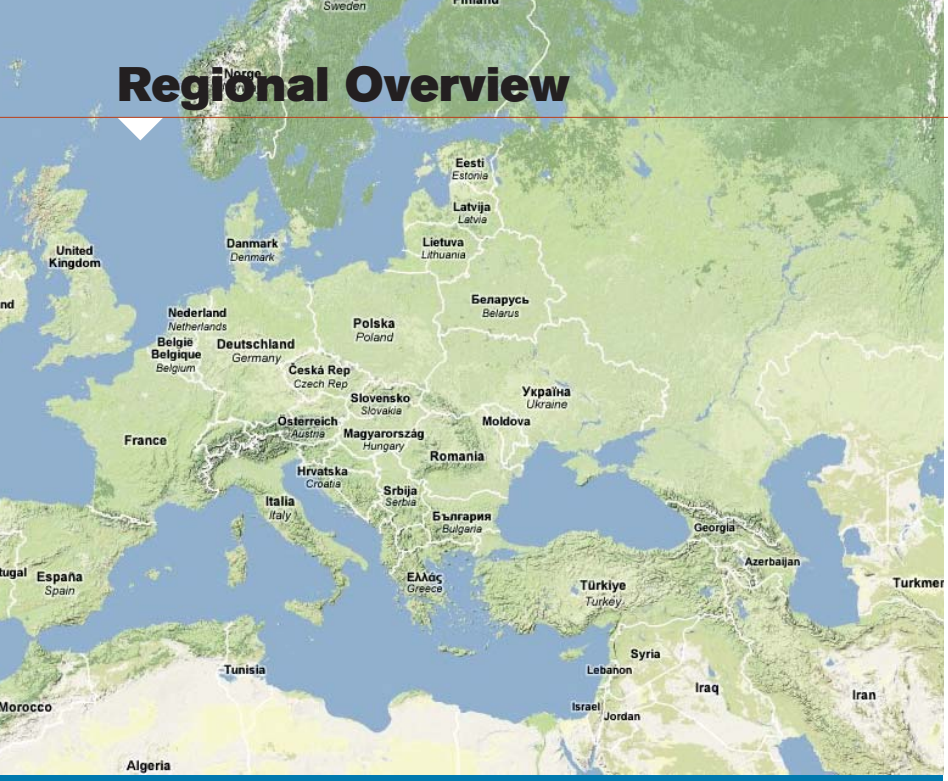

STATUS OF GIS IN EUROPE
OPPORTUNITIES AND CHALLENGES

GIS, from a 'geoinformation perspective' (availability of data sets) as well as from a methods, techniques and software technology perspective, certainly is a globalized phenomenon. The GIS industry is mainly based on some global players, with regional differences in societal frameworks, and thus policies and operational practice, limited to a few areas like cadastre or approval of permits.

Identification of particular European aspects of GIS therefore might be expected to yield less than exciting results. GIS is used widely in public administration and for the usual array of business applications, much like in many other parts of the world. There seems to be a decreasing market share of European software technologies, even more so in the hardware sector.

There is one particular exception to the global-business-as-usual viewpoint, though. Europe is a cluster of politically independent countries, and at the same time is working towards integrating into a common economic space.

This development is driven by the centralized policy implementation body of the European Commission, under joint legislative power by the Council of Ministers and the European Parliament.

TOWARDS A EUROPEAN SPATIAL DATA INFRASTRUCTURE

The vision of a 'Europe without borders' is making substantial political and practical progress. This is demonstrated by the expansion of 'Schengen-space' now including 25 European countries without internal border controls.

Paradoxically, the cross-border integration of digital representations of European spaces seems to be a more difficult undertaking with only limited progress until today. Motivated by the 1994 presidential 'Executive Order' launching the US SDI initiatives, ideas for a European SDI were put forward from 1995 onwards under the 'GI 2000' umbrella.

While GI 2000 did not succeed with substantial operational steps towards a European SDI, it certainly created a favorable environment agreeing on the need for a common GI strategy, and then infrastructure. From an industry perspective, the parallel 'Public Sector Information' (PSI) initiative (made a mandatory directive in 2003) helped with establishing a business view on the vast public holdings of georeferenced data.

Initial attempts by the European Commission aiming at centralized GIS developments generated mixed results. GISCO, the 'GIS for the Commission' built by the statistical office Eurostat never achieved its ambitious aims, and the interagency Committee on Geographic Information (COGI) was mainly limited to awareness raising.

Sectoral initiatives like the pioneering 'Coordination of Information on the Environment' (CORINE), though, delivered some early success stories demonstrating that unified European data sets on themes like land cover could be developed. Similarly, research funding

for integrated European digital road databases helped with establishing a strong European industry position in this area for example, demonstrated through Tele Atlas and Navteq.

Still, the political and practical difficulties of merging numerous countries into one political entity and into an integrated economic space left many lessons to be learned, and required starting over again with a modified approach.

INSPIRE'ATION

Based on the success of CORINE including the establishment of a European Environmental Agency, and driven by the cross-border requirements for environmental monitoring and policies, this current approach was strongly promoted by the European 'ministry' (Directorate General) for the environment.

The INSPIRE initiative (Infrastructure for Spatial Information in Europe - http://www.ec-gis.org/inspire/) had to go through a lengthy negotiation procedure but finally in 2007 was turned into a directive which makes it mandatory for EU member countries to implement legislation implementing INSPIRE over a two-year period. The main aim of INSPIRE is to make available relevant, harmonized and quality-controlled geographic information for the purpose of formulation, implementation, monitoring and evaluation of EC policy-making.

Obviously, this mission now goes far beyond environmental monitoring and essentially makes INSPIRE the foundation for a European SDI, or, more correctly, a European Commission SDI. The main thrust aims at making geographic data readily available to European central government agencies. While the data harmonization required to achieve this aim certainly will result in substantial benefits for other public and particularly business uses of Geographic Information, from an industry point of view even after a full implementation INSPIRE will not primarily serve the more general purposes of an SDI.

Still, the general INSPIRE principles are a critical step forward for GIS in Europe, emphasizing point like:

- Data are to be collected only once and maintained at the level (of government) where this can be done best (i.e., not necessarily at a central agency).
- Spatial data from different sources are to be combined seamlessly and shared between different users and applications.
- Spatial data needed for good governance shall be 'available on conditions not restricting its use' (obviously, this phrasing is a compromise between conflicting business models).
- Services need to be available for data discovery, evaluating its fitness for an intended purpose, and to establish conditions applicable for its use.

The European GI industry will enjoy substantial indirect benefits from the complex implementation process required for INSPIRE. Currently 'implementation rules' are being developed in several committees ('drafting teams') responding to input from 'Spatial Data Interest Communities' (SDICs) and 'Legally Mandated Organisations' (LMOs). This broad-based participatory approach involving many stakeholders will ultimately contribute to a valuable body of knowledge and skills important to the European GIS industry at large.

A first glimpse at INSPIRE outcomes is available at the 'EU portal for Geographic Information' (www.inspire-geoportal.eu). Access to a metadata catalog, a map client with extensive search capabilities, and online map services demonstrate some aspects of the practical value of an integrated European spatial information infrastructure.

THE SPACE SEGMENT

The INSPIRE initiative is not the only pan - European approach defining the current and future state of GIS in Europe. At least two major keywords have to be mentioned at this point - the GALILEO satellite navigation project and the Global Monitoring for Environment and Security initiative (GMES) framework.

Galileo recently has been in the media, unfortunately, for the wrong reasons: Funding difficulties and resulting delays have eroded some of the optimism and trust needed for major initiatives of this scale. Now this European satellite navigation system aiming at providing 'a permanent reference in time and space' again seems to be on track for deployment.

The prospect of an independent, fully operational high quality satellite positioning service is one of the key drivers of development initiatives across many application domains, already today contributing substantially to cutting-edge work in the GIS industry. GALILEO has been jointly initiated by the European Union and the European Space Agency (ESA) and will support users in many sectors such as transport (vehicle location, routing, toll systems, speed control, navigation, etc.), social services (e.g. aid for the disabled or elderly), the customs, security and justice systems

> There seems to be a decreasing market share of European software technologies, even more so in the hardware sector

(location of suspects, border controls), public works (geographical information systems), search and rescue systems, or leisure and tourism services.

The GMES (www.gmes.info) is an effort to bring data and information providers together with end users, obviously with a focus on environmental and security-critical information. GMES currently is an important source of research and development funding contributing to GIS in Europe.

One of the starting points for the GMES initiative, and the key common denominator of 'environment' and 'security' is space-based remote sensing information. Europe over many years has developed a strong remote sensing capability across different sensor technologies. GMES now aims at bringing these into operational practice from a spatial monitoring perspective.

GMES is strongly motivated by user requirements defining the integration of data from space-based (and in-situ) earth observation capacities. As a first step pilot operational services ('fast track services') are being developed, with emphases on emergency response, land monitoring and marine services, to be followed by services for other application domains. The reliance on a services infrastructure architecture is in line with the strong reliance on industry cooperation. The GIS industry is expected to ultimately implement and operate GMES services, making this a beacon for future business prospects.

SOFTWARE INDUSTRY

With a few exceptions, recent and ongoing consolidation in the GIS software industry has not exactly strengthened the European position in the marketplace. Looking beyond the major global players in this field, though, we can observe and expect major and interesting contributions to technologies and architectures of the future.

One indicator early on was active membership in the Open Geospatial Consortium (OGC) and the founding of OGC Europe. Through strong academic and industry participation European actors were able to first learn, and then contribute substantially to standards developments. This development is primarily driven by the urgent needs for standardization for interoperable distributed services as e.g. required by the INSPIRE initiative. Active participation in first standards, and then services development had led to the emergence of several leading edge startup software companies. Some are using a proprietary software business model, but a large and growing group of companies are considered leaders in the open source communities.

Their important role is clearly visible at major European geospatial industry exhibits (see www.intergeo.de, www.gi-forum.org) where the FOSS contributions are featured prominently and attract extensive interest. This kind of side-by-side presence is indicative for the potential complementary role of different business models facilitated by the industry trend towards services-based infrastructure. This trend can be considered a precursor for next-generation distributed infrastructures.

EUROPEAN GI INSTITUTIONS AND ORGANIZATIONS

The broad range of agencies and associations managing 'GIS in Europe' is an interesting mix of top-down and bottom-up approaches, including government branches as well as academic and user associations.

A top level view is provided by the European Commission's GI & GIS Portal (www.ec-gis-org) providing access to all GI related activities, projects and documents. From an operational perspective, the EC Joint Research Centre with its Spatial Data Infrastructures Unit is one of the key facilitators regarding the evolution of SDI services (ec.europa.eu/dgs/jrc/ > sdi.jrc.it)

The European Umbrella Organization for Geographic Information (www.EUROGI.org) is an independent NGO drawing its membership from national GI organizations and industry. It is acting as a voice for the European GI community in order to "... ensure good governance, economic and social development, environmental protection and sustainability, and informed public participation, the mission is to maximise the availability and effective use of GI (geographic information) throughout Europe." With an academic focus, the Association of Geographic Information Laboratories for Europe (AGILE - plone.itc.nl/agile/) is aiming to "promote academic teaching and research on Geographic Information Science by representing the interests of those involved in GI-teaching and

research at the national and the European level". AGILE membership is based on academic research units, and one of its widely recognized activities is an annual research conference (see www.agile2008.es). Of course numerous other organisations serve particular communities, one example being the Geographical Information Systems International Group (GISIG - www.gisig.it) which is quite successfully implementing European-level projects in areas like environment, water resources and conservation. Increasingly, the general community participation of GIS experts and researchers is shifting towards a pan-European level. This is an indicator of progress in integration, and for the important contribution of various institutions towards borderless European GIS.

OPPORTUNITIES? CHALLENGES?

Obviously, the European approach towards creating a common, transnational framework for Geographic Information has led to a particular situation offering chances to learn for SDI projects anywhere. The long-term project of European integration gives special meaning to the idea of an SDI as a common foundation to achieve a unified space for administration, economy and individual movement. It is therefore expected that European mega-initiatives like INSPIRE, GMES and the Galileo project will remain the defining elements for GIS in Europe. The opportunity to make progress based on the need for an open and interoperable services infrastructure is balanced by the challenges of making this happen in an extremely diverse, segmented, multilingual and historically multifaceted environment. Lessons learned, though, likely will contribute to progress worldwide. Whenever there is a dominant player in any SDI initiative, results likely will be achieved through hierarchical top-down processes. In contrast, Europe's diversity and the need for consensus-based negotiated decisions are not an easy route to success, but are more likely to fully leverage the benefits of true 'infrastructure thinking' in the information society. The broad movement towards European integration has not always been welcomed by its citizens. ■

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