

Two Kinds of Open Come To Open Source and Open Standards in Geospatial Tech

It is difficult to read an IT magazine, speak with a programmer or read a technical blog these days and not run into the terms open source and open standards. And, while many vendors and users advocate one, the other, or both, there have been few explorations of the implications of these ideas for the geospatial community. This article will do just that, and take a step further by revealing the power of uniting the two to solve today's challenges related to using geospatial data and services.

By Adena Schutzberg

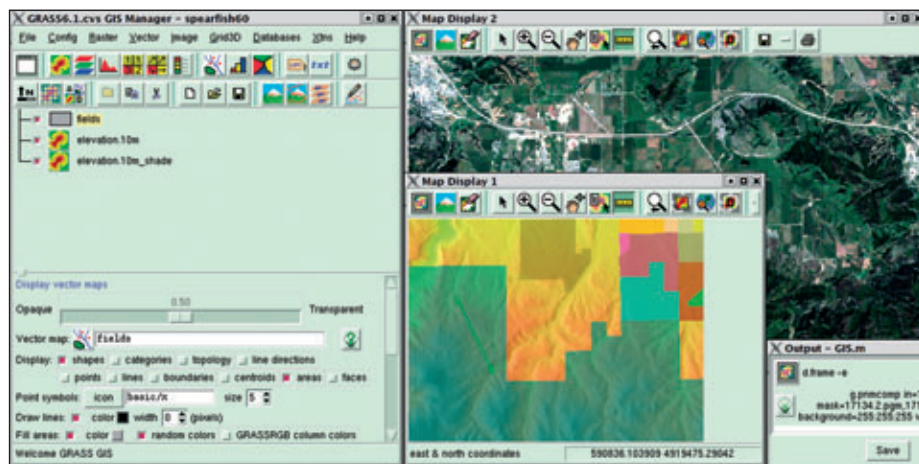


Figure 1: Interface of GRASS 6.1. Recent releases include support for the OpenGIS Simple Features Implementation Specification.

Understanding

It is worth noting at the outset the confusion in the community over the terms open source software and open software standards. The word 'open' is used extensively in articles, marketing materials, email lists, and blogs. But what does this term really mean? The definitions vary, sometimes referring to a software product's interfaces (Application Programming Interfaces, APIs) and sometimes to the source code.

Open source refers to whether or not the source code behind software is made available, among other things. If it is made available, and users can copy, modify and redistribute the source code without paying royalties or fees, it is termed open source. (For the complete story, visit the Open Source Initiative www.opensource.org/.) The

opposite of open source software is proprietary software; that's when the source code is not shared.

In 2006 it is possible to identify many open source geospatial software projects and point to the newly formed Open Source Geospatial Foundation (OSGeo, www.osgeo.org) which aims to formalize some of the efforts.

Blueprint

Before getting at open standards, let's take a step back to define standard. This is from Bob Sutor, the Vice President of Standards and Open Source for the IBM Corporation: "A standard is like a blueprint. It provides guidance to someone when he or she actually builds something." He goes on to note that it is a blueprint upon which many people need to agree. The Open Geospatial Consortium (OGC, www.opengeospatial.org) develops consensus on "blueprints" for software APIs.

An open standard can mean that a standard is open to anyone to use, even though it has restrictive licensing or requires a fee. The OGC goes a bit further and defines open standards as being:

- Freely and publicly available: free of charge and unencumbered by patents and other intellectual property;
- Non discriminatory: available to any one, any organization, any time, any where with no restrictions;
- No license fees: no charges any time for their use;
- Vendor neutral: in terms of their content and implementation concept and do not favor any vendor over another;
- Data neutral: the standards are independent of any data storage model or format;
- Agreed to by a formal, member based consensus process: the standards are defined, documented, and approved by a formal, member driven consensus process. The consensus group remains in charge of changes and no single entity controls the standard.

The key aspect of OGC open standards is that they are freely available for anyone to access and implement at any time. Software developers and development organizations,

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whether creating commercial or open source software, decide if they want to implement specific standards. It is important to realize that software packages, whether open source or proprietary, can interoperate if they all implement the same standard.

There are more than a dozen approved OpenGIS Specification open standards (www.opengeospatial.org/specs/?page=specs) implemented in hundreds of packages and products.

MOSS and GRASS

There is a rich history of open source geospatial software beginning on the desktop in the early 1980s and moving to the Web in the 1990s. Two of the oldest and perhaps the most recognized names in open source desktop software are the Map Overlay and Statistical System (MOSS) which dates back to 1977 and the Geographic Resources Analysis Support System (GRASS, <http://grass.itc.it/>) which dates back to 1982, see Figure 1. Since both MOSS and GRASS pre-dated the Web as we know it, its developers and users did not have the advantages today's open source geospatial community enjoys such as wikis (editable websites), Internet Relay Chat (IRC, a multi-user online typed discussion tool) and one-click downloads of files. Other open source desktop systems have grown up in GRASS' wake including QGIS, uDig, JUMP, OpenEV and others.

Open source components also arrived early. Development began on BBN's OpenMap (<http://openmap.bbn.com/>) with U.S. government funding, in 1987, and cleared the way for proprietary developer components. OpenMap enabled some of the earliest Web mapping in 1995.

These are just a few examples of projects that underlie today's active open source geospatial efforts. They illustrate, both by their longevity, geospatial power, and flexibility that the open source model works as well in the geospatial marketplace as in others. The case studies that follow highlight just

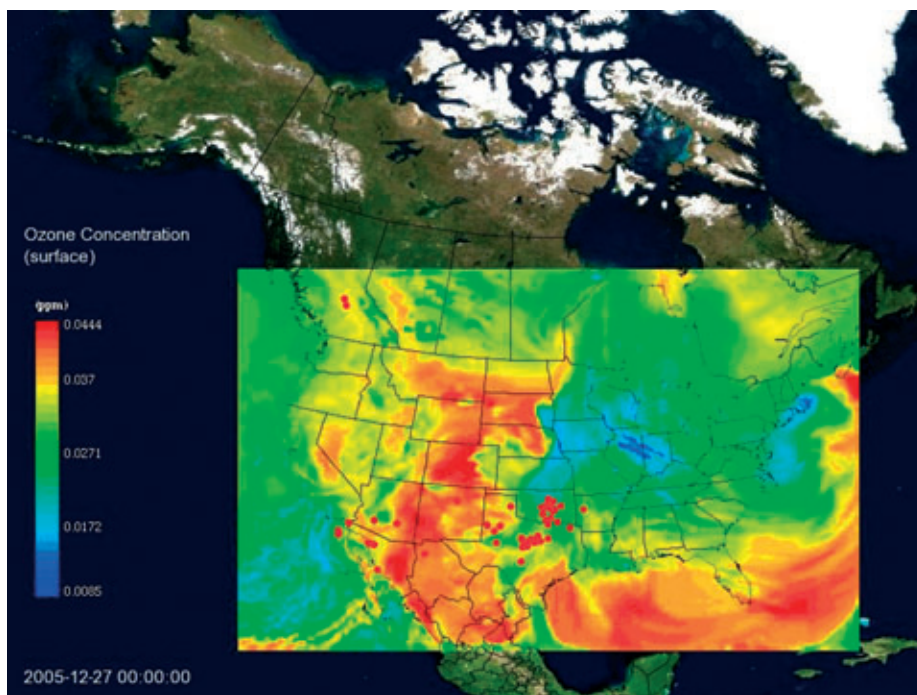


Figure 2: Surface Ozone concentration map created by GeoServer using data delivered via OpenGIS® Web Coverage Service Implementation Specification (WCS) delivered to QuickWMS viewer via OpenGIS® Web Map Service Implementation Specification (WMS). Image Courtesy Fire Chemistry Unit, Rocky Mountain Research Station, Missoula, MT.

three of the many open source geospatial projects that have embraced open standards, either from the start, or after several years of use, based on user needs. There are perhaps several dozen other similar stories to be told.

GeoServer

GeoServer has a long history using open standards. First developed to help leverage geographic data to enable urban planning tools such as traffic modeling, the project has become a sort of poster child for both the open source and open standards in the geospatial arena. The Open Planning Project (TOPP), a non-profit organization, felt that a standards-based server of geospatial data was a key piece in pulling together the framework for complex traffic modeling and other needs.

That platform, developers Rob Hranac and Chris Holmes determined, needed to include

three key characteristics: support for open standards, ease of use and integration of multiple geospatial formats. The format support was particularly important if the code was to be used in a variety of disciplines, such as local government.

How to begin? The team found a technology core in GeoTools, an open source Java GIS development platform launched in 2001. GeoTools (www.geotools.org) seemed like just the base needed as a building block, but it did not include support for PostGIS, the open source database solution for open source database PostgreSQL. That was so important, and the tools so good, that TOPP staff spent time implementing the needed code in GeoTools. "At first," says Holmes, "we felt like we were putting in all this work and getting nothing back, but in the end we had access to all sorts of format support via code developed by others."

WFS

As GeoTools began to take shape, the team determined the value of implementing the OpenGIS Web Feature Service Implementation Specification (WFS), the specification for sharing vector data. TOPP

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had already built a WFS implementation of its own. Still, the team saw the benefit of bringing that experience to the table to work collaboratively on WFS for GeoTools. At about the same time, OGC was looking for an open source reference implementation for WFS as part of its Compliance & Interoperability Test & Evaluation Initiative (CITE). TOPP was selected to provide the reference implementation and received funding to insure full compliance of GeoServer with the specification.

Web Map Service (WMS) support was added to GeoServer as well, based on work by GeoTools users in Britain, but ultimately completed by Gabriel Roldan, an Argentine programmer working for a Spanish client, see Figure 2. Other GeoServer users needed support for the OpenGIS Web Coverage Service Implementation Specification (WCS), the specification for sharing gridded data via the Web. Simone Giannecchini and Alessio Fabiani, consulting for the NATO Undersea Research Centre (www.nurc.nato.int), staff at

the USDA Fire Service and a researcher in New Caledonia (South Pacific) worked together on that effort, making the result available for every other GeoServer user.

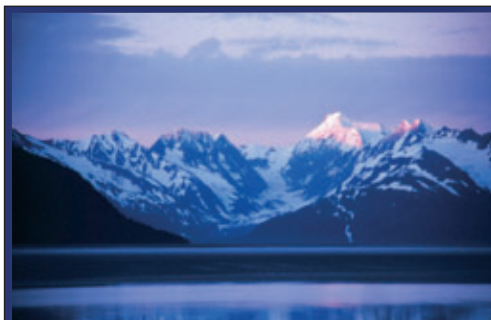
Solid Starting Point

Why are open standards important in open source? Holmes notes OGC's open standards are a solid starting point. "Otherwise, you have to sit around and argue about what a feature is. OGC has already had a lot of smart people do that work and come up with a good answer. So, we start there. Our data store for GeoServer/GeoTools is based on the data access model of the WFS specification." But it is a two way street. He continues: "Open source implementations of open standards give back to the standards community by providing a free, 'open to look at' working implementation. It is far easier for programmers to explore and evaluate a specification for use with an open source project than simply seeing the results in a proprietary one."

MapServer

So, then why is GeoServer perhaps not as well known as another open source Web map server, MapServer? Holmes is quick to point out that WFS is just coming into widespread use, while WMS, which MapServer supports, came on the scene earlier. WFS needs a fairly robust client (the returned vector data must be "understood" and rendered on the client) while WMS "picture maps" can be seen in a browser. "With Geography Markup Language [GML] maturing and more desktop WFS clients including open source uDig and MapBender and proprietary ones from companies like Cadcorp and ESRI, WFS and thus GeoServer will have a larger role in the Spatial Web," Holmes predicts.

Holmes and his colleagues are excited about the newest additions to GeoServer, which include tools to manage changes to geospatial databases. While OGC's WFS-T (T for transactional) offers the blueprints for adding, editing and deleting features, formal use of such tools requires software to roll-back changes and/or limit who can commit changes. These new tools, combined with others to ensure that added or changed features meet specific requirements (Are they



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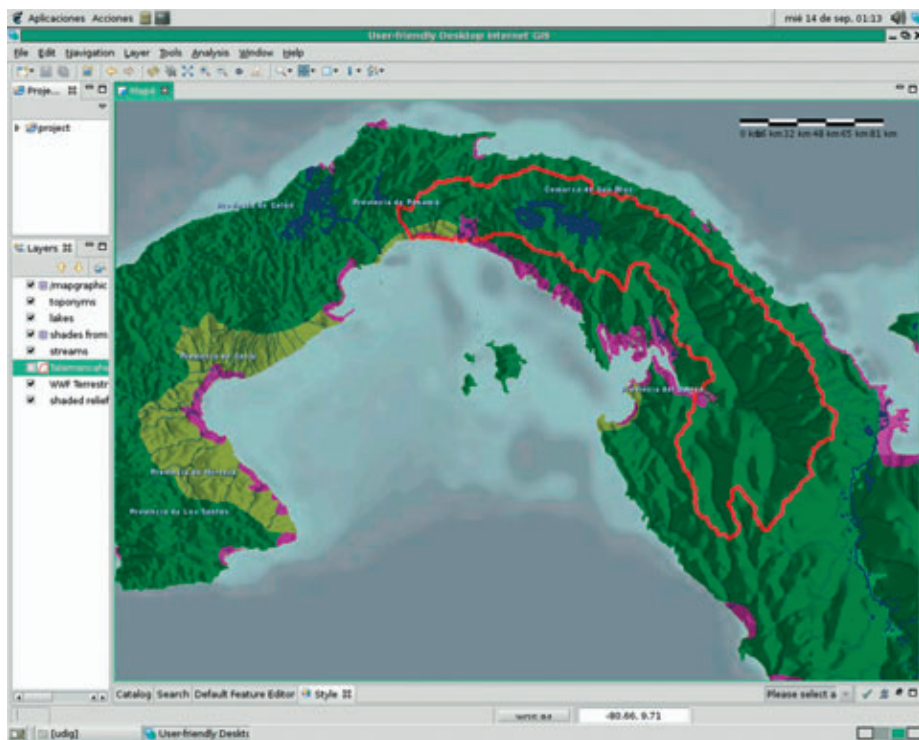


Figure 3: uDig serves as a client to a Web Feature Server (WFS) and Web Map Server (WMS) built on MapServer & PostGIS. The desktop client is part of prototype biogeography server here showing Central America.

long enough? Do they connect to other features? etc.) will lead to a whole new kind of Spatial Web offering. It will allow a "geowiki" sort of collaboration where many members of a community can participate in building and maintaining a shared spatial database via the Web.

uDig and Open Standards

Open source desktop GIS projects have gotten a bit of a jumpstart in the recent years. While GRASS was the forerunner of these, today's user interface practices have substantially changed the look and feel, and enhanced ease of use. The offering with perhaps the biggest commitment to open standards is the user-friendly Desktop Internet GIS (uDig). uDig stemmed from a grant from GeoConnections Canada to create a software tool to "help ordinary computer users view, edit, and print data accessible through the Canadian Geospatial Data Infrastructure (CGDI) and local data sources." Because GeoConnections had previously chosen to implement its spatial data infrastructure on OpenGIS Standards, the new client would need to support them as well. Paul Ramsey, president of Refrations Research, notes that while the funding was contingent on supporting standards, he and his team also "wanted to fill a hole in the OGC world of a true integrated client, where searching, seeing, querying, using, OGC services was a transparent part of the user interface (drag 'n' drop search results into

map window to see them, etc)."

Ramsey and his company are already known for their work in developing PostGIS and felt strongly that an open source project would best serve the citizens of Canada. GeoConnections is the name of the geospatial program in Canada. According to this program, the "free open-source product will provide a data access and maintenance tool that governments and the private sector can use regardless of budgets. Users of uDig will be able to access the CGDI without buying expensive proprietary desktop GIS licenses simply to view CGDI data. Consequently, uDig will make CGDI data accessible to a much wider potential audience."

uDig Map Window

uDig supports WMS and the more complicated WFS. The "user friendly" part of the name shines through since users can simply drop URLs (Web addresses) of Web services onto the uDig map window and have them added to the map. Refrations takes great pride in its product's role in OGC Web Services Initiative Phase 3. Says Ramsey, "I think I am most impressed by the different usability of the different clients in the final demonstration; simply compare the amount of interaction required to display airports using a feature portrayal service. uDig [required] one drag and drop every thing else was automated others required up to three catalog lookups, and cut-and-paste URLs."

uDig is widely used to test Web Map Servers. "I want the same thing with WFS. I want the same thing with Catalogue (OpenGIS Catalogue Service Implementation Specification)..." says Ramsey of the other specifications the products supports, see Figure 3. He is quick to point out the value of standards as a design baseline from a development standpoint. But with that comes "good news and bad news." The bad news is that "because the OGC specs tend to be more general than most implementations of GIS design, the implementation overhead we incur building the infrastructure necessary to handle them is very high." The good news is that "once we have suffered through the implementation hell we have a framework which is flexible enough to handle very odd cases, cases which cause developers with less generic models to graft onto the sides of their systems."

The Road Ahead

There is clearly much more to come from the marriage of open source and open standards in geospatial technologies. The demand for interoperability, flexibility and widespread distribution of products has and will continue to push these efforts. New programmers, working with new building blocks created around consensus-built standards are likely to be a key step in building national and global data infrastructures that not only reach to the far corners of the earth but are usable by their inhabitants regardless of budget or underlying technology.

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