system****: any information system containing one or more geographic components.*

Fours years on, we now ask, is this distributed, component-based GIS now called Spatial Data Infrastructure (SDI)? Are not the basic components of a GIS - data entry, data(base) access, geoprocessing, and data output - also found in the SDI conceptual architecture? For example, both the NASA/FGDC Geospatial Interoperability Reference Model (FGDC 2003, fig 1) and INSPIRE (INSPIRE 2002) conceptualize the architecture of an SDI as a 3-tier structure: the "application layer" is at the top, which represents the user access point to the "new GIS". The "geoprocessing" happens in the middle, and the "GIS database" is at the bottom, and the resulting data become displayed by "visualization services", again in the middle, and rendered at the client application. From the user viewpoint the location of the software components involved in accessing the data and producing the desired output is irrelevant: they may be local, remote, or a combination thereof. In the typical SDI scenario today, only the client application (a web browser or lightweight GIS) and perhaps some in-house thematic datasets, are local. So for many non-specialist users, an SDI could well be providing all that they would require from a traditional GIS, with the added potential advantage of greater accessibility (i.e. they no longer require high levels of competence as much of the processing is done by specialised services). If this were the case, then what would the implications be for geospatial research?

Spatial Data Infrastructure Research Evolution

A key question to be addressed is: what is the pragmatic difference between research to design, build and use tightly-coupled GIS components on the desktop, versus building and using a loosely-coupled SDI of geoservices distributed over various geographical locations?

More than mere systems, even loosely coupled ones, SDIs are *frameworks* of policies, institutional arrangements, technologies, data, and people that enable the effective sharing and use of geographic information. Within such a framework perspective, some argue that we are

seeing a shift from SDI as a product to SDI as a process driven by its users and its usage (Rajabifard and Williamson 2001; Brox et al. 2002; Wytzisk and Sliwinsky 2004). This process is built upon relationships: personal, political, institutional. But then again, so are corporate GIS, the main difference being that SDI cross more levels of the hierarchy across multiple organisations and thus are even more sensitive politically (Chan and Williamson 1999).
Following an evolutionary path from a single (closed) system perspective through one of distributed components to one of frameworks for social processes, we can derive some possible key differences between GIS and SDI:

1. The *software* is different: the focus in SDIs is on distributed web services instead of self-contained programs (Bernard et. al. 2005). Programmers surely have plenty to develop, test, and improve, with new programming and deployment paradigms being the subject of research programs on interoperability, peer-to-peer architectures, Grid computing and the like (Foster 2002; Messina 2002; De Roure 2003).
2. The *integration* of the components becomes absolutely critical. Up until now, integration is happening thanks to the manual connection of wire to wire. This approach does not "scale", because soon here will be data servers (web sensors, web-enabled data bases, etc.) everywhere, catalogues everywhere, map servers and geoprocessing servers everywhere...and there are not enough qualified humans to connect all the wires all the time and to maintain the broken links. So, do we do research on improved wiring, and train lots of wiring experts? Or do we develop better, smarter, semi-automatic (or automatic) processes for discovering, linking to, and executing geoservices?
3. If terms of services, what *geoservices* are we talking about? Will they be the kind of generic map and feature services we have today, or will geoprocessing ever become bottled in generic web service totally transparent to the user? If so, at what level of granularity?
4. Integration of distributed software and content depends on transparent and trusted agreements among all the stakeholders. This is a *sociological* and a *political* issue, not a technical one. But how does an SDI research agenda differ from one taking an organizational perspective on GIS?
5. How does SDI link into the general notion of Information Infrastructures (II)?

The questions above suggest some research directions that are specific to SDI. We briefly outline the key issues below, while the full paper will develop them further and conclude with a draft SDI Research Agenda.

Granularity of GI processing

Here we face a first research area that is peculiar to SDI and did not exist before: determining the optimal granularity of geoprocessing over the web. For example, should we expect a granularity at the level of familiar GIS commands (such as buffer and overlay)? Or would that mean too much complexity in each service, so that the optimal level would be lower, dealing with distances, intersections and similar operations? How does the cost of ‘heavy’ services weight against the higher transaction costs of interfacing multiple lightweight services?
Or would even these lightweight services be too hard to specify and program generically, so that we should go down to the level of basic mathematical notions like metrics and systems of linear equations? But then, maybe the complexity of standard GIS operators would also be reduced if we made them more application-oriented, offering services for computing diffusion and reachability rather than meaningless buffers. Apart from the complexity issue, what are the economic implications of bottling functionality at different granularity levels?
These questions also arise through the linkages with research in distributed computing and simulation, with the Grid as most prominent example. They touch on how to improve performance in distributed geoprocessing. The shipping of functionality (encapsulated in smart agents) towards geodata sources might emerge as a novel approach to distributed geoprocessing in future SDIs. It addresses the need to hold data as closely as possible to their origins, both in

terms of information communities and in geographic terms. Geoinformation is local, where "local" means of course something else at each spatial granularity level.

Semantics of geodata and geoservices

A second research area is that of specification methods for the semantics of data and services. Distributing the repositories and processing of geoinformation has brought the issue of what the contents mean to practitioners trying to assess and combine resources from multiple sources (Kuhn 2005). The current methods for specifying ontologies, however, are at best able to define data semantics under very controlled situations. They cannot yet support translation, and they fail to cope with the semantics of services.

One could identify a continuum, from GIS to SDIs. At one end is the individual GISer with an own desktop machine and working in isolation (e.g. academic user); somewhere in the middle is the case of large organizational arrangements where there are multiple GI systems with dedicated teams doing the processing, and other less experienced users only viewing the results; at the other end of the spectrum is the case of fully distributed SDIs addressing both specialists and end-users. The key difference we want to highlight is that whilst in the case of individual or organisational GIS most of the data used is generated internally by the user or the organisation and is therefore "known" and understood, with limited need for metadata and explicit semantics, in the case of fully distributed SDIs this is no longer the case. The situation of controlled semantics is lost in an SDI. Data models cannot (and should not) be standardized anymore. They become internal to the components, and the component interfaces need to talk about their meaning, now that this is not implicit anymore.

Specialist users remain important, but they are joined by many more potential users in government, business, and among citizens. Whilst specialist will be mainly concerned about the heterogeneity of data they can access as they do their own processing, other users will be only interested in the information product, and not the processing. This is a new dimension which requires research on user requirements, and ways to deliver the products, both from the semantic and from an economic perspective.

Organisation and Implementation

The decision to adopt or implement an SDI is no longer managerial (i.e. internal to an organization) but political (i.e. involving multiple organisations, institutional arrangements, legal frameworks). This creates a need for common standards that have to be easy to adopt and adapt, rather than creating their own complexities. The dynamics of controlling implementations involve multiple centres of decision-making, in horizontal structures where nobody is in control, rather than in a pyramidal and vertical decision-making process familiar from organizational models for GIS implementations. The whole "image" of the organizational setting is changing from the "machine" to the "living organism" (Morgan, 1997). It needs to be reflected in the implementation strategy: you do not "design" an SDI like a big GIS - you nurture its development. This also means that from a research perspective, one needs to look at theoretical frameworks that emphasize the network and sociological dimension of innovation and change, such as innovation diffusion (Rogers, 1983), social networks (Granovetter, 1983) or actor-network theory (Callon, 1986, Latour, 1987, Walsham, 1997).

Economics of GI

Whilst a GIS implementation may be decided on the basis of internal organizational priorities for efficiency, and effectiveness, the political dimension of SDI adds complexity in developing a business case. The variety of potential users and the external dimension of data exchange put more focus on issues like intellectual property rights, security, access and pricing policies, and funding mechanisms, which in turn may require marketing and business strategies for the different user communities (see for example Blakemore and Sutherland 2005 for a fascinating first hand account of emerging pricing strategies in the public sector). Moreover, the potential benefits need to be linked to the different environment and include for instance wider territorial competitiveness linked to regional economics (Porter 2000, Cook 2002) rather than purely organisational competitiveness linked to business studies.

SDI versus other Information Infrastructures

If one accepts the definition of an II as "shared, evolving, heterogeneous installed base of IT capabilities among a set of user communities based on open and/or standardized interfaces" (Hanseth and Lyytenen, 2005), then and SDI is a specialized II serving specific user communities (largely government at this stage, and the academic & business geospatial community). It is not a horizontal infrastructure serving everybody because "everything is spatial"! It shares with II most of the design and implementation issues typical of large complex entities, but it may differ in the extent to which it addresses communities (still) largely concerned with distributed access to data (as opposed to the Grid community that is concerned mainly with distributed processing or end-users who care mostly about information products), it involves sets of methods for data processing, analysis, and integration that reflect the specificity of spatial data (e.g. MAUP, auto-correlation etc.), and of course is obsessed with pricing issues!

As shown above, the key research issues raised by the transition from GIS to SDIs need to consider technical, data-related, organisational, political, and socio-economic aspects in a holistic manner. This requires the contributions of many disciplines from philosophy to computer, and social science. We will develop the challenges further in the full paper.

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Session: Posters

Wednesday 17:30 – 18:15

Meeting Room Hotel Calabona

Geopark: a development opportunity

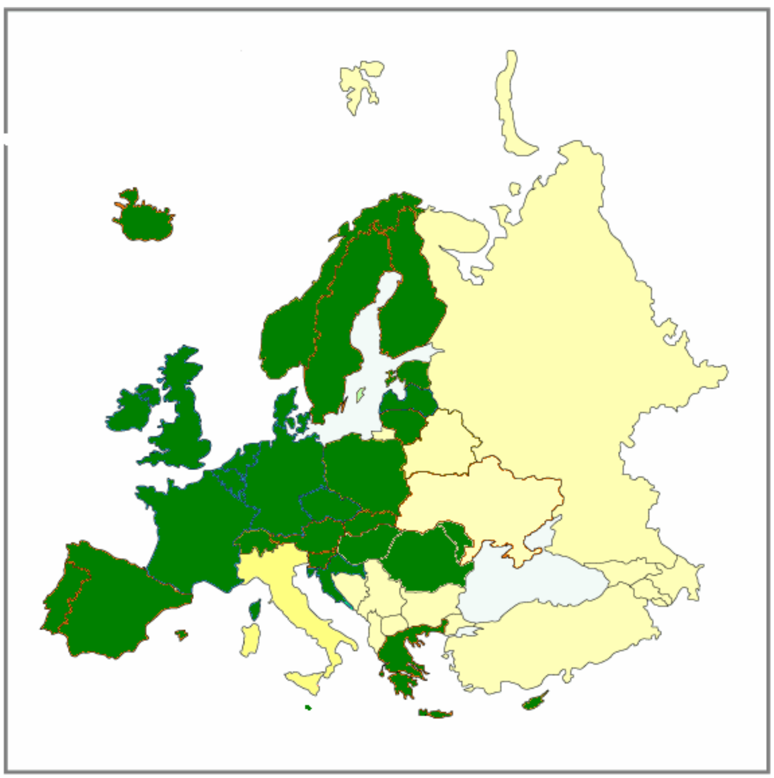
Germana Manca, Laura Pireddu
[1, 2]Geoparco S.c.a.r.l., Cagliari, Italy

The aim of this poster is to focus on the explanation of the structure of the Sardinian Geopark Spatial Data Infrastructure, addressing in elaborating the interoperability data modelling, related to *environmental research*, own *organisational implementation* and *people*. The Sardinian Environmental Historycal Geopark, established during “The General Conference of Unesco”, held in Paris on 1997, represents the first example of Geosites/Geoparks in the world. The Geopark covers an area of 3.771 kmq, subdivided in eight areas, inside the island.
A Unesco Geopark is: *a)* a territory encompassing one or more sites of scientific importance, not only for geological reasons but also by virtue of its archaeological, ecological or cultural value; *b)* will have a management plan designed to foster socio-economic development that is sustainable (most likely to be based on geotourism); *c)* will demonstrate methods for conserving and enhancing geological heritage and provide means for teaching geoscientific disciplines and broader environmental issues; *d)* will be proposed by public authorities, local communities and private interests acting together; *e)* will be part of a global network which will demonstrate and share best practices with respect to Earth heritage conservation and its integration into *sustainable development strategies.*
Each of these definitions fit the aim of this poster, because the data modelling proposed covers all the issues of the Geopark. The data modelling has been studied in order to perform the guide lines of the national geographic infrastructure, that will be integrated as a part of SITR (Sistema Informativo Territoriale Regionale). Using the case tools, the data modelling has been structured through the creation of custom features and geodatabase schemas.
Related to the *environmental research*, the data modelling has been studied in order to store the pollution emergencies, described by a geodatabase, integrated by a Ikonos multitemporal satellite images. These images help to depict the polluted area and to define the boundaries, during and after the environmental reclamation.
The activities, performed by the Geopark, has been cataloguing inside the geodatabase; the geodatabase *organisational implementation* has been carried out thanks to the availability of the field workers (using GPS) and of the planners (using CAD and other format).
Some of the working *people* has been involved in the data modelling process, through the educational activities, performed in field and in classroom.
Two versions of the data modelling has been available: one in ArcGIS and another one in GRASS. The choice of these systems has due to compare the performance of the software and to guarantee a more open system to the users. A final result of a Web-GIS has been put in the Web pages of the Geopark S.c.a.r.l.. The goal for the long term of the Geopark SDI tend to influence the policy and to support the land use planning and to programme the activities.

EuroRegionalMap: Getting through an European extended coverage

Nathalie Delattre
National Geographic Institute, Brussels, Belgium

EuroRegionalMap is an ESDI of topographic data at a reference scale 1:250 000 suitable for spatial analysis, network analysis and visualization. This ESDI is based on a pragmatic harmonisation of the NSDIs of similar scale owned by the National Mapping and Cadastral Agencies according to the EuroRegionalMap specifications.
In 2001-2003, EuroRegionalMap was in demonstration phase experimenting this spatial data harmonisation on 7 European countries.
Now the extension phase over Europe has started with the participation of 31 European countries, the new coverage should be available by end 2006.
This poster will illustrate the organisational implementation put into place for coordinating and monitoring the work of 29 NMCAs. This organization is basically composed of an international technical team of experts, regional groups of co-ordination in data harmonization monitoring and in data quality insurance and involves cross-border cooperation between countries.
The poster illustrates which communication issues we have to face between people for technical supporting, and which solutions have been implemented so far.



The current partnership of EuroRegionalMap

Creating a Data warehouse for Environment and Health

G. Van Kersschaever[1], H. Van Loon[1], R. Vlietinck[2]
[1] Academisch centrum voor huisartsgeneeskunde Katholieke Universiteit Leuven, Faculteit Geneeskunde, Leuven, Belgium
[2] Center for Human Genetics, Faculty of Medicine, Katholieke Universiteit Leuven, Leuven, Belgium
Division of Genetics and Molecular Cell Biology, University Maastricht, Maastricht, The Netherlands.

Introduction: One of the missions of the epidemiology section of the Department of General Practitioners is to examine the relation between environmental pollution factors and health using geographically localised data in a project called "Steunpunt Milieu-Gezondheid in Vlaanderen".

Methods: Existing databases used were: the National Cancer Registry and governmental data on hospitalisation, mortality and birth. All the data were made anonymous by an algorithm used by the data providers. Data were processed in three steps. First, data were checked for consistency. Secondly, age-and sex-standardised incidence rates were calculated for pathologies which are assumed to relate to pollution. Third, data on health were mapped on a chart of Flanders using Geographical Information System (GIS).

Environmental data on air pollution, for example, concentrations of benzene, ammonia (NH_3), nitrogen oxides (NO_2, NO_x,) sulphur oxides (SO_2, ,SO_4), carbon monoxide (CO) were geographically localised by the Flemish Environment Association (VMM) using the Operationeel Prioritaire Stoffen (OPS) model on the existing focal data. Those data were also mapped for Flanders using GIS.

All data were combined according to their geographical variable and presented in scatter plots and other graphs.

First analyses were done with the data from "De Vlaamse Kankerliga " (VKL). Data from 1997, 1998, and 1999 were received. Only invasive cancers were considered for analysis. The cancers were classified according to the International Classification of Diseases for Oncology, 2nd edition code (ICD-O-2). Age and sex standardised Incidence Rates were calculated for 91 different malignant neoplasms.

Data on mortality and hospitalisation were also analysed. Data were received from 1997 till 2003. Only diseases with a supposed relationship to pollution factors were considered. Diseases are classified according to the International Classification of Diseases 9th edition (ICD9) (hospitalisation) or 10th edition (ICD10) (mortality).

When databases with environmental data are associated to databases with health indicators results have to be examined critically. Different, well defined users have to provide feedback and socio-economical standardisation has to be taken into account.
A possible cluster has to be interpreted very carefully before confirming a relationship between environment and health.

The Dynamic Atlas on the Mediterranean Marine and Coastal Protected Areas

Daniel Cebrián-Menchero[1], Stefanie Weykam[2]
[1]*UNEP Regional Activity Centre for Specially Protected Areas, Tunis, Tunisia*
[2]*UNEP Consultant, Madrid, Spain*

MedGIS is a pilot project within the framework of the Mediterranean Action Plan (MAP). It aims at demonstrating the capabilities of a GIS and Web Map Service for the Mediterranean marine and coastal protected areas, sites of conservation interest and biodiversity. The objective is to make the information freely available on Internet by means of an interactive mapping tool (http://80.25.140.79/MedGIS/).

MedGIS includes data on the presence, abundance and composition of coastal and marine flora and fauna, habitats, related human factors (presence and activities), as well as the impacts and risks sensitive areas are exposed to. Access to sensitive data will be restricted to MAP partners.
At this stage, we focus on demonstrating and testing the functionalities which are interesting for the Regional Seas Programme, Mediterranean Action Plan and other user communities. Priority is given to show how data of disperse origin and formats can be displayed, mapped and queried online, while data completeness and aesthetics will have to be improved during a follow-up project.
We expect MedGIS to develop soon into a suitable tool for decision making, conservation, prevention and quick response in emergency cases.

One of the lessons learned is that a suitable standardization of data gathering and reporting is needed. Information loss during the compilation of already existing data derived from different projects and stored under different conditions is also considerable. Metadata are often lacking or incomplete and tracing back the core metadata is hard work.

One of the aims of this pilot project was to show how data can be shared via Internet with projects of similar interests. MedGIS will soon connect (as client) to the Mediterranean Database on Cetaceans (MEDACES) hosted by the University of Valencia/Spain and share their maps on cetacean stranding (see also: http://medaces.uv.es/). Additionally, we hope to establish a connection to the Regional Marine Pollution Emergency Response Centre for the Mediterranean Sea (REMPEC) in Malta in order to include on one hand oil spill events into MedGIS and on the other hand to provide REMPEC with data on sensitive areas.

We invite other Web Services to connect to MedGIS as WMS or WFS server. The corresponding GetCapabilities-Request has been published on our web page (see: About the Data). We are also seeking to become interoperable and compliant with other initiatives such as the World Conservation Monitoring Centre (UNEP-WCMC), the Global Biodiversity Information Facility (GBIF), the Ocean Biodiversity Information System (OBIS) and Nature-GIS.

Web Soil Services for Soil and Environmental Policy Systems Concept and Example

Stolz, W., R. Baritz, G. Adler, W. Duijnisveld, J. Feinhals and W. Eckelmann
Federal Institute for Geosciences and Natural Resources (BGR, Hannover, Germany)

The requirements to the use of digital soil information – maps and inventory data – are continuously increasing. An overview of the available and required soil data in the light of the various soil and environmental policy schemes in Europe is given.
The following components of existing data vary greatly throughout Europe:

- map purpose (overview maps and basic maps, thematic maps)
- map scale
- methodology (e.g. top-down and bottom-up)
- soil classification
- degree of digitization (geometry, attribute data)

The main aspects to be considered are the purpose of the map, and the time needed to produce it. Higher quality and resolution soil data are increasingly asked for at aggregated scales for environmental monitoring and policy support. This requires the efficient use of modern technologies to compare, to present and to evaluate soil data. INSPIRE already gives technical guidance. However, soil-specific aspects for harmonization and data presentation have to be considered as well.
The proposed poster presents a first approach to present soil data at various scales, and to allow methodological operations with different data sets. The approach – Web Soil Services – represents the initial phase of the adjustment of a soil information system (FISBo BGR) under the above mentioned frame conditions and INSPIRE proposals. The following objectives can be identified:

- policy support: decision on the basic map for presenting 'state' and 'pressure' (DPSIR concept) at national scale
- read data from various sources, aggregate them into scale of interest; overview scale (e.g. 1:1.000.000)
- harmonization as external rules: Metadata: product comparison,
- representativity of input data/error estimation of products

As following particular requirements are recognized:

- decision on scale/basic data bases
- upload service/links to needed data from other services (e.g. Federal *Laender*)
- method data base: run evaluations (risk maps, degradation maps, functional maps)
- import service (use WSS to calculate own maps/run methods/evaluations with own data: deploy XML standard to read data

The Poster itself contains examples:

- schematic overview of above-described frame conditions
- scheme of WMS (ideal future case)
- highlighted existing tools already implemented
- example: data base (top-down soil map data base with standard soil profiles); other soil profiles can be calculated (= IST status)
- example: method (examples developed; not released yet)
- example: same platform: higher resolution soil maps (examples developed; not released yet)

Geo-informatics for the management of electrical energy sustainability

Mircea D. Badut[1]
[1]*OCPI Vâlcea, Râmnicu-Vâlcea; PhD candidate at Cluj-Napoca Technical University; Romania*

This paper is firstly a trial of revealing applicability directions and practical issues about using GIS in planning, developing and managing the electrical energy. It presents various aspects of geo-spatially approaching for durable electricity planning, for disclosing and assessing the potential resources (being these natural or cultural). But it is also a call for more balanced development of the electrical energy sources: remembering that the earth is fragile and threatened by mankind's activities, therefore understanding that we all have the obligation to develop and promote high quality, clean, renewable energy sources, in an acknowledged effort to preserve our shared environment.

Any electricity development must be seen outside of the inner/isolated context, thus revealing the relationships with its neighborhood and with the environment, and not only at a moment but in a long-term perspective, due to the inherent cumulative effect of the anthropogenic development (electrical power generation is actually one of the major pollution factor). Therefore – taking into account that, on the one hand, the environmental issues have a geo-spatial spread, and, on the other hand, the mankind activities are usually deployed in crowds/communities covering large spaces too – the geographical coordinates are obvious, and consequently we have to understand that we can count on the geospatial information (GIS) to find durable energy solutions.

This paper reveal geo-informatics applicableness in developing/enhancing the actual power sources, in searching for new power sources (mainly low-impact and renewable ones), and in learning about these issues. It is also about how the GIS technologies can be involved in broader information dissemination for public, in order to know about the geo-spatial effects of the electrical energy choices and policies, and about the available alternatives for future development. It can help us to reach international consensus, and consequently to support a long-term economic stability and a healthy environment.

Such GIS solutions involved in durable development of the electrical energy must become related to the European, national or regional Spatial Data Infrastructures (SDI) (or even to become part of them), for a proper collaboration between the governmental institutions and the non-governmental organization, and also for leveraging public participation.

In addition, the usefulness of geo-informatics derived from the energy market decentralization trends is revealed (for studying social, economical and environmental effects of passing from large-scale to mid- and low-scale electrical power developments).

For electrical power enterprises, the GIS solutions assist the assets management, the network/grid exploitation, the operational maintenance activities, the customer connectivity and consumption, but also the electrical network/grid strategic development. It is about day-by-day tactics and enterprise activities, and also about strategic decision about the enterprise future, about its relation with the surrounding environments: nature, markets, people.

The paper describes effective application of GIS for planning, designing and managing renewable energy applications, such as: a terrain model of a large area, providing basic winding aspects (such as average wind directions and speeds), can help to search locations suitable for wind farms (aeolian generators); meaningful studies over the sunlight (flux, brightness, mean daylight duration, typicalness of the clouds-shading, etc); offshore waves statistical mapping. Such geo-spatial studies not only help to find suitable location for wind/solar/tidal capturing sites, but they can assist the specialists (engineers, responsible peoples, managers) to choose the most efficient solutions (what type of generation principle or equipment is more suitable – e.g. high or low speed turbines; if the photovoltaics is more applicable than a solar heat transfer), to make strategic and tactic decisions concerning the electrical power facility (distributing, grid-connection, exploitation, maintenance).

Also, GIS can support monitoring of the power plants exploiting, to reveal the effects over the environment, and to assist economical strategic decision. Such application can also improve the social norms which refer to many geo-spatial aspects. A principal GIS suitability consists in monitoring the environment indicators (not necessary directly linked to the energy sources, e.g. the bird population are very sensitive to changes affecting the environment – such as pollution, waste contamination, biomass large crops –, thus this is considered as an appropriate indicator for environmental monitoring).

GeoInformation can also be engaged in demographically and geospatially monitoring of many aspects related to electrical energy consumption (human activities, travelling, environmental risks, weather, utilities distribution, HVAC, census, population densities, economical power, whealtiness/poorness, etc).

The applicableness of GIS in studying the climate changes (these being on of the most important effects of the pollution provoked by energy facilities – mainly caused by the population pressures and energy demands) is also stressed in this paperwork. The greenhouse gas (GHG) emissions, nuclear wastes (packaged, sealed and stored) can be monitored or/and managed by GI applications.

In order to help the integration of the geo-informatics (as a support for durable development/management of the electricity) some governmental/parliamentary support for geography education will be needed. Also many national and international organizations have to deploy significant standardization efforts, concerning systems interoperability, data/information exchanging, GML, XLM, Internet mapping, data translators (ISO/TC211), metadata publishing, etc.

The future decision must be more carefully made, and the GIS technologies can help to disclose, to represent, and to control many of the durable development related issues. This technology can play a key role in worrying for the environment and respecting the society, in raising awareness, shifting attitudes and behaviours.

OCEANIDES Harmonised European Oil Spill Reporting System

L. Tufte[1], O. Trieschmann[1], P. Clayton[2], P. Carreau[3]
[1]*Federal Institute of Hydrology, Koblenz, Germany*
[2]*QinetiQ, Farnborough, United Kingdom*
[3]*JRC, Ispra, Italy*

Accidental or operational marine oil discharges from vessels have a strong impact on the marine wildlife, marine habitats, the economy and the public health. Oil tanker accidents (e.g. Prestige) receive much attention in the media and the public but a large amount of oil is also discharged from vessels during their operation. The 3 main sources of illegal operational oil pollution from ships are ballast water, tank washing and engine room effluent discharges.

The future strategy of the EC concerning marine oil pollution is outlined in the report "Towards a strategy to protect and conserve the marine environment" published by the Commission in 2002. Concerning oil pollution the following objectives are to be achieved:

- Ensure compliance with existing discharges limits of oil from ships and offshore installations by 2010 at the latest;
- to eliminate all discharges from these sources by 2020.

The oil spill monitoring in Europe is mainly based on aerial surveillance activities. Some countries are using satellite data in addition. In the North Sea and Baltic Sea a comprehensive monitoring system (Bonn Agreement, Helsinki Convention) is established. Some European seas are still not regularly monitored.

The EU project OCEANIDES identified key issues regarding a Europe-wide system for monitoring a recording of oil spill data. Factors currently limiting the full understanding of the marine oil pollution situation in Europe are the gap in data availability, the reporting and recording in a variety of formats and a lack of harmonization.

The OCEANIDES project developed a standard nomenclature. This standard set of oil spill attributes should facilitate the development of a harmonized oil-spill reporting system at a European level in order to build up a picture of the level of marine oil pollution and the required level of monitoring and enforcement effort. The adoption of a standard nomenclature and reporting format is essential.

A database with a data model based on the standard nomenclature was developed and populated with the oil spill data gather by the project. A Web GIS application was implemented and allows public data access, visualization and analysis.

The OCEANIDES nomenclature could act as a basis for further development. Data providers should be encouraged to co-operate and comply with the reporting and recording standards that have been recommended. Achieving this may require EC legislative action.

To design a reference model for in integration geodata from various resources

Lucie Fredmannova, Petr Kubicek, Karel Stanek
Masaryk University, Brno, Czech Republic

Data interoperability is key issue of developing spatial data infrastructure. Existing geodata are created in very heterogeneous environment. For integration of data is necessary to create mechanism for harmonisation of data. In frame of the open regional atlas we designed methodology allowing integration of data from various resources. This methodology is based on combination of a landscape skeleton and stable feature in background maps. The landscape skeleton is composition of terrain lines, water lines and fixed communication lines. Based on geomorfometrical, hydrological and importance characteristics is created hierarchical model of line segments. This model is used for multi-scale description of behaviour of the landscape skeleton. The Landscape skeleton is completed by map stable features. This features are stable in time and in scales. For geographical features entering into the atlas is identified source topographic background. For this topographic background is created landscape skeleton with the same rule like landscape skeleton of the atlas. Between the landscape skeleton of the atlas transformed into proper scale and the landscape skeleton of the features background is created relationship. From this relationship is derived transformation formula for features. A research is part of Czech Science foundation project "Open regional Internet atlas".

Nature-GIS: A community of spatial data users for Protected Area and Nature Preservation

Giorgio Saio et al.
(1) GISIG - GIS International Group, g.saio@gisig.

The Nature-GIS (www.gisig.it/Nature-GIS) IST 2001-34641 project grounds on the needs of the "nature users" and of the GI professionals: on the one side nature conservation and protected areas management present complex problems, varying from environmental planning to economic and social aspects and involve numerous different organisations, interest groups and individuals from diverse cultural or technical backgrounds. On the other side the entering in force of European directives (Birds and Habitats) and the consequent institution of protection zones (SPA and SCI) aimed at assuring the preservation of species and habitats across the Europe through the establishment of the Natura 2000 Network and contributed to increase the awareness and the need of harmonising Geographical Information and data on natural heritage.
Even more recently, the issue of the European Directive 2003/04/EC about public access to environmental data increased the need of data sharing at European level and of availability of information related to regional and nature planning and management.

All these aspects enforce the linkage between the INSPIRE (INfrastructure for SPatial Information in Europe, http://inspire.jrc.it) initiative and the management of protected areas as well as the need to set standards for information at European level, in order to strengthen the capacity of protected areas stakeholders for information flow and communication, and to provide coherent sources of information and services.

Nature-GIS has been developed as a demonstration project of the INSPIRE principles: it demonstrates through the implemented use cases, the feasibility and advantages offered by an open, multi-sector, multi-level SDI, and identify and manage technical issues in building interoperable platforms.
The Nature-GIS project has now developed into a pan- European network for the operators of protected areas and Geo-Information, bringing together users and experts in information technology (IT) and nature conservation, a living community of spatial data for Protected Areas and Nature Conservation.
The objectives are to contribute:

- in harmonising information relevant for the EU nature protection and bio-diversity policy
- in raising awareness about GI/GIS for nature protection and conservation, in the wider context of European documents and conventions that require research, identification and exchange of information to ease and promote conservation of bio-diversity
- in developing and broadening the dialogue among the levels of responsibility, from the EU to the local (according to the 6th Environmental Action Plan), by supporting access to data and information.

Operationally, Nature-GIS is proposed as a focal point to identify specific GI and GIS requirements for “nature conservation & biodiversity” in European Policies and to demonstrate clearly how web access to information is applicable in this field. Operational tools in such a process are the main results achieved during the Nature-GIS project producing a network stakeholders, technical Guidelines for GI use in protected areas and a demonstrative Internet portal (www.naturegis.net) for data sharing (search, access and retrieval).
Nature-GIS can serve the community of people dealing with environmental protection programmes and management of protected areas in their daily tasks, with applications and information services that conform to the standards proposed by the future INSPIRE legislation

and that better stream the flow of geographic information (at local, regional, national and supra-national levels), through the definition and adoption of common data models.
The project website (the repository for all the information related to the project) and the thematic portal, are the two web components mutually interlaced of Nature- GIS.

The Nature-GIS Guidelines are one of the main project outputs and are structured into three parts.
The first part, "NatureGIS Context", is to provide the salient findings of the project and to draw "best practice" indications for the discovery, access and use of geo-spatial data on protected areas. It is useful for all who need a general introduction and focuses on background information relevant to Nature-GIS, setting the project boundary conditions
The second part, "Nature GIS Survey-Questionnaire", is addressed to all who want an overview of needs and requirements for using GIS in nature preservation. It is based on a questionnaire which was sent to stakeholders involved in protected areas management in order to tune the project development and outcome on the actual users.
The third part, "Nature-GIS Architecture and Technical Guidelines" is for people who, even not specialists, need a more in-depth-view of the GI technical matters: for this reason it goes into some details about technological issues, International standards to describe geographic information datasets (metadata) and specifications to freely exchange geographic information in a distributed (different locations on the network) environment.

The portal (www.naturegis.net) is a powerful example of the webGIS way of operating and represents then by itself an introduction to this technology and facility for the final user. The entire architecture is based on the latest ISO/TC211 standards and OGC specifications for GI interoperability and is compliant with the INSPIRE principles.
The Thematic Portal aims at creating a gateway from where one can search for spatial data, information, services and organizations related to nature conservation, following the principle of INSPIRE:

"Data should be collected once and maintained at the level where this can be done most effectively"

It does not store or maintain the data. These can be distributed in national and thematic servers across Europe and each server is maintained by its responsible organization.
Building a spatial data infrastructure implies also the definition of a geospatial objects vocabulary. Indeed, building an information community requires a consensus about the vocabulary that will be used. The Nature- GIS data model defines this vocabulary and more generally identifies all data sets that can be useful when managing protected areas. The standards and specifications used, the metadata profiles and the data model are described in the Nature- GIS guidelines.
The Nature- GIS Thematic Portal has two main gateways, giving access to:

- the Catalogue of online data that can be combined on the display by the user
- the gallery of demonstration use cases.

The open- architecture and the adopted interoperability standards guarantee the access and sharing of data through many different types of GIS software or viewers, generating, for example, noticeable saving of time in converting data formats and projections.
The benefits deriving from the use of such interface include the possibility to search and visualize huge amounts of data and information collected in various locations and published with different map-serving techniques but all harmonized and collected into a common catalogue, continuously updated with a "capabilities harvesting" method.
The challenge of the Nature- GIS network is now to integrate this created tool with existing initiatives, networks and projects related to nature protection in Europe. The increasing interest in web-services and interoperability issues fosters in fact the creation and testing of these "geo-portals" which allow the users at all the different levels, from the newcomer to the advanced

GIS expert, to easily access the information needed. The Nature-GIS portal is theme-oriented and can be viewed as a horizontal development of a typical geo-portal. The developed use cases are intended to give a practical idea of its possible use.
In particular, the main scope of the use-cases was to access and share geo-information stored in different databases and map-servers which adopt the OGC standards for GI interoperability, thus making a contribution in the bootstrap of an European thematic Spatial Data Infrastructure - SDI.

On above basis and willing to continue and exploit the experience of Nature-GIS project, the Members of that project have agreed, by approving a Memorandum of Understanding, the creation of a thematic SDIC about Geographical Information for Protected Areas and Nature Conservation, to properly exploit the potentiality of the established Nature-GIS Network, thus contributing to the INSPIRE implementation process and giving a further added value to a three years long activity.
The efficacy of this Nature-GIS Community is based on its capacity to share the acquired experience in the field of webGIS and to co-operate with other networks in the field. This capacity relies on the success and on the outreach of the Nature-GIS network, gathering at the moment more than 160 registered stakeholders, (intended as "actual or potential users and producers of GI technology in Protected Areas").
We are confident that they represent a valuable Community for contributing to the INSPIRE implementation rules in the specific field by exploiting and sharing the results of Nature-GIS project and the acquired experience.

3D GIS applications in the "Parco Marino" on the Island of Asinara, Sardinia: a natural Aquarium?

Alberto Marini & Sunny Healey
TeleGIS Laboratory - Earth Science Department - University of Cagliari - telegis@unica.it

The Island of Asinara was a prison for more than 100 years. On 1998, for the passage from the control of Ministry of Justice to the Independent Region of Sardinia was organized a GIS as instrument to know the conditions of the Island: 437 buildings and 318 abandoned ruins are mapped with 52,360 square employable meters are resulting in an unbelievable rich natural landscape. 22 base maps 1:4.000 were prepared ready for the thematic surveys, and 8 maps at the scale 1:1.000 are are ready to be linked to a data bank.

Today a few watchmen guard the park during the night. The old village has completely disappeared, replaced by the empty village of Cala D'Oliva, that was used by the families of the guardians during the period when seven prisons were active.

Some old maps and the description of the geographers show the village at the foot of the castle on the southern Fornelli plain. There are however other older remnants, for example the „domus de janas" (old tombs from the pre-nuragic epoch) and a zone of Phoenician or Roman fortress, a castle and an old monastero, a series of very old wells and some ancient Spanish towers.

The island of Asinara is comprised of the oldest basement rock in all of Italy with age of 900 my but from a geomorphologic point of view it has a contrastingly very young landscape, where the land is being actively eroded and where the Quarternary evolution can be recognized.

The remainders of the medieval castle of „Pirata Barba Rossa" dominate the landscape between the island of Asinara and Sardinia proper, with the more 300 ruins, of which we are slowly losing the knowledge of the history. The central sector has had more anthropologic activity over the years because of it's fertile land and the protected cove that allowed easy access by sea. In 1885 the „Institute of Colonia Penale Agricola" and the „Stazione Sanitaria Marittima Quarantenaria" were established there.

The Island is composed of four small mountainous cores connected by isthmus: the character of the coast changes from high coastal cliffs that are being actively worked and elongated baies. The two rias of Cala Scombro and Cala Scombro di Fuori (rias is a Spanish term for a section of coast bay developed during the regression of the sea during glaciations and recovered after the transgression of the sea), between the elevated areas of Punta Tumbarino and Punta Romasino, are at the opposte sides of the smallest isthmus of the island: 286,6m. Close to this elongated baies there is another arm of the sea: Rias di Cala Marcutza, that is filling the path from a paleohydrography.

Practically all the bays on the eastern coast have remnants of stone walls used for closing the bays for fishing. This activity was maintained up until the years of the WWI when 20,000 people inhabited the island. We are indicating the possibility to use this old implementing to constitute reserved areas on the sea. The barriers are made of lines of stones, some submerged below the sea level. The top was likely completed with canes, constructed for keeping and breeding fish. These structures could now be renewed for the purpose of organizing a natural aquarium were directly meet the life on the sea.

There are an enormous quantity of large structures remaining from the old prisons, each with a big courtyard surrounded by buildings that can be used for research laboratories and fish tanks, for an activity in full synchrony for the finality of the Parco Marino and for a new synergy with the sea.

Utilising GIS to meet the Expectation of the Local Community

D. De Ketelaere and A. Spiteri
Integrated Resources Management (IRM) Co Ltd., Senglea, Malta

In many environmental research projects, an important challenge is to produce a GIS that leads to a series of maps that are not only accurate and informative but also that are user friendly and prove to be a planning tool to local stakeholders. Colasu ([1]), an EU sponsored 3 year research project, focusing on two lagoon environments in North Africa presented such a challenge.

The project's objectives target the study of the present state of the El Meleh (Tunisia) and Nador (Morocco) lagoons. A comprehensive collection of field and desk data on the physical and human environment, was followed by systematic laboratory and GIS analyses. The focus was on the linkage between anthropogenic activities and the occurrence of selected heavy metals and their harmful effects on the ecosystems. The resultant interpretation led to the formulation of sustainable management recommendations targeting both the local specific scale and the catchment scale. The process of data collection and analysis in a GIS environment proved very similar to the steps advocated by the INSPIRE team.

As scientific coordinators, the authors' first concern was to ensure that existing datasets were collected in a standard format. This resulted in the design of a standard scientific matrix that enabled the consortium partners to report on existing base maps for both study areas in a harmonized manner. The next task was to transform the Lambert projection maps to UTM coordinates. To assist the partners in their systematic field data collection, the construction of a digital database template followed. This allowed both in-situ measurements and the results of different laboratory analyses (on water, soil, sediment and parent rock samples) to be uploaded directly in the GIS. This process was accompanied by rigorous checks on sampling labels and their geo-referenced location as well as on analytical results received from the participating laboratories in Spain, Portugal, France, Morocco and Tunisia.

In this phase of the project, interpretation and digitisation of aerial photographs led to a geomorphology base map for El Meleh; and the digitisation of elevation contours and drainage pattern (oueds) from six topographic sheets for Nador lagoon led to the construction of a Digital Elevation Model (DEM) and other ancillary maps. Landsat images for both lagoons provided a large regional scale scenario.

In the second year of the project, with three sampling campaigns carried out in both lagoons and the GIS database slowly taking shape, the authors met with various stakeholders, from the local mayor of a small seaside town, to the Ministries responsible for the Environment, the Management of the Coastal Zone and others. This exercise proved of great interest as it gave direction to what type of information these stakeholders required from the project.

In this phase of the project, more maps were added to the GIS, including a gps location map of all major industries and a landuse/landcover map for El Meleh from the digitising of four topographic maps. This map was then transformed into the landcover-landuse legend used in the Corine classification (European reference standard).

In the last phase of the project, equipped with a substantial catalogue of maps in the GIS together with all the laboratory results of by now four campaigns, it was possible to draw conclusions both at the site specific and the catchment scale. In addition to pollution zoning, the final output includes maps showing the possible evolution scenarios of both lagoons.

([1]) COLASU: Sustainability of Mediterranean coastal lagoon ecosystems under semi-arid climate, INCO-Med Project ICA3-CT-2002-10012 (2002-2005)

Allometry and GIS for tree savanna biomass estimation

Dimos P. Anastasiou

Abstract: The purpose of this study is the development of a methodology for the estimation of basal area and biomass for the Trees Outside Forests at the community and tree level with input exclusively orthorectified aerial photos and no ground inventory records. The existing relationships between the crown and stem diameter of tree species are employed in a GIS-based spatial aerial photo sampling design. The photogrammetricaly derived crown width in combination with dimensional relationships of Open Grown Trees is used to estimate site and individual tree basal area -and biomass-. This GIS approach is demonstrated at orthorectified aerial photos from the country of Slovenia based on the National Inventory System.

Rationale

Forest inventories are designed with the timber production in mind, excluding the savannas and sparsely vegetated areas which provide Non Timber Forest Products.Slovenia carries a forest inventory from 1950 and onwards at the areas classified as forest, which cover approximately the 60% of the country, a lot of quantitative information is available for them. But, for the specific need of this Slovenian study, the non-forest classified areas are of interest. Part of the Slovenian forest inventory aerial orthophoto data set was made available for this study (see Data Index).

The individual trees existing at open woodlands develop in a different manner than the trees in a forested environment. Competition for light and resources with other trees in closed canopy forests is responsible among others for different dimensional relationships[1] in forest grown trees than in open grown ones. 'In dense stands trees with the same diameter are taller than those in less dense stands" (Zeide et al, 2001). As a consequence, using relationships of trees or stands of closed canopy forests widely available in the literature will in many cases produce errors in prediction.

"In Europe relatively little research has been done on OGT's" (Hasenauer, 1997). Limited numbers of studies do exist for Austria and other European countries (Hasenauer, 1997[3] and citations within) and other parts of the world. An important amount of relevant work comes from the continental US, where mostly the Mid-West upland woodlands and tree savannas are studied. Trees in agro forestry and agricultural areas, developed free of competition from neighbouring trees, when combined with the appropriate distance independent[2] (IUFRO, 1988) forest models can provide quantification of woody biomass at open grown woodlands, savannas and dehesas[3].

"The combined crown width regressions for these open-grown trees were essentially the same as for open grown upland oaks" (Krajicek et al, 1961). "However, the crown variations in forest-grown trees were much greater than among open grown trees"(Minckler et al, 1970). Krajicek at 1961 (Krajicek et al, 1961) in order "to determine crown diameter of a tree in relation to its breast-height diameter (DBH) diameter observed open-grown trees" (Law et al, 1994). They defined the term MCA, or Maximum Crown Area, of a tree[4]:

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[1] The mathematical equations that relate the height of a tree with its diameter at breast height, or with its crown width, its biomass, and many other attributes. Predicting height of an open grown tree from its crown width using an available equation from the literature for forest grown trees, it is very possible that it will be overestimated. OGT's, as the name implies, grow wider, and since there is no competition with neighbouring trees for light, their height increment is lower

[2] Distance Independent Forest Models: Spatially explicit models, the ones which grow the tree without accounting for the Stand - Tree inter specific competition, "growing" it at the maximum crown width, as it would grow out in an open field. For that reason, they are considered as the most appropriate to model trees in agroforesty and other open woodland formations (IUFRO - 6, page 1130).

[3] Dehesas are the oak tree savannas that occupy a big part of the Ibiric Peninsula.

[4] $CC = \Pi (CW)^2 \div 4$ With the assumption that the crown 2-dimensional shape is circular

$$MCA = 0.0060\,D^2 + 0.0205\,D + 0.0175$$, D = dbh (inches)

Equation 1: **After Krajiceck et al, 1961. A single tree's Maximum Crown Area Equation; the maximum space a tree can facilitate if it is open grown, expressed in terms of its diameter and its basal area**

Similar work (Gingrich, 1967; Law et al, 1994) for the creation of a crown cover chart of oak savannas produced the Stand Crown Cover formula for the stand level5:

$$SCC = 0.0175\,(N) + 0.0205 \sum \int_1^N D + 0.0060 \sum \int_1^N (D)^2$$, D= Dbh (in) and N = tree number

Equation 2: **After Gingrich, 1967; Law et al, 1994. A Stand Crown Area Equation; the space trees can facilitate expressed in terms of its tree number, summation of diameters and the basal area compartment, the tree squared dbh summation.**

"Crown width in feet was two times the Dbh in inches" is a general rule of thumb proposed in a study done for mixed forest stands and tree savannah species (Minkler at al, 1970): "ratios of crown width over tree Dbh were similar for all species, crown classes and sites".

A study that took place in Austria for the examination of the dimensional relationships of open grown trees (Hasenauer, 1997) mentions among others that with the exception of stone pine and white oak (Krajicek et al, 1961) "the crown width relationships of all compared OGT studies are similar". Crown width – dbh and dbh – height relationships are given for certain European species (Hasenauer, 1997). With the availability of new field inventory records from areas classified as non-forest, a simple statistical model can be constructed, custom made to the diameter distributions and dimensional relationships of the local species. Metric unit measurement equations can be developed for this crown cover model (Rogers, 1980)

SCA ={-3.547(N) +1.041[(DBH1) + ….(DBHN)] + 0.019[(DBH(1)^2)+…DBH(N)^2]}/1000

Equation 3: SCA equation from stand 1(see Stand 1 index) derived with multiple linear regression after computing the variables using data generated from Haseanuer (1997) relationships. Equation generated log-data has been corrected for logarithmic transformation bias. Metric units were used for this stocking equation.

The comparison of the US and Austria dimensional relationships of OGT's has been done by Hasenauer at 1997. Since US species relationships are very similar with the Austrian ones, it is now assumed that Austrian equations will fit very well the same European species in the neighbouring country of Slovenia. A US –Austrian comparison made with crown width photogrametrically derived crown data from the Slovenian aerial orthophoto provided very similar results, between eight different species, as was mentioned by Hasenauer: "This confirms that crown width is strongly related to diameter at breast height, regardless of site and genetic differences". Following several authors (Krajicek et al, 1961; Gingrich, 1967; Curtis, 1970; Minckler et al, 1970, and Law et al, 1994) interpretations and stand tables can be constructed, appropriately modified for use in future aerial photo and/or field forest inventories (see Chart 3).

The model

Aerial sample unit stratification to two sub-samples: Wooded and non-wooded

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$$MCA = \Pi(CW)^2 \div (4/435.6) = 0.0018(CW)^2$$

$$CW = (1.829\,dbh + 3.12)$$ after regression analysis of the 1961 data

$$(CW)^2 = 3.345\,DBH^2 + 11.413\,DBH + 9.734$$ (After Krajicek et al, 1961)

[5] Based on the assumption that the summation of all individual maximum crown areas constitutes the maximum crown area of the stand, and adding the N –tree population number- to account for the whole stand area.

The rationale behind this estimation methodology is that we do not treat the whole area of the open field, which belongs to the inventory sample, which are both the wooded part and the non-wooded. Instead, we stratify the aerial photo sample to two sub-samples: a)The tree covered sample and the b) Non-Wooded Area = Total area - Wooded part

By doing sub-sampling, we assume that the tree covered area has 100% tree cover. Since this is in the middle of a field, we assume that the trees that constitute it are open-grown for the rest of this paper. (If not, then the known forest biomass estimation methodologies apply). Then the following steps should be applied: a)Calculate the individual tree crown areas and their sum, the total stand crown cover. B)Extrapolate the crown cover (and the correlated variables with it such as tree stem diameter, volume and biomass) for the whole area of the field and per unit area for the given number of fields that constitute the total sample. c) The estimator of the mean and average biomass/crown cover per ha will be then derived from the sampling units. Aerial photo stratification in two classes, wooded and non-wooded, is considered as a mean to improve timber volume estimates in forests. Crown area weighting and classification further improves the desired estimation in forested areas with aerial photo sampling (McLean, 1972).

Aerial Photo Samples

According to the Systematic Grid sampling plan for the forest inventory of the country of Slovenia the sampling points of the areas non-classified as forest were also outlined following that design (Drigo, Personal communication, 2003). For methodology demonstration reasons, two aerial sampling plots were chosen subjectively, where all the previously described steps were applied. The digitised individual tree crowns are registered in to the GIS system geodatabase (see Data Index, Sample 1 and 2, Table Columns 1 and 2). The Systematic grid sampling design followed is he it applied for the country of Slovenia (Drigo, 2003). Each polygon chosen by the sampling grid points is selected as a sample.Each GIS digitised tree crown basal area is assumed to be circular.

$$Tree\ Crown\ \ Area\ = [\pi * (cw = crown\ \ diamater\ \ )^2]/4 \rightarrow cw = \sqrt{[(cw * 4)/\pi]}$$

Equation 4: Photogrammetricaly derived crown cover computed to crown diameter.
Assuming that common open grown trees for the country of Slovenia belong to the species of Quercus spp., Fagus spp., Fraxinus spp. and Tilia spp the interpretation from the crown area to stem diameter, basal area and height took place. Existing log-linear regression relationships from open grown trees of Austria were used (Hasenauer, 1997) corrected for the logarithmic transformation bias (Hasenauer, 1997; Miller, 1984 Sprugel, 1983)

$$\ln(CW) = a + b * \ln(dbh)\ that is \ln(dbh) = (\ln(cw) - a)/b$$

Equation 5: Linear regression relationship between crown width (cw) and diameter at breast height (dbh). Symbols a and b are regression coefficients.

$$\ln(CW) = a + b * \ln(H)\ that\ is\ \ln(H) = (\ln(cw) - a)/b$$

Equation 6: Linear regression relationship between crown width (cw) and tree height (H). Symbols a and b are regression coefficients.

$$H = \exp(\log(H)) * \exp(Var(\log(H))/2)$$

$$dbh = \exp(\log(dbh)) * \exp(Var(\log(dbh))/2)$$

Equation 7, 8: Adjustments for the logarithmic transformation bias for height and diameter generations of individual records. The described procedure incorporated in a spreadsheet using the crown area measurements of individual trees produces dbh and height records
Basal area can be estimated from the diameter at breast height.

$$Basal\ \ \ area\ = BA = 0.00007854\ \ \ \ \ DBH\ ^2 = (\pi\ DBH\ ^2)/(4 * 10.000\ \ )$$

Equation 8: Basal area calculation per tree and or per stand basis can be done in the first steps of the model. (After Avery and Burkhart, 1975(25))

The equation for beech biomass (Baterlink, 1996), and any other species of interest can be computed for each record, using as input height and diameter the ones derived from the equations 3-7 for open grown trees[6].

$Y = C_1 * DBH^{C_2} * H^{C_3}$ Where c1, c2, and c3 are regression coefficients

Equation 9: Biomass calculation for branch, leave and total biomass. (After Baterlink, 1996)
Incorporating these two variables the tree and site total volume estimation can be done for the photo samples and the extrapolation of the results for the area of interest.

With the availability of a stereoscopic aerial photo(s) and the appropriate photogrammetrical equipment and /or software, this GIS system will be able to include in the spatial aerial photo sampling tree height measurements in combination with the crown area. Then, using just the Equation 1 below:

$$\ln(CW) = a + b * \ln(dbh) \; that is \; \ln(dbh) = (\ln(cw) - a)/b$$

And the aerial photo height and crown width measurements crown – biomass tables can be constructed with accuracy.
LIDAR imagery use can provide tree height measurements also (Faruque, 2003), which is another possible way of using remotely sensed data for TOF inventory, an alternative of the other solutions.
Conspecific dominance as a method of determination of the site structure is mentioned in biometry work that took place in the tropical Australian Savannas (O' Grady et al, 2000). Its determination for the area of interest could improve the estimation for further also positive consequences to future estimations management.

$$Conspecific \; dominance \; of \; species$$
$$CSD = basal \; area \; spp.(sq.m./ha)/total \; basal \; area(sq.m./ha)$$

Equation 10: Conspecific dominance: one of the main contributors of stand density (After Grady et al, 2000) which can also be estimated from aerial photo identification of tree species.
Since in TOF there is not much variability as in forested environments the identification of tree species from aerial photos can be done from skilled and acquainted photo interpreters, or from a field sample when carried. In addition, if a field inventory is desired, the aerial photo sample unit coordinates can be inserted to a Global Positioning System- GPS- and the field location of the individual trees can be accessed. The non forest classified areas have by definition low forest cover, which in turn favours the use of Global Positioning Systems equipment comparing to closed canopy woodlands, and also the individual tree recognition on the ground can be done from the aerial photo directly from the ground inventory crew, since individual trees or clusters of them in an area of 2% to 10% forest cover is far easier to be located on ground than in forests. Allometric relationships between crown width, Dbh, height and any other tree dimension of interest can be developed after the field measurements and they can be used for future biomass estimations through aerial photo sampling.
Crown diameter measurements on aerial photographs of forested environments have been proposed as a valid forest inventorying technique by many authors (Avery et al, 1975; Hunch et al, 1982; and many others). In fact, from some of them it is considered as a probably better technique than the ground measurements of crown diameter (Hunch et al, 1982). However, the literature research did not reveal any similar work for open woodlands or Trees Outside Forests.
Volume per tree from aerial photo interpretation and remote sensing technologies is also under development on a semi automated forest inventory system is a research project in Germany (Katch) The solution of LIDAR imagery could be also considered; "the ability of some LIDAR images to travel through trees and reflect off the ground means that both the tree cover and the bare earth elevation can be measured" (Faruque, 2003)
Conclusions

[6] An open grown tree biomass equation was not available. For this calculation, a forest grown tree biomass equation is used, but with input the height and breast height diameter of an open grown tree.

Incorporation of past and current research on stand and tree allometric relationships in a spatial modelling environment can help on the estimation of basal area and biomass.

The methodology can produce basal area and also biomass estimates from a desktop computer utilizing remotely sensed data such as the Slovenian aerial photos:

Reducing the need for field studies, thus being cost efficient
Being flexible enough to employ past and current research for estimations of basal area and also biomass at the tree and community level.
Benefiting from the fact that Trees Outside Forests and low density woodlands have lower variability and so are easier to estimate their attributes
Combining all those information layers in the GIS environment, for locating and managing in a spatial real world map the wood fuel biomass supply of rural areas.

The customisation of the model is possible for TOF and low-density woodlands that belong to temperate and tropical ecosystems and for forest classified areas too, where more information is available. The already small amount of computational time required can be further reduced with customized ArcGIS applications and Microsoft Excel spreadsheets.

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Open-Source Software for Multilingual Geo-Data Distribution via Internet

J.Belickas[1], V.Rapševičius[2], Ž.Denas[1,2]; A.Tchistiakov[3]
[1] *Geological Survey of Lithuania, Vilnius, Lithuania, julius@lgt.lt*
[2] *Vilnius University, Vilnius, Lithuania, v.rapsevicius@it.lt*
[3] *TNO-NITG, Utrecht, The Netherlands, alexei.tchistiakov@tno.nl*

Keywords: geo-information, borehole database, multilingual web service, eContent, European Union

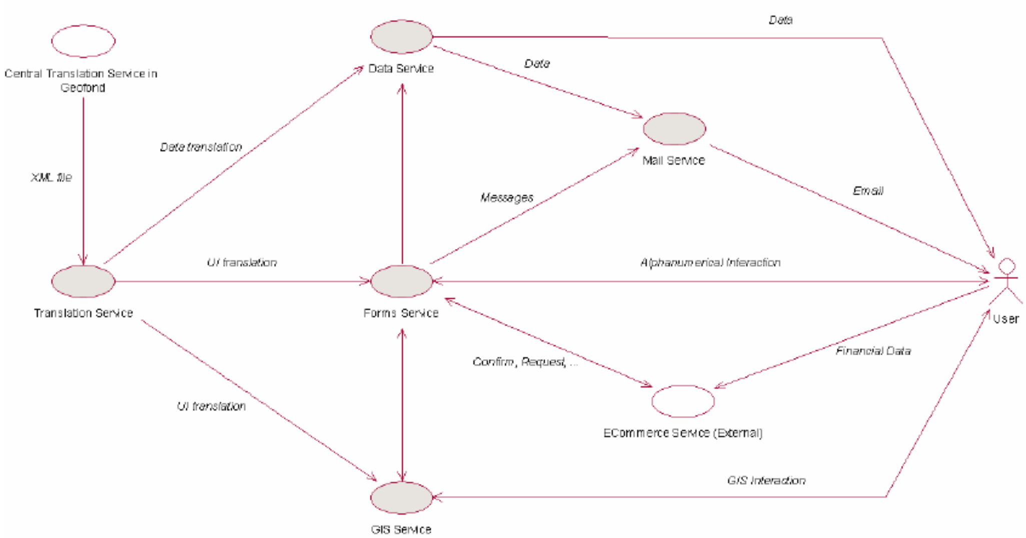
Development of multilingual cross-border geo-information services based on public geo-data stored in the national geo-databases is the main goal of the newly started EC-funded project Electronic Access to the Earth through Boreholes (eEarth). While rich geological institutions can afford using costly commercial software for maintaining geo-science databases, cheaper but not less efficient solutions can be applied in the geological surveys and companies having limited funds available for their geo-databases. This could be offered by clever usage of open-source software. Applying these free of charge technologies for borehole information services can be successfully used for integrating new candidate countries into the European Union geo-science database network. This is the reason why one of the eEarth work packages is aimed particularly at analysis and demonstration of capabilities of open-source software for creating digital geo-databases as well as for disseminating the geo-data via Internet.

The software specification includes:
- Inventory and analysis of different open-source software tools;
- The software architectural solutions;
- Manual on installation, maintenance and integration in multilingual framework (eEarth);
- Recommendations for building and installing an IT-framework for institutions from new EU member states, especially for organizations that have small budgets for central databases.

The main criteria for selection of open-source software tools are their functionality, robustness, performance, compatibility with different platforms, and quality of the APIs. The compiled set of the open-source software will allow fast and economic deployment of GIS and database applications.

Below are listed components of the system (see figure) and a brief description of open-source software packages that have been chosen to implement those components:

Operating environment. It consists of operating system, web server and data storage (relational database). Operating system should be chosen in between different brands of Linux or BSD systems. Main criterions to evaluate operating systems are: 1) support of needed hardware, 2) support of necessary (see below) software and 3) being popular in various web service solutions. For a web server we have chosen Apache httpd server that is the most popular in the area. The choice of databases included MySQL, PostgreSQL and Borland Interbase solutions. We have chosen widely spread MySQL database version 4.1 or up that supports Unicode. All above listed packages – Linux/BSD, Apache httpd and MySQL database – are free of charge and are well known to supply a stable and efficient service for applications of any scale.
Form Service. The purpose of this service is to supply a user with a borehole database search facility implemented. Form Service is implemented in HTML by using scripting language PHP.



GIS Service. This service supplies user with GIS interface: clickable web map, reference map, navigation tools and other GIS common features. Web based GIS service is implemented using PHP/Mapscript which is actually a PHP module to supply a full UMN Mapserver functionality. Vector GIS format data for this service is provided directly from the server file system. Borehole layer can be taken either directly from MySQL database (which is actually a pre-processed snapshot of the main Oracle borehole database) or from a precompiled borehole layer in the vector layer format. For the second option the OGR tool of Open GIS Consortium can be used.

Data Service. The main purpose of this service is to handle user data request: query database, prepare selected data in XML format and send it to user. Data service will be implemented using scripting language PHP and its internal XML parser. If this solution will not match the required functionality (Unicode, performance, etc.) the IBM XML4C can be used. It is a simple and full-featured XML parser for C/C++ languages. It proved the market to be fast and reliable solution for XML parsing that need high performance and reliability.

Translation Service. This service to function must be a-priori provided with translated user interface (UI) and borehole coded data dataset from the central translation service at Geofond (CZ). This dataset in XML format can be stored in the main data storage of the system (MySQL). Thus, Translation service consists of data import facility and two applications of translation service – one for user interface translation and another for a coded borehole data translation. Both should use the same data source (preloaded data in MySQL database). User interface translation will use template files that will be supplied with the pre-loaded variables substituted with values related on selected language. Coded data translation will be done in series, one by one. Both applications will be implemented by using PHP and XML parsers (see Data Service description).

ECommerce Service. It is a special eEarth application that interacts with the external ECommerce site. Finance data collection and all the financial operations are handled by the external secure web portal. Not sensitive customer information should be stored also and in local database (MySQL). ECommerce service will be implemented using PHP scripting language.

Mail Service. Many components of the eEarth portal need mail service that mainly includes data and other information delivery to customers and system administrators. We use a freeware Mail

Transfer Agent (MTA) Sendmail that is essential for most Unixes and is a part of operating system. With MTA communicates PHP applications.
Mobile Service. Mobile application is just an adoption of common web interface application to a small screen device. It should reuse main components and solutions of the system including Web forms, GIS service and others.

To conclude below is provided the full list of open-source software packages that are or going to be used to implement multilingual cross-border geo-information services:

Operating System: Linux; Web Server: Apache httpd version 2.0 and up; Database: MySQL version 4.1 and up; Scripting language: PHP version 4.0 and up; GIS application: UMN Mapserver and PHP/Mapscript; MTA: Sendmail; XML parser: IBM XML4C (optional).

Acknowledgments: we would like to acknowledge the eContent program for funding the eEarth project.

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http://www.php.net/ PHP website
http://www.opengis.org/docs/99-049.pd OGC OpenGIS Simple Features Specification for SQL

An Approach for SDI Texture

B.Rachev, D.Ilieva, M.Stoeva,
Technical University of Varna,Varna, Bulgaria

AN APPROACH FOR SDI TEXTURE MODELING

B.Rachev, D.Ilieva, M.Stoeva,
Technical University of Varna,Varna, Bulgaria

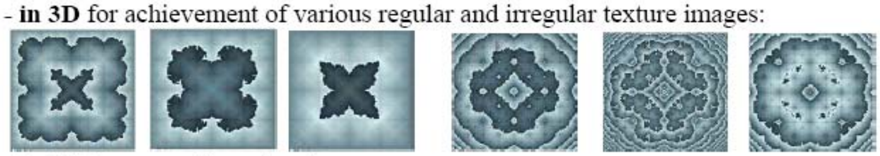
The application of stochastical models is an approach of syntesis of complex scenes with natural phenomena in computer graphics. One suitable stochastical model that can be adapted to the approximately imitation of different stochastical phenomena reduces the necessity of modeling the phenomena separately.

Stochastic fractal techniques possess some properties that make them very useful at the synthesis of natural images. The textural images through the presented adaptable algorithm can be applied in different areas of science for example geology, geography, meteorology, medicine, etc. The model allows important information to be saved and analyzed without working directly with real surface. The structure of data, used for presenting the surface is quadrilateral regular lattice. One of the most common stochastic models for presenting a curves and surfaces is used – fractal model. The researches show that the fractals can be successfully used for generation of discrete models of terrain with satisfactory punctuality and speed of computing procedure. Another important advantage of the proposed approach is that the user can calculate terrains with unlimited levels of details without expanding the database.

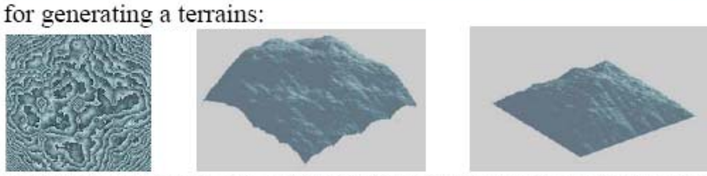
Applications of the suggested algorithm

- in 2D - for generating a silhouette of a mountain:

- **in 3D** for achievement of various regular and irregular texture images:



-**in 3D** for generating a terrains:



The algorithm is adaptable and applicable for varied purposes. It can be applied for creation of regular and irregular texture images and also in the systems of modeling of natural phenomena. After some changes are adapted, it can be applied at modeling of clouds, ocean waves, fire flames and other phenomena that have stochastic texture surfaces.

The number of levels in division and the noise factor are related with the fractal dimension and they control the extent of roughness of the terrain. When local control is applied at the area for division we can model natural scenes with different specifics (meadows, hills, clouds, etc.). The user can control the level of details. It doesn't influence significantly the duration of the procedure.

Implementation of enterprise SDI at central government agency

W.C.A. de Haas
Rijkswaterstaat AGI, Delft, The Netherlands

The directorate-general (DG) for Public Works and Water Management (RWS) is responsible for maintaining and administering the main roads and waterways in The Netherlands. RWS is a organization with a headcount of about 10,000 employees, an annual budget of € 11 billion and more than 200 offices throughout the country. A new Dutch government policy has urged RWS to deliver more value for money on the same budget and to simultaneously reduce its employees. To achieve these goals, the organization is moving from a decentralized approach to a centralized steering model using uniform working models and organization-wide standards.
The department of Geo-information and ICT (AGI) is working with RWS to meet the challenge of reducing ICT (information and communications technology) costs considerably. The strategy to meet this challenge is built on the principles of: uniform working models, open standards, server-based computing and central data hosting and maintenance. A geo-information infrastructure based on the OpenGeospatial Consortium (OGC) Services Architecture has been established using both open source software (OSS) and vendor components. This infrastructure has already enabled broad geo-information sharing throughout the organisation and has proven to be cost effective.

Expected future developments include feature services and the implementation of a transactional web feature service for mobile clients.

Attention will be paid to the following aspects:
1. Software architecture;
2. Lessons learned;
3. The use of both Open Source Software (OSS) and proprietary software.

Combining geographic information and fire modelling to design landscape management strategies in fire-prone Mediterranean areas

B. Duguy[1], J. A. Alloza[1], R. Vallejo[1], A. Röder[2], J. Hill[2]
[1]*CEAM, C. Darwin 14, 46980 Paterna (Valencia), Spain (bduguy@porthos.bio.ub.es)*
[2]*University of Trier, Remote Sensing Department, Campus II, D-54286 Trier, Germany*

The number of large fires increased significantly in the 1970s in the Valencia region (Eastern Spain), as well as in most northern Mediterranean countries, as a consequence of land abandonment and undergrazing. Recently, spatial technologies, such as Remote Sensing (RS) and Geographical Information Systems (GIS), combined with fire modelling have contributed to improve our understanding about landscape structure and fire interactions (Finney, 1994; Stephens, 1998).

The main objectives of this study were: 1) to parameterise the FARSITE model (Finney, 1994) in the Ayora site (a 31.700-ha area burned in 1979), 2) to explore the effect of fuel spatial distribution on fire propagation and 3) to test the effectiveness of different firebreak alternatives on fire spread. We aimed to propose a methodology to design sustainable fire management strategies.

FARSITE was parameterised for the fuel and weather conditions of the 1979 fire (situation of high fire hazard). Then, different fuel scenarios and/or firebreak networks were tested, maintaining the same topographical and weather conditions as in 1979. The 1979 fuel model map was generated in ArcView after the RS-derived 1979 vegetation structure map. We used the Rothermel's fuel model types (1972).

FARSITE simulations showed that fire propagation was greatly influenced by the spatial distribution of heavy surface fuels, such as fuel model 4. The fragmentation of large fuel model 4 areas through the promotion of dense wooded patches minimised fire spread. The introduction of firebreaks was also very effective in reducing fire propagation. Dense networks with medium-width firebreaks were more effective than less dense networks with wider firebreaks.

The FARSITE-provided indications led to a target fuel spatial distribution. It was combined with several GIS layers (geomorphology, elevation and weather) to generate spatial recommendations for fuel management actions (reforestation, introduction of woody resprouters to increase the landscape diversity and resilience to fires).

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Intergraph SDI components implementation

Peter Bartak[1]
[1]*Intergraph Corporation, Hoofddorp, The Netherlands*

Over past few years a number of real life implementations of various essential components of SDIs (and similar initiatives) have been conducted around the globe. This is bringing the SDI from 'talking about it' to 'working with it' and Intergraph was there too. This poster presents how earlier efforts in sharing GI in an open manner as well as some very latest implementations by Intergraph or using Intergraph's technology were successful and where some of the major benefits lie. In most cases the focus is on portals and their features. While building of portals remains the forefront of the game Intergraph has placed a strong emphasis on the server side technology where the data is being managed and served up. With the strongest possible effort to promote and include open standards based solutions Intergraph has provided solid server platform for serving data into any real SDI based on relevant OGC and ISO standards. That way the interoperability, so crucial in the SDI paradigm, is not achieved by enforcing a single platform or single format solutions but it is rather based on standards that are open enough to enable platform, vendor and format independent implementations.

Examples will include cases such as Terramapserver, German 'Runder Tisch GIS', Czech Land Survey office 'Geoportal', or Indian NSDI.

An analysis of AGILE conferences' papers: a snapshot of the GI&GIS research in Europe

P. Di Donato, M. Salvemini
LABSITA – University of Rome La Sapienza, Rome, Italy

GI&GIS permeate the Information Society and penetrate on one hand a growing number of academic subjects, on the other hand the mainstream business.

The presence is sometime well visible, just thinking to the several EU funded initiatives and projects, from GI2000 to INSPIRE, from Madame to ETEMII to GINIE to hundreds projects listed on the ECGI&GIS portal, sometime it is not clearly visible but substantially supporting other very important activities for example, just quoting from the IST 2005-2006 Work Programme priorities, "ICT research for innovative Government", "eSafety - Co-operative Systems for Road Transport", " ICT for Environmental Risk Management", etc.

All this clearly shows that awareness is by now high on the crucial role of GI&GIS for the socio-economic and political growth of Europe, and INSPIRE is just the last but important demonstration of this situation.

At the same time it implies that the European GI Research Community has been and is really active. The relationship between the GI Community and the Political domain is twofold; the Research Community has often provided the decision makers with useful inputs and tools for their activities, while vice versa some political decisions and activities have highlighted hot themes to be addressed and investigated by the Research Community itself.

The poster aims at giving a snapshot of the European GI Research through the analysis of high level scientific papers and posters presented during the last six Agile conferences (1999-2004).

SISA: Informative System for the Area Development

Antonio Patta
BIC Sardegna S.p.A

SISA - Informative System for the Area Development, is realized by BIC Sardegna within the Measure 4.4 of the POR Sardegna 2000 2006. - Integrated development of areas and economic clusters and, particularly, within the action 1 - Promotion and support to integrated projects.

Mission
SISA informs and assists local authorities and enterprises in the designing and implementation phases of local development programs of in Sardinia, offering social-economic operational tools, freeware on the web.
Services
In SISA (www.sisardegna.it) local authorities and enterprises can easily find all methodological references for an effective approach to the development of their own territory and operational tools, like:

- all local development opportunities in progress or in project in Sardinia, with the description of the general model, the procedure and the regional, national and European legislation;
- an updated review of the programs of local development, operating in Sardinia with a focus on all infrastructural and entrepreneurial interventions included, highlighting the physical, procedural and budget state of the art;
- the updated Sardinian economic, social and geographic ratios, on a town basis, matchable and extractable on sheets and through GIS (Webgis) on geographical maps
- the available financings for the local authorities and the incentives for the enterprises with search engine for territory, kind of investment, sector, etc..
- a world review of best practices in local development;
- the legislation and the documentation concerning local development, a daily news related to local development;
- Sardinian market strategic information focussed on several business sectors (olive oil, wines and liqueurs, ICT, etc...)

Benefits
SISA is the only regional tool in which the actors of the local development can find the useful inofmation to design and implement local development actions in their territory.
SISA's tools are freeware.

Relationships between European and non-European SDIs in Europe: a perspective from the private environmental sector.

Andrea Giacomelli
CH2M HILL, Milano, Italia

Multi-national companies operating in the field of environment rely on information assets, organisational schemes, and business processes designed and scaled to address the needs of clients which seldom have facilities or offer services in a single geographic area, and whose operations often span across several countries.

We may take the case of an environmental restoration program concerning the assessment and remediation for a non-European industrial subject, owning facilities located in different European states. The geographic location of the sites will typically bring to confrontation -and require integration of- data collection and processing standards, investigation approaches, regulatory settings and policy practices deriving from different nations.

In such a context, most of the requirements identified by INSPIRE for the establishment of a spatial data infrastructure in Europe (e.g. in terms of metadata, data harmonisation and data sharing) are in fact of relevance, both in day-to-day tasks and in efforts covering a broader scope. For example, data used by the company owning the facilities to describe key environmental information on the sites could be stored in an enterprise-wide information system which is compliant with data standards derived from the company's home country. This is perfectly consistent to insure an efficient view of information across sites in different countries from a corporate viewpoint, but may often pose data sharing issues among various project members, or communication issues (e.g. maintenance of multi-lingual data sets) with external subjects, such as local environmental authorities.

The impact of these issues, in situations where spatial data infrastructures are not in place or only partially developed, can be significant within a project, from the standpoint of resources and scheduling, and, thus, needs to be appropriately addressed.

The presentation will propose a "side by side" comparison of a spatial data infrastructure with a "project delivery" data infrastructure applied to the environmental sector, considering technological and organisational aspects. This will be done with reference to ongoing CH2M HILL activities in Europe.

In particular, examples will be provided, showing where points of contact with SDIs at different levels exist, cases where EU- and non-EU spatial data infrastructures are actually co-existing, and where areas of optimisation may be explored, in the interaction with European SDI developments related to INSPIRE.

Effects of INSPIRE to the German state survey offices and the spatial data infrastructure on national and regional level

C. Loeffelholz
Vermessungs- und Katasteramt Pirmasens, Pirmasens, Germany

Caused by the gradual change to the information age all scopes of the public sector will face fundamental alterations in the following years. In the range of geographical information this change includes the transition from closed geographical information systems (GIS) to interoperable, interconnected GIS. Multiplicities of spatial information are managed in closed systems at present. High additional expenses are being caused by this special and utilisation oriented data management. Furthermore this information is difficult to detect and to access for third party. To afford an effective and efficiently work, substantial additional expenses are necessary.

Spatial information and services can be making available for a large number of users enabled by the progress of the information technology and the availability of the internet in private households.
The infrastructure for spatial information consists in the technological, political and institutional measures, that assure, that methods, data, technologies, standards, financial and human resources are available to the extraction and using of spatial information according to the requirements of the economy (AdV, 2002 [2]).

This article describes updated the results of the homework for the second state exam in the range “land survey and cartography” (LOEFFELHOLZ [1]).

The initiatives of the state survey offices creating a spatial data infrastructure (SDI) in context of INSPIRE are presented. Furthermore problems are discussed.

With the proposal for a directive of the European Parliament and the Council establishing an infrastructure for spatial information in the Community (INSPIRE [3]) few allowances to the spatial data infrastructures in the member states are provided. These assumed political, institutional and technological measures.

In the first part of the paper, the basis of the SDI, the political decision for set-up and the co-ordination of the adjustment and build-up process is shown.
The development status in the Germany’s federal states is very different as a result of the administrative structure. Figure 1 presents the initiatives of the federal states to setup a multidisciplinary spatial data infrastructure. The predominantly part of the federal states instigates the development of SDI (10 of 16).
Otherwise there are allowances of INSPIRE, to implement structures in the member states within 2 years after the commencement of the directive, which are required for a European Spatial Data Infrastructure.

Caused by this demands, different tasks come up to the federal states in Germany. Based on an internet inquest, presently structure and future tasks are explained in this paper.

Technological demands for a European Spatial Data Infrastructure are described in article 8 to 22 (INSPIRE [3]). These are explained in the second part of this paper, considering available structure in Germany. Determinations for metadata, interoperability of spatial data specifications and network services become examined.

Figure 1: federal states initiatives in Germany to build-up an interdisciplinary SDI[1]

In the INSPIRE position papers „core datasets“ for a European Spatial Data infrastructure have been determined. This “core datasets” are explained product-oriented in contrast to the available spatial data in Germany (Figure 2).

Spatial data and services of the federal state survey offices are displayed in reference to the proposal of INSPIRE in the third part. A measure catalogue for the survey offices is the last part of the paper. A first impression is given by the Figure 3.

[1] Figures are based on an internet inquest in March 2004; it’s updated at present

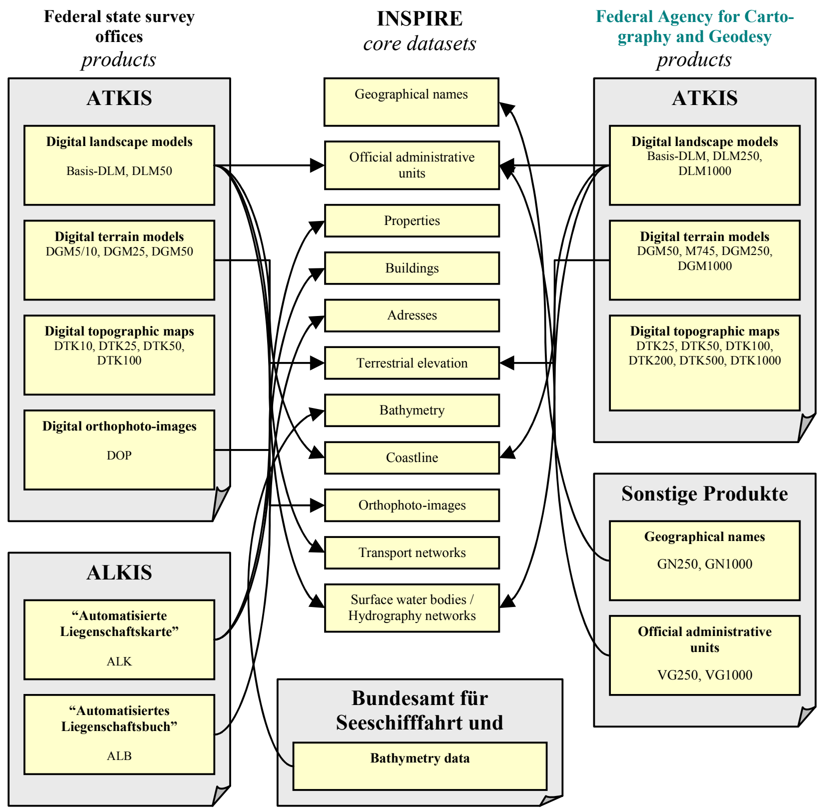

Figure 2: comparison of the INSPIRE-„core datasets“ and spatial data (geo basic data) in Germany

In summary it can be ascertained, the development status of the German SDI is, based on the federal structure, very inhomogeneous. But the level is altogether very high. The major tasks are in the technologic and institutional range. The horizontal (between branches) and vertical (between regional and national level) co-operation must be improved.

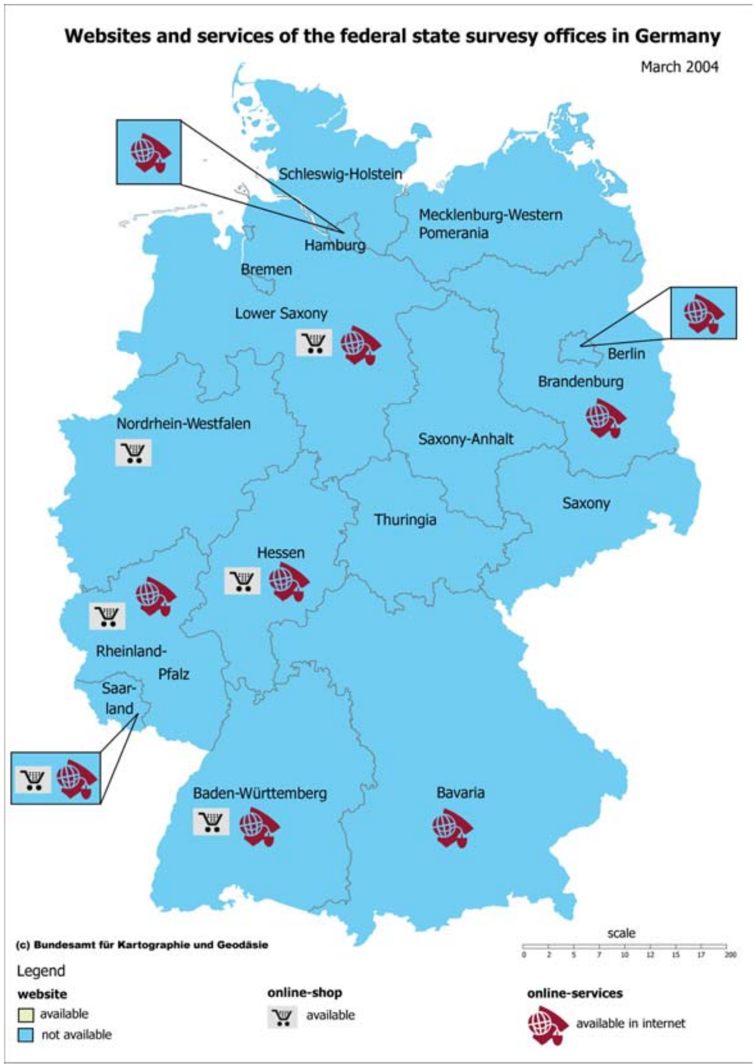

Figure 3: web-sites and spatial data services of the state survey offices

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Image Similarity on Relative Spatial Location of Image Objects in SDI databases

B.Rachev, M. Stoeva, D. Ilieva
Technical University of Varna,Varna, Bulgaria

This paper presents our work in the area of image retrieval in SDI Databases (SDIDB) for images saved by spatial similarity of domain objects location. We propose a geometric based structure which makes possible the extraction of spatial relations among domain objects that are invariant with respect to transformations such as translation, rotation, scaling, reflection, view point change as well as arbitrary compositions of these transformations.
Extended objects of each image are saved in image databases by symbol names and coordinates with reference to a Cartesian coordinate system of five typical for the object form points, whose determination is invariant with respect to transformations. The absolute location of each object's area is described by its centroid and the 4 tops of a new object area approximation named Minimum Area Rectangle (MAR). MAR is defined as the minimum area rectangle that covers the object. In general its sides are not parallel to the coordinate axes. This information that is saved for each object, allows us to use ring sectors determined by concentric circles for approximating the objects' shape extent. By using this representation we analogically to the orthogonal models determine the well-known 13 relations in one linear direction and one specifically used circle direction. We provide the transformation invariance of determination the atomic relations between two objects by utilizing the properties of the object and image centroids.

We introduce an algorithm presented that recognizes transformed images and subimages. The algorithm temporary complexity is n^2, where n is the number of objects that are common for both the query and databases images. The algorithm is robust in the sense that it can recognize translation, scale, and rotation variant images and the variants generated by an arbitrary composition of these three geometric transformations.

The effectiveness and the efficiency of spatial similarity retrieval algorithm are evaluated by using an expert-provided rank ordering of a test collection with respect to a set of test queries using the R_{norm} measure. The results are compared with related to the subject published results. The experiments result demonstrates that the proposed algorithm is invariant with respect of transformations including reflection and its evaluation has stable behaviour when enriching and detailising spatial relations among objects. Our contributions are as follows:

- Utilization of new approximations that provides short symbol description for storage in SDIDB. This short information allows achieving invariance from transformations when determining the spatial relations in images.
- Spatial similarity algorithm and distance measure for image retrieval from SDIDB that recognize the shape, measures and mutual location of their objects. They detect transformed images and sub-images.