

AVAILABLE WEB SERVICES AT SPANISH NSDI

A. F. Rodríguez¹, P. Abad¹, J.A. Alonso¹, A. Sánchez¹, C. González¹, C. Soteres¹, M. Juanatey¹, E. Díez¹, H. Potti¹

¹Instituto Geográfico Nacional
C/ Gral. Ibáñez Ibero, 3, 28.003 Madrid
afrodriguez, pabad, jaajimenez, asmaganto, gonzalezc, csoteres, mjuanatey, ediez,
hpotti@fomento.es

Introduction

Spanish NSDI (named IDEE for *Infraestructura de Datos Espaciales de España*), with a multilingual Geoportal opened in 2004¹, is a collective, open, fully distributed project embracing national, regional and local SDI resources in Spain.

IDEE is an example of a collective project based on the cooperation of a large number of actors in Spain: governmental bodies at national, regional and local levels, private companies, universities, citizens, designed to freely offer a wide range of geographic resources on the Net. Its spirit is based on cooperation and openness through their consensus and experiences according to European Directive INSPIRE guidelines², Open Geospatial Consortium (OGC) interoperability specifications³ and ISO 19100 standards⁴.

This project has been coordinated by the National Geographic High Council, a governmental body, which committed its Geomatics Commission, renamed in 2007 as SDI Commission, to define the Spanish NSDI. This Commission launched a Working Group for the IDEE that has produced a set of technical recommendations based on consensus to harmonize the individual initiatives of its members: How implement WMS; Spanish Core Metadata based on ISO 19115 and Dublin Core; and Spanish Gazetteer Model based on ISO 19112 and other relevant projects.

The Spanish legal framework can be summarized as follows:

I) At National level:

- Royal Decree 1545/2007⁵ defines the composition and role of the National Geographic High Council, describe the fundamental principles of Spanish NSDI, and assign the roles of coordination of the project to the National Geographic Institute of Spain (IGN Spain).
- Ministerial Order FOM 956/2008⁶ defines a new data and services policy for IGN Spain, the most basic reference data and services (administrative

¹ <http://www.idee.es>

² <http://inspire.jrc.ec.europa.eu/reports.cfm>

³ <http://www.opengeospatial.org/standards>

⁴ http://www.isotc211.org/pow_all.htm

⁵ http://www.boe.es/boe/consultas/bases_datos/doc.php?coleccion=iberlex&id=2007/20556



Figure 1: The English interface of IDEE national Geoportail. Each flag includes a link to the correspondent Autonomous Community.

boundaries, geodetic networks, the national gazetteer and a database of population entities) is free and can be used for any purpose with the only condition of mentioning the authorship of IGN Spain. The rest of the cartographic production of IGN Spain, and the geoservices based on it, have been also free for non-commercial uses. For commercial uses, a specific license must be established.

II) At Regional level:

Three Autonomous Communities has approved a legal framework for the Regional SDI: Cataluña, Andalucía and Castilla y León. Their philosophy and principles are very similar to the national ones.

Regarding data and services policy at Regional level, there is a wide variety of approaches in the 17 Spanish Autonomous Communities, from strict data licensing to completely free geodata, but in general terms there is a lot of data available under open, free and sensible conditions.

In any case, the existing considered basic three services (visualization, catalogue and gazetteer) are considered in the community as being free and open, and in general, all the web services implemented are also free.

This legal and organizational situation has created an exciting atmosphere of collaboration and data sharing, with an incredible variety of projects in different application environments: archaeology, civil protection, coast management, local government, environment management, real state, sustainability monitoring... (See Figure 1).

Table 1: Evolution of Spanish NSDI in figures

IDEE evolution	2007	2009
OGC standards implemented	7	10
SDI nodes	> 140	> 400
WMS available	70	675
Layers available	700	7,000
N° of requests per month received in the national node	> 4 M	> 30 M

Spanish National SDI evolution

IDEE project state of play was presented at 23rd International Cartographic Conference held in Moscow on 2007 August⁷ in a communication under the title “New Ways of Exploring Cartography”, presenting the Spanish project as an example of a new era of cartographic production based on sharing web geoservices among a wide community of actors in a collaborative atmosphere.

In 2007, Spanish NSDI had a national Geoportal in 7 different languages (Spanish, English, Basque, Galician, Catalan, Portuguese and French) and 7 different OGC specifications (WMS, CSW, Gaz, WMC, WFS, WCS and WCTS) implemented, in a chainable and usable way. At that time, more than 140 SDI nodes were sharing cartographic resources in the Net, including more than 70 WMS with more than 700 layers available.

During last two years, three additional OGC specifications have been implemented in the national node:

- Style Layer Descriptor (SLD) allowing the user to design and change the portrayal and cartographic appearance of a remote WMS.
- Web Processing Service (WPS), offering some processing functionality as a publicly available service: profiles calculation; visibility map computing; average altitude, slope and aspect computing in a given polygon; combined queries exploiting Corine-Land Cover information in a Municipality with values of altitude, slope and aspect.

⁷ http://cartography.tuwien.ac.at/ica/documents/ICC_proceedings/ICC2007/html/Proceedings.htm

- Keyhole Markup Language (KML), to manage multimedia georeferenced data, as photos, videos, notes, geometry...

And the Spanish SDI community has grown considerably and a lot of new resources have emerged until having services and Geoportals from seven ministries, sixteen Autonomous Regions, more than 380 municipalities and a lot of thematic projects, until complete a set of more than 675 Web Map Services offering a bunch of more than 7,000 layers of cartography.

In Table 1, a summary of the evolution of some figures describing Spanish SDI development can be seen.

Two of the key points that have made possible this remarkable evolution are: the bottom-up approach and the collaborative production of set of cartographic products covering Spain at large scales:

1) Bottom-up approach. SDIs initiatives in Spain has been launched not having waited for INSPIRE Directive approval, for having finished Implementing Rules, completed ISO standards and stable and proved OGC specifications. A community of actors from private sector, government and academia has implemented practical solutions, services and applications in a bottom up approach with a minimum set of recommendations and guidelines. We have always in mind the possible future needed reengineering to adapt the NSDI to the INSPIRE Implementing Rules, finished standards and specifications.

2) New cartographic production. A new way of harmonized and collaborative cartographic production has been set up by means of several key projects:

- Aerial Orthophotography National Plan (PNOA) funded by National (66%) and Regional government (34%), to produce by means of a collaborative organization, a national orthophoto coverage 50 or 25 cm resolution, depending on the area, each two years, to be published as a free, open WMS.
- CartoCiudad, an official street and road database build harmonizing cartography from IGN, Cadastre, Statistical Office and Post Office, published using OGC services, and open to collaboration with Regional Governments to updating and a coordination work with Municipalities.
- Land Cover & Use Information System 1/25,000 (SIOSE), a collaborative project involving 7 Spanish Ministries, the 17 Autonomous Communities and private sector, to produce a Land Cover and Use IS according a Object Oriented Model defined by consensus.
- Harmonized Topographic Database (BTA), as a harmonized by consensus Data Product Specifications for topographic regional DB at 1:5,000 and 1:10,000 scales, compatible with national DB at 1:25,000 scale.

This datasets produced collaboratively at large scales and published via OGC services are complemented with other cartography: cadastral parcels of all Spain, data from

National Statistic Institute, and a long list of datasets until complete an actually good description of Spanish territory from different approaches and visions.

New lines of development

Some new lines of development and innovation initiated in the evolution of IDEE Geoportal and central node are:

- New applications and developments to give more visibility to the resources of other SDI nodes (national, regional, local and thematic) integrated in the NSDI.
- Analysis services to offer GIS functionality via web services
- Collaboration with neighbours SDIs
- New gadgets in the Geoportal.
- IDEE 2.0
- An Application Programming Interface (API)

New applications and improvements

A set of resources has been recently implemented and improved with the objective of interoperate with all the web services available in the nodes of Spanish NSDI and give more visibility in the national geoportal to those services:

1) A Services Catalogue (SC)⁸, describing all the standard services existing under the umbrella of Spanish NSDI. It is conformant with EN ISO 19119: 2005 “Services”, with INSPIRE Implementing Rules on metadata⁹ and it provides a CSW 2.0.2¹⁰ standard service.

To catalogue a new service it is enough just to declare which type of service is (WMS, WFS...) and to enter the URL address of the web service. The system captures automatically the metadata describing the services from its Capabilities. The client is multilingual and can be explored at IDEE Geoportal¹¹.

2) A multiple client for catalogue services, named Catalogue Connector¹², developed as Free Software by the development team of IDEC (SDI of Catalonia), allowing querying simultaneously different catalogue services if they are compliant with one of the OGC existing profiles. It is a very flexible approach as far as any new catalogue standard or profile can be added introducing a supplementary code module to the original software.

3) A multiple gazetteer client¹³ developed also as Free Software, by University of Zaragoza, able to launch a query to different gazetteer services compliant several OGC profiles (WFS-G, WFS, WFS-MNE...). It is also very easy to enhance its possibilities by adding new gazetteer standard or profiles.

⁸ <http://www.idee.es/IDEE-Gazetteer/Gazetteer.html?locale=en>

⁹ <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2008:326:0012:0030:EN:PDF>

¹⁰ <http://www.opengeospatial.org/standards/cat>

¹¹ <http://www.idee.es/IDEE-ServicesSearch/ServicesSearch.html?locale=en>

¹² <http://www.geoportal-idec.cat/geoportal/catalogconnector/CatalogConnector>

¹³ <http://www.idee.es/IDEE-Gazetteer/Gazetteer.html?locale=en>

4) The viewer¹⁴ and other client applications (for WFS, WCS,...) has been reengineered to give easy access not only to the services provided by IGN node, but to all the services available at all the nodes federated in Spanish NSDI. In the viewer: a service and layer three shows the active WMS being visualized in each moment; a service directory shows all the reference WMS (ortophoto and topographic cartography) available at national and regional level; a specific option give access to local services; and it is possible always to use the service catalogue to search a service and add it to the viewer.

5) The IDEE viewer supports WMS and WMS-C (Web Map Service Tile Caching)¹⁵ as defined by OSGEO as a recommendation to speed-up the visualization services. The main idea is to define an abstract tessellation to have standard tiles¹⁶ that can be stored in a cache. The same idea is going to be incorporated in the OGC future specification WMS-T (Web Map Service Tiled).

SDI as a GIS on the Net

An SDI can be seen as a GIS completely implemented on the Net, based on a set of distributed interoperable resources, and that implies all the characteristics of an SDI: standards, agreements, collaboration, legal framework, metadata and so on.

To explore this line of progress we were developing and deploying in the IDEE Geoportal from the very beginning analysis GIS functionality under the form of standard web services, most of them using Web Processing Services (WPS).

1) A first step was the implementation of WPS, based on the Web Coverage Service (WCS) publishing a DTM of all Spain, and offering information about the altitude, slope and aspect of a given point, the computing of profiles between two points selected by the user and visibility maps from a point over the ground.

2) A second phase were covered by the called Territory Analysis¹⁷ application offering on line and remote combined analysis using Corine-Land Cover information and the mentioned CSW to calculate the areas of a given Administrative Unit that fulfil a condition combining land use classification, heights, slopes and aspects.

3) A third step based on the implementation of more complex analysis functions as WPS: overlay of different polygon layers; buffer calculation around point, lines or polygons and distance calculations between features.

Collaboration with Andorra, SNIG and IGN F

IDEE is collaborating with the neighbour SDIs:

¹⁴ <http://www.idee.es/clientesIGN/wmsGenericClient/index.html?lang=EN>

¹⁵ http://wiki.osgeo.org/wiki/WMS_Tile_Caching

¹⁶ http://wiki.osgeo.org/wiki/WMS_Tiling_Client_Recommendation

¹⁷ http://www.idee.es/clientesIGN/analisis_territorial/index.html

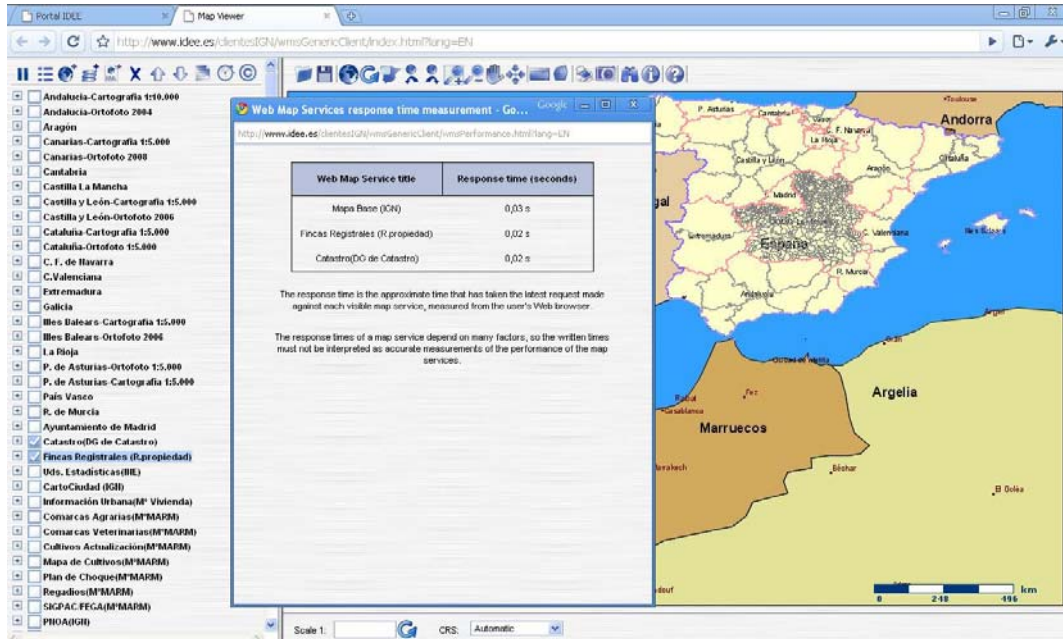


Figure 2: Response time utility in IDEE viewer

- SNIG (Geographic Information National System)¹⁸ in Portugal.
- The *Géoportail*¹⁹ implemented by *Institut Géographique National* in France
- SDI of Andorra²⁰, developed by Andorra Government

To increase and promote the interoperability of services and SDI resources by means of a set of common actions:

- Direct links to this geoportals in the front page of IDEE.
- Promotion of multilingualism, translation of each geoportal to the other side of the border language.
- Availability of neighbour WMSs in the viewer of each geoportal.
- Interchange of experience, good practice and ideas.

Some new gadgets

Some new functionality, that can be named gadgets, had been added recently to the standard viewer available as part of IDEE national geoportal:

- Performance meter: Symbolized by a little clock, there is a new facility measuring in each moment the response time of the last petitions performed against all the Web Map Services available in the viewer (see Figure 2). It is not an objective measurement of the performance of a service because there are a lot of factors affecting the result

¹⁸ <http://snig.igeo.pt>

¹⁹ <http://www.geoportail.fr>

²⁰ <http://www.ideandorra.ad/geoportal/>

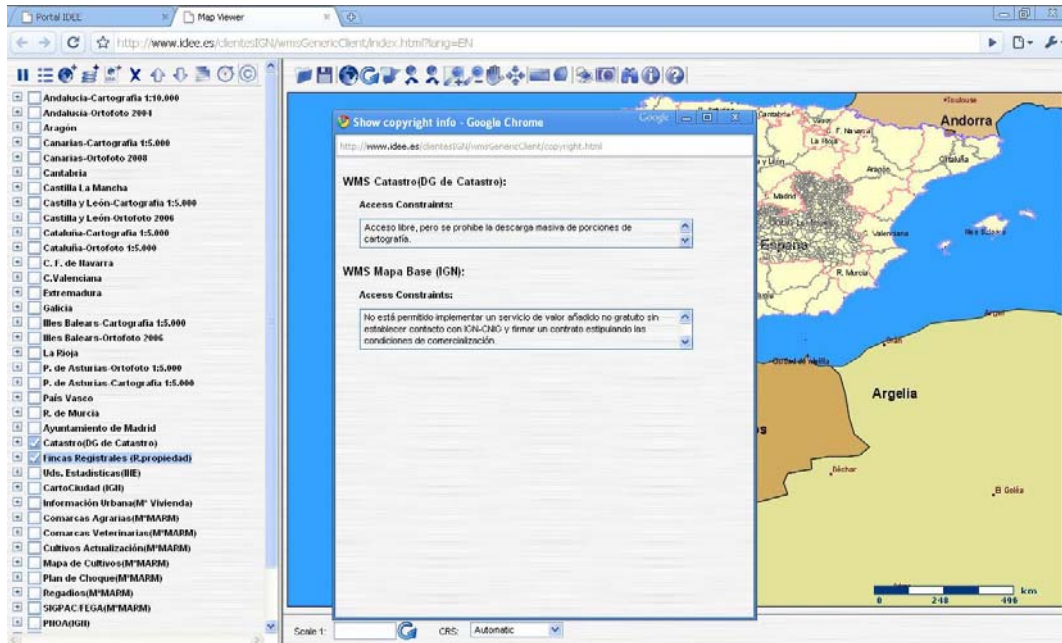


Figure 3 Copyright utility in IDEE viewer

(bandwidth, user's computer characteristics...) but to have this information gives the opportunity to the user of choosing the quickest service in each moment.

- Copyright reader: We have implemented an utility displaying information about authorship and use conditions by reading *Attribution* and *AccesConstraints* parameters from the capabilities document (see figure 3). This is a way of trying to avoid the alternative solution of displaying copyright messages inside the cartographic window, action that can cause a lot of problems: overlap of different messages from different services; confusion between geographical names and copyright messages; possibility of understand that a copyright message from a service is referring to other map services overlaying the original one...Anyway, marginalia was always written outside the cartographic frame and clearly distinguished from cartographic information.

IDEE 2.0

There are three categories that are sometimes presented as exclusive alternatives: SDI, Virtual Globes (VG) and Volunteer Geographic Information (VGI). We think this is not a good picture of the actual situation: SDI as distributed virtual systems based on standard interfaces maximizing interoperability among heterogeneous nodes; and VG, as thick clients of non-standard visualization services maximizing performance between a specific client and a particular service, can be seen as different alternatives. But Volunteer GI (VGI), or Neocartography as we prefer, as a new and different approach to GI production process that see users as users/producers, let's say volunteer contributors, is completely compatible with VG as well as SDIs.

This is why we speak about SDI 2.0, or IDEE 2.0 in the case of Spanish NSDI, when we try to take advantage of the participative and open points of view of the Web 2.0 from the SDI world.



```

<html>
  <head>
    <title>simple-test</title>
    <meta http-equiv="Content-Type" content="text/html; charset=UTF-8">
    <script src="http://www.cartociudad.es/VisualizadorCartografico/CartoVisor.js" type="text/javascript"></script>
  </head>
  <body>
    <div id="mapa"></div>
    <script type="text/javascript">
      var map = new CartoVisor("mapa",-5.900,38.800,0);
    </script>
  </body>
</html>

```

Figure 4: CartoCiudad API and the code needed to include the viewer in a web page

To progress in this direction we have initiated some new developments:

1) KML support. The standard viewer is being prepared to support KML visualization, at least for two dimensional data. This would allow users to overlay KML layers on top of WMS cartography to take advantage of all the information available in this format. KML data can be added from a local storage in the user computer, identified by the name of the file and the complete path (private data), or can be added from a public URL available on the Net (public data). The IGN node of IDEE is going to offer a server to store this kind of data, offering the possibility to the users of uploading their KML files.

2) The possibility of interactively drawing simple geometric primitives (points, curves, polygons) using the set of available WMS as a reference to save the result as a KML file to be viewed later on. Users can generate its own point of interest and geometry, add associated attributes, and store the result locally or in the IGN's servers to a KML layer to be displayed. A user's management application has been implemented to give the control of access and edition of each contribution to its author.

API

CartoCiudad project, the official street and road digital map of Spain, has developed its own API (see figure 4) named CartoVisor. It is based on Open Layers²¹ and allows integrating easily a viewer showing CartoCiudad WMS in a web page by copying a simple html code. There are six different available version of the viewer with different information and functionality²².

A more general version of this API is under development with the objective of offering the possibility of visualize any Web Map Service available. It includes some facilities: see legend, search a geographical name, add WMS and the most common viewing functions (pan, zoom...).

Conclusions

Spanish NSDI, IDEE for *Infraestructura de Datos Espaciales de España*, defined as a collective and cooperative project led by the different government authorities in Spain, national, regional and local, but implying also private sector and academia, has been evolved since its birth on the summer of 2004.

From the organizational point of view, coordination has been managed in the Working Group for IDEE, open to all relevant actors from public, private sector and academia, devoted to interchange experiences and take decisions by consensus.

Legal framework is defined under the umbrella of European Directive INSPIRE (2007/2/EC) and composed by national regulations defining SDI components and organization (RD 1545/2007), regional legal texts defining regional SDIs in three Autonomous Regions (Cataluña, Andalucía, y Castilla y León), and the Law transpositioning INSPIRE Directive, which is expected to be approved and published this year 2009. On the other hand, cartographic production of IGN has been freedom for non commercial purposes (OM FOM/956/2007) and at regional level there are different data policies but, generally speaking, data can be accessed in the majority of situations under sensible open conditions.

From a technical point of view, a first stage, that can be called IDEE 1.0, including nine different OGC standards, geoportals, viewers and applications implemented in a network of interoperable nodes, around a core of fundamental services (Web Map Service, Catalogue and Gazetteer), were developed during last 5 years.

A second stage, let's say IDEE 2.0, is now emerging based on the idea of taking advantage of the philosophy and developments of the Web 2.0, giving the opportunity to the users of adding its own contents and information. This line of work is complemented with a greater interaction with users, by means of blogs²³, e-mail lists, forums²⁴, news webs²⁵... with the objective of having feedback and implying them in the production process.

²¹ <http://openlayers.org/>

²² <http://www.cartociudad.es/VisualizadorCartografico/>

²³ <http://blog-idee.blogspot.com>, <http://blog.grafcan.es>

²⁴ <http://www.redidecanarias.com>

As a conclusion of the whole process of evolution and growth experimented by the Spanish NSDI, a few ideas arise as very important:

- The central role of the community. To build and foster a strong, healthy, open community of actors from public, private sector and academia, committed in the promotion of web services, standards and interoperability is one of the key points to implement a national successful SDI. It is also very important to create a collaborative atmosphere where everybody can feel comfortably accepted and supported, and where every actor can rely on other actors.
- Practical measures for interoperability are often essential and have a great impact, for example: multilinguism, CRS harmonization, high visibility of services URL, harmonized services and layers names...
- SDI, Virtual Globes and VGI need to be harmonized to take advantage of the good points of the three technologies.
- Bottom-up approach is a good approach to progress quickly. It remembers a little bit the evolution mechanism: in a first step, a lot of resources are implemented, maximizing the number of resources available; then, in a second step, harmonisation and standardization measures are applied to maximize interoperability, services visibility and resources sharing. It is a good mechanism to promote the deployment of a big ecosystem with a wide and creative variety of resources interoperating among them.

²⁵ <http://tero.corank.com/>