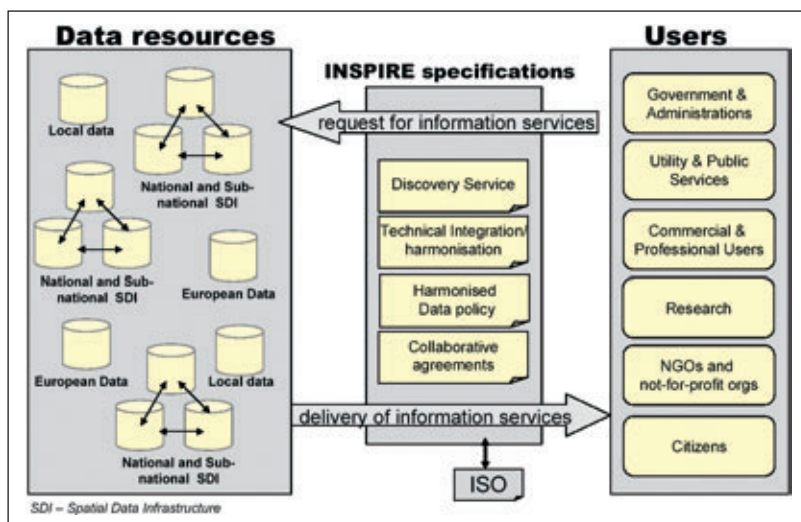


Europe Advances Rapidly Toward Wide Implementation of Standards

Digital devices of all kinds continue to proliferate and become smaller, more powerful and less expensive. But what is most amazing about this progress is that they are being made to communicate with each other on an unprecedented scale.

Communication, of course, means "transmitting or exchanging through a common system of symbols, signs or behaviour." The government programs described in this paper have adopted the common systems, or standards, that define the Internet, the World Wide Web, and the "Geospatial Web".

By Martin Klopfer and Guenther Pichler



Diagrammatic View of the INSPIRE Vision (from the INSPIRE Architecture and Standards Position Paper www.ec-gis.org/inspire/).

Non-proprietary Standards

The success of the government programs has much to do with the fact that the underlying standards are non-proprietary standards developed by open, global consensus standards organizations. The developers of these standards represent a broad spectrum of organizations – technology providers and technology users - who are committed to the standards' widespread commercial implementation.

Geoprocessing standards help organizations leverage their investments in systems and data. Sharing and reusing data helps organizations decrease costs and gain or provide access to more and better information. Open standards also enable selection of the best software tool for each job and reduce technology and procurement risk, like the risk of

being bound to one vendor. A 2005 study commissioned by the US National Aeronautic and Space Administration (NASA) found that programs based on open standards have a 25% better return on investment than programs based largely on vendors' proprietary interfaces and formats.

Organizations around the world are moving to "open architectures", which means high level information system designs based on open standards, and "service oriented architectures". The latest are high level information system designs which involve computing processes communicating with computing processes on other servers, usually through standards-based interfaces and encodings. The initiatives described in this article show that this transition includes a robust geospatial component.

INSPIRE

The "Infrastructure for Spatial Information in Europe" (INSPIRE) initiative aims at delivering integrated spatial information services to the largest possible number of users. Such services include visualisation of information layers, overlay of information from different sources, spatial and temporal analysis, and many others. The target users of INSPIRE include policy-makers, planners and managers at European, national and local levels and also citizens and their organisations.

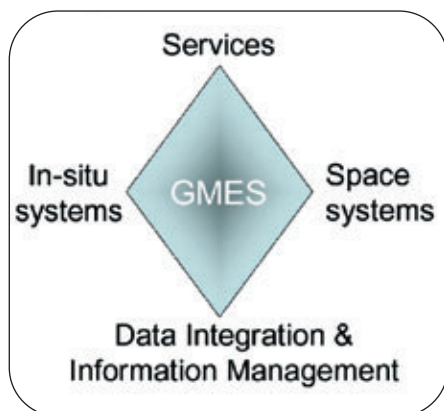
To support INSPIRE, OGC and OGCE, the European OGC subsidiary, provided input to the early Position Papers for INSPIRE and the Extended Impact Assessment, evaluating the political and socio-economic impacts of INSPIRE. European OGC industry members participated in the Internet consultation prior to the adoption of the Framework Directive by the European Commission. OGCE was also a partner in the Geographic Information Network In Europe (GINIE) Project. The aim of this project was to develop a cohesive Geographic Information Strategy at the European level, and which thus provided strategic input to INSPIRE.

Alessandro Annoni, ESDI Action Leader, Spatial Data Infrastructures Unit at the Joint Research Centre (JRC), says: "The adoption of the INSPIRE directive is expected in 2006. Non-EU countries including Norway, Switzerland and Croatia are also likely to align their national initiatives to the INSPIRE framework. This means that across Europe there will be an increasing demand for GI services based on open standards and for standards-based portals that will provide access to multiple "aggregated" sources of data and online geospatial services. The development of INSPIRE-compliant infrastructures initially focusing on the environmental sector is expected to extend to other thematic sectors in near future, from the beginning to include the regional level and also to influence the local level in some cases."

GMES

The "Global Monitoring for Environment and Security" (GMES), a joint initiative of the European Commission and the European Space Agency (ESA), represents a concerted effort to bring data and information

rd Geo-Interoperability



providers together with users. This way they can better understand each other and make environmental and security-related information available to the people who need it through enhanced or new services. Networks of geolocated in-situ, vehicle-mounted, aerial and satellite-borne sensors will play a role. After an initial period of preparation (2001-2003), the implementation phase is on-going (2004-2008).

The requirements that drive the implementation of GMES include: openness, federated architecture, simplicity of architecture, scalability, dependability, user-friendliness, data security, quality of service, and global ubiquity of access.

EUSC

The European Union Satellite Centre (EUSC), located near Madrid, Spain, is an agency of the Council of the European Union dedicated to the exploitation and production of information derived primarily from the analysis of earth observation space imagery in support of decision-making in the areas of the Common Foreign and Security Policy (CFSP), especially the European Security and Defense Policy (ESDP).

In October 2005, after several interoperability studies, the EUSC awarded a contract for the design and support of the EUSC Reference

The GMES capacity as represented by the "GMES diamond", from the Communication from the Commission to the European Parliament and the Council, "Global Monitoring for Environment and Security (GMES): Establishing a GMES capacity by 2008 - (Action Plan (2004-2008))".

Facility (EUSC-RF). A prototype has been made available for review and testing by EUSC and other agencies whose operations mesh with EUSCs.

The EUSC-RF is the result of rigorous analysis of EUSC operations and data sharing requirements and consideration of the ways in which modern Internet technologies can support EUSC workflows.

ESA's HMA Project

In September 2005, the ESA launched the Heterogeneous Mission Accessibility - Interoperability (HMA-I) Project. HMA-I will define the necessary interfaces and a generic, service-oriented architecture to ensure interoperability within the GMES Space component comprising a constellation of satellites together with its Ground Segment and the interfaces to the other components of GMES.

Besides ESA missions like Envisat and ERS-2, national missions like Cosmo from ASI (Italy), Pleiades from CNES (France), RADARSAT-2 from CSA (Canada) and TerraSAR-x from DLR (Germany) will be providing the Earth observation data necessary to allow an operational rollout of the GMES services starting from 2008. EUSC is also participating in this joint effort on interoperability and service-oriented architectures based on open standards. JRC's INSPIRE Team and ESA are working together to ensure coherence of INSPIRE and GMES developments. According to Pier Giorgio Marchetti, the HMA Project Manager at ESA, "HMA will leverage recent advances in interoperability specifications and service oriented architectures. This will empower the GMES services with seamless access to space data from the already identified missions. The others which will be contributing in the near future, as well as the necessary interoperability with the geospatial infrastruc-

From a presentation at the ESA EUSC IIM workshop 2005, "Web services integration in an European geospatial agency - The EUSC case," by Lucio Colaiacomo [earth.esa.int/rtd/Events/ESA-EUSC_2005/Pr05_Colaiacomo.ppt].

ture required by the forthcoming INSPIRE implementing rules."

Other EU Projects

Other EU Projects supporting INSPIRE, GMES and CFSP/ESDP are:

- Open ARCHitecture and Spatial Data InfraTRucture for Risk Management (ORCHESTRA): September 2004 - August 2007. This Integrated Project is funded by the EC under the Sixth Framework Programme that incorporates emerging specifications of INSPIRE and GMES and contributes to these initiatives. With the goal of improving the efficiency in dealing with risks by enabling interoperability, ORCHESTRA participants are designing an open service-oriented architecture and spatial and non-spatial services for risk management, and are contributing to software standards for risk management;
- Reference Information Specifications for Europe (RISE): September 2005 - August 2007. This Specific Support Action is funded by the EC under the Sixth Framework Programme, also to support INSPIRE and GMES. Its objectives are data harmonisation by defining a repeatable methodology and producing guidelines for the creation of geospatial data specifications. The RISE project focuses on the hydrology and elevation themes and thus there is a strong linkage to different GMES applications and the Water Framework Directive (WFD);
- Closely coordinated with RISE is Marine Overlays on Topography for Annex II Valuation and Exploitation (MOTIIVE): September 2005 - August 2007. The focus of this project is on elevation and dynamic marine features. MOTIIVE is working closely with the national and international meteorological and oceanographic communities and has a key aim to deliver a reference implementation for a feature catalogue registry;
- GEOdata and CRisis Early Warning Situation Awareness Architecture Concept (GEOCREW): January 2005 - December 2005. This was a Specific Support Action funded by the EC Preparatory Action on Security Research, to support CFSP/ESDP and GMES. GEOCREW's objectives were to integrate various information resources for a crisis early warning "situation awareness" architecture.



DGIWG and NATO

In September 2005, OGC announced the signing of a formal Memorandum of Understanding (MOU) between the Digital Geospatial Information Working Group (DGIWG) Secretariat and the OGC. DGIWG, established in 1983, is a standardization body comprised of 18 nations whose first objective was to set up an effective exchange standard allowing for the transfer of data between the countries' geospatial production agencies, to meet NATO geospatial requirements. A current objective is to help develop and to encourage the use of technical standards that enable improved interoperability and integration of geospatial information systems. DGIWG wishes to transition from creating military specific standards to using consensus industry and international standards wherever possible.

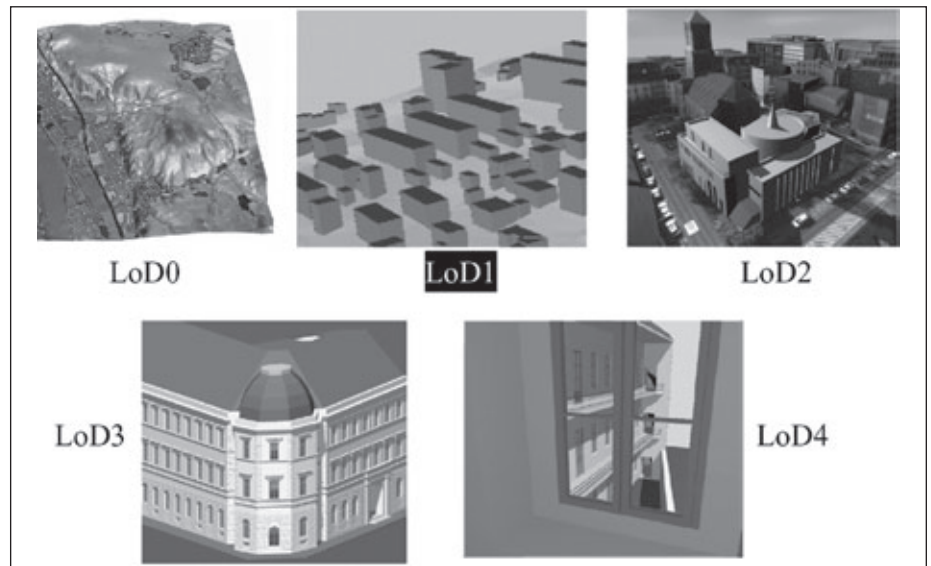
Brigadier Nick Rigby, Director DGIWG: "The collaboration with OGC is a major part of DGIWG's strategy to work with key partners in order to maximize the output from our mutual efforts to deliver geospatial standards. Such cooperative effort is essential in the prevailing climate of increasing requirements but limited resources."

A recent NATO "information for bid" (IFB CO-11424-GIS) call for "a common spatial, reliable, and time reference framework akin to enabling the 'fighting off the same map' at the strategic, operational, and tactical levels." The description of work specifically mentions OGC implementation specifications, ISO Geospatial (191XX) standards, and/or NATO's/DGIWG's ISO specifications (profiles, application schemas, data dictionaries, etc.)

Spain

The Spanish NSDI, named IDEE for "Infraestructura de Datos Espaciales de España" (www.idee.es) connects geospatial catalogues, gazetteers and services distributed in servers all around Spain at different levels of detail. IDEE is providing services that implement many of OGC's OpenGIS Specifications. ISO19100 standards, the INSPIRE initiative and OGC specifications make possible a framework that has been the basis of a Spanish Core Metadata standard (NEM for "Núcleo Español de Metadatos"), a minimum set of ISO19115 metadata items; a Spanish Gazetteer Model (MNE for "Modelo de Nomenclátor de España"); a common schema for Gazetteers compliant with ISO19112; and a Spanish Data Model for geographic vector data (MDE for "Modelo de Datos Español") based on ISO 19107 Spatial Schema.

There is a well-established regional SDI in Catalonia, Infraestructura de Datos Espaciales



The five levels of detail defined by CityGML [from "CityGML – Interoperable Access to 3D City Models", Thomas H. Kolbe, Gerhard Gröger, Lutz Plümer].

de Catalunya, (IDEC). Other Regional (Basque Country, Navarra, La Rioja and Galicia) and Local (Zaragoza) SDIs, National Agency Reference Nodes and other projects are in progress. A project called "GeoPista" has produced a standards-based local Government GIS that will be extended to the more than 4,000 local authorities.

According to Sebastián Mas of the Spanish NSDI Working Group at the Instituto Geográfico Nacional, "The Spanish NSDI (IDEE) is a powerful emerging reality based on strong technical support and flourishing national and regional initiatives proceeding in a spirit of coordination, collaboration and sharing of knowledge."

UK

The Ordnance Survey has been licensing digital Geographical Information (GI) to customers since the early 1990s, a business worth tens of millions of euros. Technical standards developed in the OGC with the Survey's active participation have enabled the Ordnance Survey to offer new capabilities and new benefits to their users. Most notably, the Ordnance Survey has provided the OS MasterMap products, which are distributed using GML.

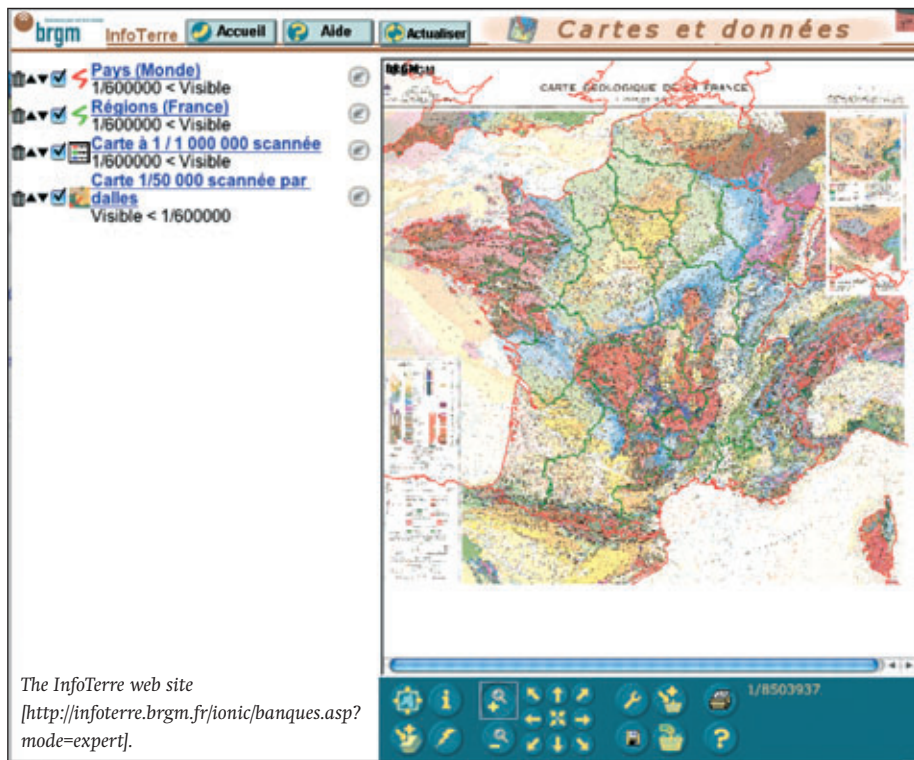
This progress has shown the need for further development of OGC Web Services specifications. Increasingly, users of geographical information are using geospatial data to support decision making processes that involve automated transactions. In the insurance industry, for example, or in Location Based Services (LBS) delivered on mobile devices, there is a requirement for structured intelligent information rich in attribution and capable of being linked to associated information stored elsewhere. This often involves chaining of Web services, and not all of the

required open interfaces for these services have been developed into standards. One of these gaps in being addressed in OGC's "GeoDRM," or Geospatial Digital Rights Management initiative. The Ordnance Survey is leading the development in OGC of digital rights management techniques. Ed Parsons, Chief Technology Officer of the Ordnance Survey, says: "Web Services that utilize OGC standards will play a crucial role over the next five years in delivering up-to-date geographically based decision-making support to a wide range of users without the massive management overhead of the past."

Germany

German companies and agencies have been active in OGC for a decade, and they have implemented standards-based systems at all levels of government. In 1998 the Federal Cabinet founded the Interministerial Committee for Geo Information (IMAGI) and issued the instruction to develop an efficient geodata management framework for the federal government. Since then the Geodata Infrastructure for Germany (GDI-DE) has grown rapidly. In 2003 the chief executive officers of the Federal Government and the 16 states took the decision to implement the GDI-DE in a combined effort at all levels of public sector. The GeoPortal.Bund portal which went on-line during the INTERGEO 2005 conference in Düsseldorf is to be the central entry point to the GDI-DE.

The Geodata Infrastructure of North Rhine-Westphalia (GDI-NRW) was founded in 1999 by the NRW state government, organizing the efforts and resources of more than 100 institutions. Also in North Rhine-Westphalia, Conterra implemented the TIM-online GeoPortal.



The InfoTerre web site
[<http://infoterre.brgm.fr/ionic/banques.asp?mode=expert>].

"CityGML," a GML3 Application Profile for virtual 3D city models, is providing important input into the OGC effort to integrate geospatial information with information about built structures. CityGML was developed by the Special Interest Group 3D (SIG 3D) of the GDI-NRW, chaired by members of the University of Bonn (Thomas Kolbe and Gerd Groeger). Many cities are constructing 3D city models for applications such as urban planning, disaster management, tourism, vehicle and pedestrian navigation, facility management, but there is no appropriate standard for data exchange. This is what CityGML developers and others in OGC are working on.

The Netherlands

In 2003 the Dutch Directorate for Public Works and Water Management, Rijkswaterstaat (RWS), which is responsible for the maintenance of dikes, roads, bridges and the navigability of canals in the Netherlands, started the GeoServices project, a system for web based access to geo-information within Rijkswaterstaat using ISO and OGC standards. The goal was to make geoinformation available directly from multiple local sources. The use of open standards was a given, whereas the use of open source software to realize the OGC web architecture was one possible choice. Under supervision of Rijkswaterstaat, the company Geodan built the GeoServices application architecture and then delivered a proof of concept, on the basis of which full implementation was completed. In 2005 the RWS SDI infrastructure was

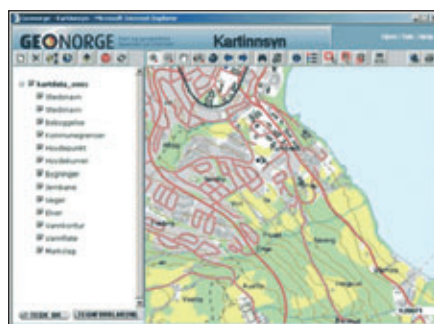
expanded with IONIC's standards-based Redspider products in order to provide more scalability for transactional and mobile geo-applications. It is expected that in the end the RWS Spatial Data Infrastructure will consist of more than 40 connected applications.

France

BRGM is a French public institution with a mission to acquire, manage and diffuse geological data necessary for implementing public policies relating to the development and sustainable management of natural subsurface resources. To support this mission, in 1998 BRGM created InfoTerre, an Internet site providing access to geological maps and other georeferenced data of France.

Soon after InfoTerre started, BRGM adopted a policy of interoperability concerning the information domains for which it is responsible. In 2001 this resulted in BRGM becoming the first supplier of French data to join the Open GIS Consortium, Inc. (OGC).

The standards-based version of InfoTerre was released in March 2003, providing users with



The GeoNorge portal www.geonorge.no/.

access to many more sources of georeferenced data, including data from other organizations' OGC-compliant servers on the Web, and including access to analytical, computational and data processing facilities. BRGM represents the Association of European Geological Surveys (EuroGeoSurveys) within INSPIRE.

Norway

The Norwegian Mapping Authority (NMA, or Statens Kartverk) was identified by the Norwegian Ministry of Trade and Industry as a key agency for the success of the Norwegian e-Gov initiative. A national "GeoNorge" project was initiated, led by Olaf Ostensen, Chairman of the ISO/TC 211 Committee and a key player in the harmonization of OGC and ISO specifications. The first version of the project connected the servers from National Mapping Agency, Norwegian Geological Survey, Norwegian Institute for Land Inventory, Public Roads Administration, and the Directorate for Nature Management and County Administration. All servers are made accessible through their implementations of the same standard OpenGIS interface specifications. This was accomplished smoothly and quickly, without migration of any data, technical re-engineering, or purchase of new GIS Servers.

Conclusion

Europe's leadership role in the development of geospatial interoperability standards is now paying off in the widespread implementation of these standards. Instead of downloading or mailing massive data files, data sharing is being accomplished with a few keystrokes in Web-based applications. Remote online geoprocessing services can be invoked to derive information, without the need for the user to own expensive software. If progress toward this goal has seemed slow at times, it now seems to be moving forward at a remarkable pace.

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