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A Spatial Data Catalogue Based Initiative to Launch the Spanish SDI

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Introduction

Multiple organisations from INSPIRE at European level to national and regional bodies have spent considerable time and effort over the past few years debating optimal SDI architectures, which depend to some degree on the maturity (availability) of standards documents and standards-based components. After several years lamenting the lack of completed standards and components, there is now a healthy offer which allow SDI developers to prototype the three basic technology components of a SDI: 1) metadata collection and publication, 2) catalog and registry services, and 3) web mapping servers and clients. While we acknowledge that fact that political and institutional aspects of SDI creation provide the toughest challenges, in this paper we focus on the important role technologists play in facilitating politicians' decisions regarding how to go forward, or at times whether or not to even begin.

We distinguish two classes of SDI project. The on-going NorthRhine Westfalia pilot project is an excellent example of how a rather large collection of companies and public institutions created standards-based components according to a well-defined project architecture (reference model, see Münster 2001). However, it would seem that many regional SDIs across Europe have not defined (or at least have not published) such consensus-driven architecture. Several nascent SDI projects within Spain are good examples of this second class of SDI, where significant interest exists yet a common model or architecture does not. The authors of this paper represent a collaborative team (see TeIDE 2002) of academic technologists who have developed a set of prototype components in order to demonstrate the possible capabilities of various scales and types of SDI. Beginning with technology pilots might be considered putting the cart before the horse, but we have witnessed how this can serve to spark interest in interagency collaboration --it becomes easier to convince people of what is possible-- which then facilitates creation of the political pressure necessary to make the architectural planning happen. We see this methodology as essentially reverse-engineering the SDI creation process, again, normally a top-down political approach.

SDI Components

Implementation of a Spatial Data Infrastructure is fraught with important and interesting political and institutional challenges, for which no single formula exists, however the technological picture has become quite clear during the past year or so. As is the case of the INSPIRE initiative (see INSPIRE 2002), we adopted (earlier) the Digital Earth Reference Model (DERM) designed by technicians who are both NASA contractors and active OGC and ISO/TC211 representatives. The DERM document (see NASA 2001) nicely synthesizes the multiple options regarding standards and components to be implemented, and distills the potentially endless array of options into the simple graphic below. We have utilized a translated version of this diagram to explain to politicians that the SDI is really quite simple, consisting of basically three components: reference data repositories, metadata catalogs and user services (primarily web mapping), connected in a service chain initiated by an end-user via a no-cost web browser. Using the graphic it is not difficult to map these "new" concepts back to more easily understood client-middleware-server (3-tier) concepts that many politicians understand. The basic message we have been able to communicate is that *although there are many options (and confusion certainly exists), in the end there are only 3 components to be developed, and we know how to acquire or create each of these, today*! This message is reinforced through demos, preferably with the politicians' own data sources.

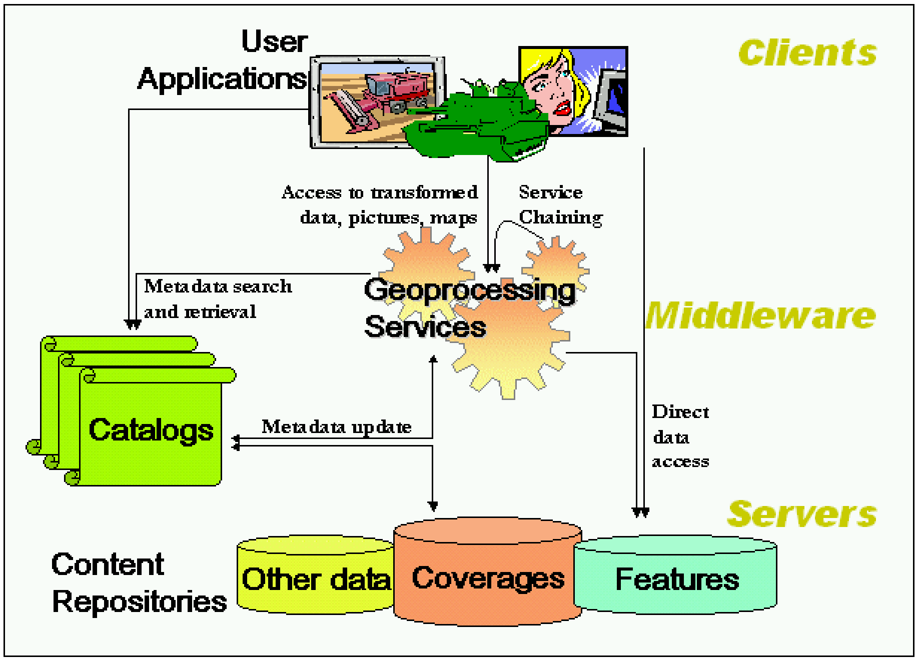

Figure 1. Digital Earth Reference Model (DERM); NASA (2001).

Document availability

Most organisations have programmers on staff that are capable of creating the necessary components, or certainly of configuring available components, albeit with a little consulting guidance on the side to smooth out the rough areas. These components are defined in a series of technical documents, and one of the prime reasons cited for delay in implementing SDI components is that people (implementors) are waiting for the definitive version of a particular standards document to become public. A prime example is the ISO 19115 standard on geographic information metadata. While it is certainly true that the ISO *de jure* standardisation process is a slow one, we can confidently suggest two things:

1) once an ISO/TC211 standard document reaches DIS (Draft International Standard) status, it is very mature and essentially ready to be implemented or relied upon;
2) the ISO/TC211 process is streamlining its throughput, to the point where new standards can theoretically emerge publicly within 12 to 18 months.

Furthermore, this apparent access barrier has not stopped commercial enterprises such as ESRI, Intergraph, Ionic Software, etc. from implementing 19115 capabilities based on the DIS version, and neither should it stop SDI implementers in the public sector. This particular standard is, as of this writing, in about as stable a condition as can be, given that it is still awaiting the ceremonious passage from *Draft* to *International Standard* status. We underscore: 19115 is ready to be implemented now; the minor editorial changes it might experience in the final days before the aforementioned passage, are likely to be trivial and will NOT disrupt any on-going SDI initiative. Therefore, our group (specifically Univ Zaragoza) has created and demonstrated Java applications for creating ISO 19115 metadata and storing it in Access or Oracle databases. Other open solutions are emerging as well (and are expected to be published at the www.gsdi.org website), and in addition the major GIS vendors will within 12 months ship products that output this format. (We should warn creators/users here that metadata creation need not be tied to any current GIS platform; generic solutions abound.)

A related concern is how to gain access to ISO/TC211 Draft International Standards. DIS documents are not available (or for sale) on the ISO website because they are not yet approved standards. They are, however, available via ISO/TC211 national liaison members (normally at NMAs) and through the OGC liaison Cliff Kottman (in the case of OGC members). Furthermore, it should not come as a surprise that older drafts[1] may be found on the web, using *Google* and other search engines. Although the GI community is still not satisfied with the ISO document accessibility policy, we can state from our experience that any organisation seriously considering their implementation, should have no problem accessing relevant DIS documents through the aformentioned liaison channels. In addition, we suggest OGC membership as a key investment in SDI development, as membership opens doors facilitating access to a wide array of on-going technology development: the public can only directly access *approved* OGC and ISO specifications and certain drafts, whereas members may access the entire in-progress archive and essentially get a several-month head start. Several public institutions --Ordnance Survey, United Nations and FGDC to name but three—have recently joined or increased OGC membership level in order to gain increased access to the OGC knowledgebase and decision making process.

Catalogs and Services

We do not consider reference data repositories here, and we have already mentioned metadata creation, which we consider an issue no longer open to debate regarding formats or standards. A related part of the second SDI component, is the catalog service, a tricky one because on one hand a mature OGC specification exists (version 1.0), while on the other hand rumours of impending "stateless catalog services" (advanced web services) are widespread and have caused some implementers to sit back and wait. Our recommendation is to implement 1.0 immediately, because we believe (and so does the INSPIRE working group on Architecture and Standards) that access to reference data is of immediate priority. This access (to multiple distributed sources) is facilitated only via a working catalog service, and we see no reason to leave end users "unconnected" because we, as technologists, are waiting on the latest-greatest innovation from the IT world. The NRW pilot has implemented a (OGC-conformant) catalog service based on 1.0, and our research group has done the same (albeit at version 1.1, which cannot be conformance tested as the test does not yet exist), as shown in figure 2. Now is the time to connect metadata repositories (in relational databases) to users via current catalog service technology. GIS-vendor-specific catalog servers are another alternative, but we would warn the implementer to try to leave all doors open to OGC-conformant solutions for maximum scalability in the future.

The third SDI component, what we term end-user services, was previously termed "web mapping". These services have now expanded beyond presenting users with pictures of maps (e.g. GIF/PNG), to include (OGC) Feature servers for vector data, Coverage servers for continuous field-based data, and soon other geospatial processing and portrayal services. As far as including direct views of geodata within an SDI, implementers have several possibilities. One is to modify the Minnesota Map Server (http://mapserver.gis.umn.edu/), which publishes its source code and is compatible with OGC WMS specification 1.0. A related method is to follow the WMS cookbook, published by International Interfaces at http://www.intl-interfaces.net/cookbook/WMS/index.html. Finally, the WMS documentation is sufficiently complete to allow for the creation of basic (and open) web mapping clients such as that shown in figure 3.

[1] One example is an old draft of 19115.3 (metadata) at http://www.standardsinaction.org/gismetadata/.

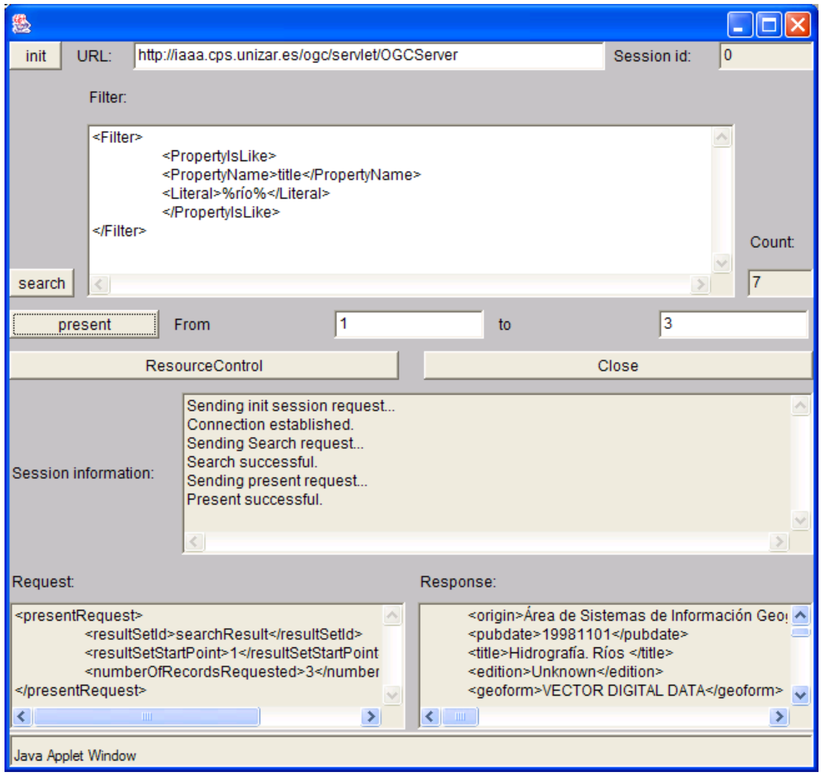

Figure 2. A prototype OGC Catalog Service client, consulting a version 1.1 (draft) Catalog Server for information on rivers (ríos). Note: an end-user application would reformat the XML output to create an appealing results web page.

We would be remiss not to mention that several GIS vendors now support the WMS 1.0 or higher specification for serving maps, including the products by ESRI, Intergraph, Ionic, Geodan, Cadcorp, SICAD, etc. (the latter 4 are European companies; the entire list is found at http://www.opengis.org/cgi-bin/implement.pl). Caution should be taken, however, to determine just how open each commercial map server is to the use of OGC WMS protocols instead of its native protocol, and to the integration with other SDI components.

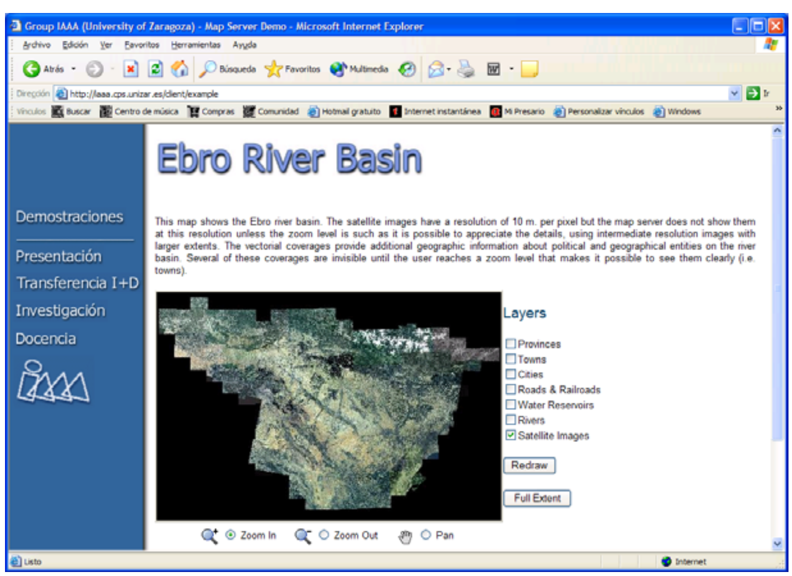

Figure 3. Basic WMS client

More complex user services such as the coverage and feature servers mentioned, will come onto the market within 12 months, as they are just now emerging from the Open Web Services initiative (which has served as a greenhouse for these technologies) as Draft Interoperability Program Reports (DIPRs). Again, OGC members already have access to these draft technologies, and our group has implemented much of it, in order to offer more complete and diverse demos to our politicians, who will hopefully support future generations of regional and national SDIs.

Conclusion and Future work

In conclusion, we have shown a process which has been described as reverse engineering: *The process of analysing an existing system to identify its components and their interrelationships and create representations of the system in another form or at a higher level of abstraction*. This seems to describe well our objective within a three-year technology research project funded by the Spain Ministry of Science and Technology, described in Bernabe et al. (2001): study what technology components are currently available and in use, and combine them to create pilot applications. If a particular region currently lacks a cogent SDI policy and architecture, it may just be that the relevant politicians have not seen clear demonstrations of what is possible today employing accessible, open, standard software components. We should also add that INSPIRE has certainly lived up to its name in our case, as the large shadow cast by this European initiative, has served to inspire politicians in Spain, who are now more confident regarding the possibilities for creating SDIs which are sustainable; the methods we are using are supported by INSPIRE, and *vice versa*.

Speculating where technological development will head during the coming years is always subject to unexpected "Big Bangs" (such as the sudden appearance of the WWW). Barring such radical disruption, it would seem that Web Services-based development will dominate the horizon for the coming years. (We note that if WS live up to their potential, and hype, they will in fact constitute a big bang.) This prediction is grounded in the on-going and planned initiatives within OGC (Open Web Services) and related interoperability organisations such as Object Management Group (www.omg.org) and the OpenGroup (www.opengroup.org), all aimed at the controlled application of web services technologies emerging from within the wider IT community. It should be noted that while we foresaw the advent of these simplified XML and HTTP-based services (Gould 99) we did not know until very recently what they would be called or in what form they would appear. Web services will change the implementation of catalog and registry functionality, as well as the way in which users "find" and "bind" them to their own applications, however we continue to recommend immediate implementation of current solutions (e.g. OGC Catalog Spec 1.0/1.1) and anticipate the emergence of a wide offer of migration solutions. In fact, our own research agenda will aim in this very direction. Another interesting direction for investigation in the SDI field (especially in Europe) will be tools to represent and exploit multilingual and cross-disciplinary ontologies (Mata et al, 2002): the key to semantic interoperability.

Acknowledgements

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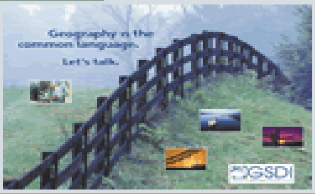

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The Global Spatial Data Infrastructure Association

GSDI 6 Budapest, Hungary

September 16-19, 2003

Theme: From Global to Local

Conference Program

September 16, 2002

9:30 – 18:00 Registration at conference site (MATÁV Telecommunications Company)

9:00-10:30 GSDI Steering Committee Meeting

[abstract] [slides] [paper]

10:30 – 11:00 Coffee Break

11:00 – 12:30 GSDI Steering Committee Meeting

[abstract] [slides] [paper]

14:00 – 15:30 Pre Conference Workshops

Workshop 1a: Meet EUROGI members, EUROGI roundtable, Burning GI Issues in Europe

[abstract] [slides] [paper]

Workshop 2a: Legal & Policy Issues, SDI Legal and Policy Issues, An Overview

[abstract] [slides] [paper]

Workshop 3a: Technical Issues, Interoperability in GSDI, Standards, solutions and futures

[abstract] [slides] [paper]

15:00-16:00 Coffee Break

16:00-17:00 Pre Conference Workshops

Workshop 1b: Meet EUROGI members, EUROGI roundtable; Burning GI issues in Europe

[abstract] [slides] [paper]

Workshop 2b: Legal & Policy Issues, Providing services and addressing legal barriers in the virtual era; Best practices from Europe.

"European geographic data infrastructures: the EuroRegionalMap and EuroGlobalMap projects"

[abstract] [slides] [paper]

Claude Luzet, Programme Manager, EuroGeographics, France,

"From data harmonization to data interoperability"

[abstract] [slides] [paper]

Andrew Trigg, Head of Technology, Ordnance Survey, United Kingdom,

"The digital national framework of Great Britain"

[abstract] [slides] [paper]

15:30 – 16:00 **Coffee break**

16:00 – 17:30 **Three parallel sessions**

Stream 1 – Developing SDI's, session 3 – SDI case studies 2, Focus on metadata/clearinghouse

Chair: Richard Kirwan, Executive Director, Ordnance Survey, Ireland

[abstract] [slides] [paper]

Joep Crompvoets, Assistant Professor, Geo-Information Science of the Laboratory for Geo-Information Science and Remote Sensing, Wageningen University, The Netherlands,

"Developments of national clearinghouse for geo-information"

[abstract] [slides] [paper]

Michael Gould, Department of Information Systems, University "Jaume I", Spain,

"A spatial data catalogue based initiative to launch the Spanish SDI"

[abstract] [slides] [paper]

Jiang Jingtong, Professor, National Geomatics Centre of China, Beijing, China,

"Implementation of data sharing for sustainable development information in China"

[abstract] [slides] [paper]

Stepán Kafka, GIS specialist, Czech Association for Geoinformation, CAGI, VSB-TU, Czech Republic,

"Project MIDAS"

[abstract] [slides] [paper]

Rodrigo Barriga Vargas, Advisor, Military Geographic Institute,