OPEN SOURCE #10: GEONETWORK OPENSOURCE

THE FAO'S JEROEN TICHELER INTRODUCES GEONETWORK - A GEOGRAPHIC LIBRARY ON THE WEB

How often do you search for an administrative boundaries layer you can use to map your statistics? When was the last time you downloaded tons of satellite images freely available on the Internet to convert them from an obscure HDF format into a GeoTiff before you could simply see it as a backdrop in your GIS?

Finding and accessing geospatial information from trusted sources can be a time consuming, expensive and frustrating experience. It can be just as difficult to find reliable reference data within your own organization or company as it is from others. When looking for information in written works such as books or journal articles, we use a library catalogue and connect with other library catalogues from around the world. GeoNetwork opensource lets us do this for geospatial information.

GeoNetwork is a digital library enabling you to find and access geospatial information. It allows data providers to systematically describe both their data and distribution services. A catalogue of data and distribution services can then be published through the internet for use by anyone looking for geospatial information and they may be able to access it from a data distribution service listed in the catalogue. On-the-fly data conversion and re-projection have made direct data access from a distribution service a viable option for those with good Internet access.

By providing a catalogue for data and distribution services and facilities to exchange information with other catalogues as part of a network, GeoNetwork helps to organize and share geospatial information within and between the interoperable, spatial data infrastructures (SDIs) that many states are building.

History of GeoNetwork

The United Nations Food and Agriculture Organization (FAO) and the World Food Programme (WFP) joined forces in 2002 to develop an open source spatial information management tool, GeoNetwork. It was designed to harmonize and improve access to spatial databases that support decision-makers in agriculture, forestry, fisheries and food security. Another goal is to promote multidisciplinary approaches to sustainable development by allowing FAO, WFP and other UN agencies, non-governmental organizations and research institutions worldwide to share and distribute geospatial information more easily.

Over the past years, the United Nations Environmental Program (UNEP) and the United Nations Office for Coordination of Humanitarian Affairs (OCHA) added support to the project together with non-UN contributors. GeoNetwork is now known to be deployed in the United Nations, the Consultative Group on International Agricultural Research (CGIAR), Global Earth Observation System of Systems (GEOSS) GEOportal, in Europe among others in the context of INSPIRE, in Australia, France and many others.

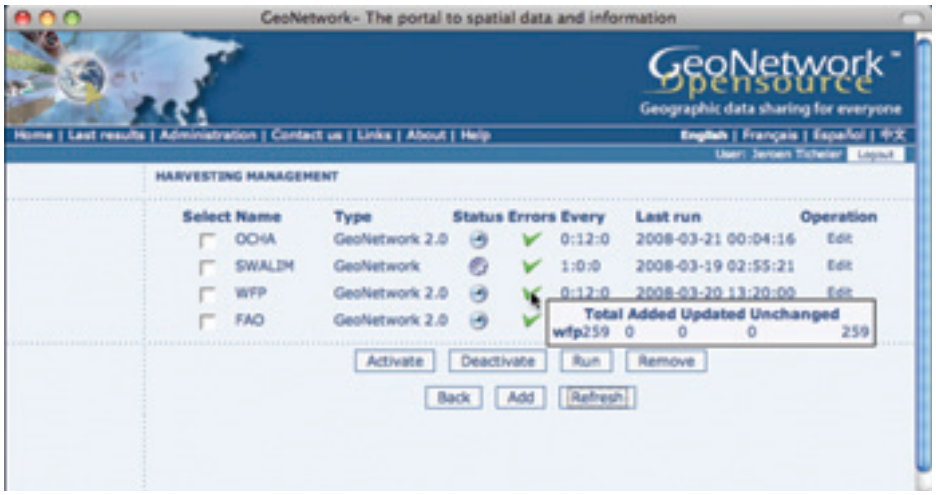


FIGURE 1: Harvesting Management in GeoNetwork

FIGURE 2: GeoNetwork catalogue search example]

To ensure long term sustainability of the project and to ensure the project meets the expectations of a larger audience, the GeoNetwork Advisory Board decided in 2006 to move the project out of the UN and into the newly established Open Source Geospatial Foundation (OSGeo). A Project Steering Committee (PSC), established in 2007 for day-to-day management of the project, consisting of 7 active community members, evaluates proposals for new functionality, decides on new releases and approves new software developers with direct write access on the project's source code repository. The software is released under the GNU GPL license. The most recent release is version 2.2.0 (March 2008).

Sharing data and services

Sharing information in a world already overloaded with information is problematic. Many of us search for information using one of the big search engines on the Internet like Yahoo or Google. Some find these search engines not effective enough and will use social bookmarking sites like Delicious or Dig instead. These sites help users to organize or find content using tags, user provided descriptions and popularity indexes. Others prefer to subscribe to services that provide them automatically with updates when they occur such as newsfeed (RSS) subscriptions. GeoNetwork provides functionality for all these users. Search engines can index public content in the catalogue through interfaces like the Open Archive Initiative Protocol for Metadata Harvesting (OAI-PMH) and the OGC Catalogue Services for the Web (CSW), users can bookmark resources on the popular Social Bookmarking websites using unique, RESTful URLs or can subscribe to GeoRSS news feeds. The catalogue also provides basic and advanced search capabilities through its web interface (see Figures 1 and 2).

Setting up private and public catalogue networks

One of the strengths of GeoNetwork is the possibility to create a network of catalogues that can exchange information. This allows users to find geospatial (and non-geospatial) information from a variety of organizations in a single website. The FAO together with sister agencies uses this approach to provide easy access to a large number of resources from the different data providers in one FAO GeoNetwork site. Proper attribution ensures transparency, so the user clearly knows who the publisher of the information is.

The catalogue administrator has a wide variety of options to configure the content of the catalogue at their site. A web interface allows the administrator to define the remote catalogues that are available to users of the site and the content retrieved from these catalogues can be filtered. The administrator can also schedule when and how often the content from a remote catalogue is read. Content from rapidly changing catalogues can be read more frequently than content from static catalogues. Updated or deleted entries are taken care of automatically.

Metadata standards

GeoNetwork acts as a geospatial library and uses a standard set of descriptive fields – like digital library 'cards' – to describe geospatial data and distribution services. There are many different sets of fields that can be used to describe data and distribution services, some of which have been standardized, e.g. Dublin Core (ISO 15836-2003) or ISO 19115:2003. GeoNetwork uses a generic approach to these descriptive fields by supporting multiple standards in XML. By default, ISO 19115:2003, FGDC and Dublin Core standards are supported for data and ISO 19119 metadata for services. Developers can easily add other metadata standards or custom metadata profiles where required without impacting the core of the system.

The system allows publishers of content to validate the metadata at two levels to ensure compliance with the metadata standard being used. The first level (schema validation) basically checks that the descriptive fields are present and correctly ordered, whilst the second level (which uses schematron processing) uses predefined rules to check the content of the fields. Reports are generated for the user to check and fix any errors.

Metadata standards:
ISO19115:2003 & ISO19119:2005 (ISO19139:2007 encoding)
FGDC
Dublin Core

FIGURE 3: MapViewer catalogue

FIGURE 4: OpenSearch results

Catalogue interfaces

Catalogue interfaces provide standard ways to connect and browse through a catalogue's content without necessarily using a web browser interface. GeoNetwork implements a number of catalogue interfaces. Using such an interface allows a wide range of software to connect and exchange information with a catalogue. Examples are metadata exchange between catalogues, integration of catalogue searches from within a desktop application or custom web application. Figure 3 shows an OpenSearch interface and Figure 4 the results of a search on a GeoNetwork catalogue using the interface, Figure 5 shows the results of a search in GeoRSS format overlaid on Google Maps.

Catalogue interfaces:
OGC Catalogue Service for the Web (CSW 2.0) (client & server)
Z39.50/ISO23950 (client & server)
Open Archive Initiative Protocol for Metadata Harvesting (OAI-PMH) (client & server)
OpenSearch (with Geo extension) (server)
GeoRSS (server)
WebDAV (client)

Web Map Viewer

GeoNetwork has a tightly integrated web map viewer (InterMap) for specifying spatial searches and exploring data provided by OGC compliant web map servers. The web map viewer provides all the usual facilities of a web map viewer such as zoom, pan, identify (GetFeatureInfo) and layer manipulation (add, remove, re-order, etc). New features have been added in version 2.2.0 such as the ability to place markers on the map, email a map composition with markers to a friend, produce PDF output with captions and generate a link to the current map shown in the map viewer window.

Web Mapping:
OGC-Web Map Service (WMS)
Web Map Context (WMC)
KML

Integrating with web and desktop GIS

Besides those already described, a number of additional efforts are underway within the open source communities to make integration of GeoNetwork in the daily workflow of GIS professionals easier. At present, development is underway in the gvSIG and Talend SDI communities so that these tools can generate, insert or update metadata within the GeoNetwork catalogue. Some work is also underway to provide these facilities for ESRI's ArcCatalogue.

Metadata Exchange Format (MEF)

The GeoNetwork project had a need to effectively exchange, backup, restore and migrate metadata and data both within and between GeoNetwork catalogues. This led to the definition of a metadata exchange format (MEF) file. An MEF file is a zip-compressed file that includes the metadata record itself, preview images, basic catalogue privileges, and optionally, any data files uploaded to GeoNetwork. The MEF file can be exported and imported by GeoNetwork. MEF files are also used to backup resources that are deleted from the catalogue. MEF files automatically deploy in GeoNetwork and put all information in the 'right' places. Tools that create or read MEF files greatly facilitate automated catalogue management.

Web Map Server integration based on GeoServer

Spatial data can be served interactively through the internet using a range of dedicated software applications. GeoNetwork itself does not implement any Web Map Server functionality but has recently integrated GeoServer into the standard release. GeoServer provides OGC Web Map Services, Web Feature Services and Web Coverage Services, amongst others. In the GeoNetwork release, GeoServer has been configured by default to serve two lightweight base layers used in the map viewer. Users can add new services through the standard GeoServer administration interface.

In future releases of GeoNetwork, users will be able to directly deploy Web Map Services on GeoServer when uploading spatial data like shapefiles and GeoTiff with their metadata. This integration is under active development in a collaborative effort between the GeoServer and GeoNetwork communities.

GN FOSS Community

An active and healthy developer and user community around GeoNetwork ensures that new functionality is constantly added and existing functions are further improved. New developments in the global "GeoWeb" can be quickly tested and integrated, if found useful. The community currently doubles on a yearly basis, and moving the project into OSGeo has increased collaboration with other geospatial FOSS groups, as well as helping ensure sustainability.

Technology

GeoNetwork is developed in Java and runs as a servlet application. Internal representation of data is in XML format while XSLT is used to transform this XML into HTML, text, PDF or XML output. Many of the services that build up the web interface are also available as XML services to allow other applications to use them directly.

Links:

Dublin Core: dublincore.org/
FAO GeoNetwork: www.fao.org/geonetwork
FGDC: www.fgdc.gov/
GeoNetwork opensource: geonetwork-opensource.org
GeoServer: geoserver.org
gvSIG: www.gvsig.gva.es
ISO: www.isotc211.org
OAI-PMH: www.openarchives.org/pmh
OGC: www.opengeospatial.org
OpenSearch: www.opensearch.org
OSGeo: www.osgeo.org
Talend SDI: www.spatialdataintegrator.com
Z39.50: www.loc.gov/z3950/agency/

FIGURE 5: GeoRSS output on Google

Article by Jeroen Ticheler, OSGeo supporter and passionate believer in Africa, people, maps and open source technology, which led him to develop GeoNetwork opensource in 2001 at the UN's Food and Agriculture Organization (FAO). Jeroen is task group manager on interoperable services in the UN Geographic Information Working Group (UNGIWG) and promotes the UN Spatial Data Infrastructure (UNSDI) within UNGIWG. Email: Jeroen@Ticheler.net.

Kingston Centre for GIS
The Geographical Advantage

Fully revised and expanded GIS Distance Learning Programme
Residential Summer School in GIS with two five day courses:
- Introduction to GIS (7th-11th July 2008)
- Map Design for GIS Users (14th-18th July 2008)

Courses cost £595 ea. (£450 for academics) or £1100 for both (£850 for academics)
Application deadline - 30th May, 2008 (late applications with a fee until 23rd June, 2008)
The course fee does not include accommodation. Enquiries: kcgissummerschool@kingston.ac.uk

Professional Training

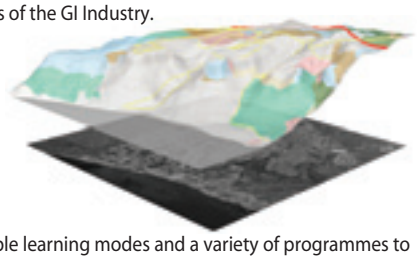
MSc degrees
Geographical Information Systems & Science
(subject to validation)
Applied Geographical Information Systems

NEW! Full Distance Learning MSc

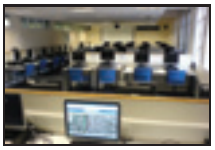
BSc degrees
Single & Joint Honours degrees

- Flexible distance and face to face learning modes to suit all needs
- All courses can be taken in full or part-time mode
- Extensive resources and full online virtual learning environments
- Option of foreign fieldwork in mobile mapping
- Fully licensed GIS software for home use for duration of course
- Access to important GI datasets, databases and imagery
- Reduced membership of professional organisations
- Free access to ESRI Virtual Campus

The internationally renowned Kingston Centre for GIS delivers high-quality courses in Geographical Information Systems and Science to meet the education and training needs of the GI Industry.



Flexible learning modes and a variety of programmes to suit all needs, develop in-depth knowledge, understanding and technical competence enable you to take advantage of the latest developments in GIS. Whatever your career aspirations, professional development needs or prior experience in GIS, a KCGIS course provides the right environment for your learning.



Kingston University was the first in Europe to deliver a GIS degree and has over 18 years of experience in GIS education and training. It is acknowledged by The Times Higher Education Supplement as being a 'world leader in GIS' and been first choice for over 600 successful students.

Kingston University London
gis-admissions@kingston.ac.uk
www.kingston.ac.uk/centreforGIS