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Standards Drive Progress in Geospatial Technology

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Introduction

In a world where progress often seems uncertain, it is nice to discover that there is clear progress in the world of Geospatial Technology.

Today, most Geospatial technologies, including GIS software products, provide tools and applications that allows the user to build, deploy, and/or access geospatially enabled applications on the Web. At the same time, the amount of Web-accessible geospatial content is growing rapidly. Geospatial content sharing on the Web goes well beyond what one might have expected a few years ago. GIS users accustomed to getting much more content than they needed on tapes, CDs and DVDs are finding applications on the Web that enable them to access and display or download only those features they need. These users no longer need to be GIS experts and they can now quickly browse the content before downloading, panning and zooming to their hearts' content, using only a Web browser.

In fact, consumers who only want maps and not the actual content can find many sites that create tailored maps but never expose their content. Some Web sites even provide a free client that enables the user to go to other Web sites to get multiple thematic maps of the same region to view together as overlaid "transparencies." The coordinate transformations happen automatically and no geospatial or GIS software is necessary on the user's computer. Remarkable! Such clients can even style the data from disparate remote sites in the same way (secondary roads are blue lines two pixels wide, etc.).

Online geospatial metadata content and service catalogs can automatically handle queries for services, such as a coordinate transformation service, as well as content. Such catalogs, based on vendor-neutral protocols, are at the core of most modern spatial data infrastructures.

Today, applications can “reach” across the Web to operate on data held in other systems' proprietary databases, even though the systems are from different vendors! Who would have imagined this was possible a few years ago? Other wonders, too, flow from the Web: databases storing data records that have a geospatial field (such as a street address) are able to serve such data up on the Web as spatial data, accessible in real time to any Web-connected GIS with the right standards-compliant interface.

Most of these advances in sharing geospatial content are the result of an international standards development process.

How the OGC develops standards

In 1994, with the stated goal of overcoming the difficulties of moving data from one GIS vendor's system to another's, a number of US federal agencies and GIS vendors from the US, Canada, the UK and Europe collaborated in the formation of the Open GIS Consortium, Inc. (OGC, now the Open Geospatial Consortium, Inc.). This group did not want the OGC to develop yet another data format standard. Instead, the focus was on defining and approving software interface standards that enable interoperability of geospatial content and services.

Since 1994, the OGC members have achieved considerable success. They developed and continue to evolve an efficient process for creating and adopting interface and encoding specifications. As of November 15, 2004, there are 14 OpenGIS® Specifications. Other specifications are in progress, and the public can track the progress. (See "Documents" at http://www.opengeospatial.org.) Because some of the interoperability issues in the geospatial domain are complex, some of the specifications are also complex. However, a number of the key web services oriented OGC specifications are relatively easy to implement and solve a number of key interoperability issues in our technology domain.

The process for developing an OGC specification is detailed in the OGC Policies and Procedures. These documents guide the work of the Technical Committee, in which Working Groups tackle specific interoperability issues, and the Planning Committee, in which Principal Members, including representatives from other standards organizations such as ISO TC/211, formally adopt the Technical Committee's specifications as standards and make decisions such as which new specifications to develop.

To accelerate technical progress, the Planning Committee also authorizes "Interoperability Initiatives" such as testbeds and pilot projects. These are largely driven and funded by technology-using organizations with particular interoperability requirements. Indeed, one of the reasons for the OGC's success is that, from the beginning, users have played a major role in defining and driving specifications. OGC also has a robust software product compliance testing program and programs for education and outreach.

It is worth mentioning that although OGC did not set out to create data standards, the growth of the Web created an irresistible opportunity for defining a standard for encoding geospatial content. That is, when it became clear that virtually all Web browsers and other Web applications would one day be able to "read" text data encoded in the eXtensible Markup Language (XML), it made perfect sense to have a single, non-proprietary, standard XML encoding for geospatial data. That encoding, the Geography Markup Language (GML), developed in the OGC, is now both an OGC standard and an ISO standard. The Ordnance Survey, as most UK GIS professionals know, relies heavily on GML.

Conclusions from the 'Plugfest' at OS in June

On June 16, 2004, an OGC "Interoperability Plugfest" held at the Ordnance Survey in Southampton gave software developers a chance to test their products' interoperability with other products.

Plugfest participants Cadcorp, ESRI, Galdos Systems, Intergraph, Ionic Software, lat/lon, Ordnance Survey and the University of Delft tested interoperability between clients and servers designed to comply with the OpenGIS Web Map Service 1.1.1 and OpenGIS Web Feature Service 1.0 specifications. The event was open to any company or organization with software that implements these OGC specifications. The procedure was to find problems between specific product pairs, document them, and work together to fix the problems.

All the participants agreed that it was a success, and they expressed the hope that OGC would organize more plugfests, using the same format as the UK event. As Cadcorp Ltd.'s Martin Daly said, "Cadcorp was delighted to be involved in the first ever OGC plugfest, and looks forward to taking part in many more in the future. These events are a great arena for ironing out the differences between the 'theory' of the implementation specifications, and the 'practice' of the implementations themselves."

The status of interoperability

Historically, most vendors have provided customers reasonable interoperability within that vendor's product line. Further, vendors have offered "filters" or format conversion tools that enabled their customers to convert data files to and from the formats offered by other vendors. As the first section of this article points out, the industry has moved beyond this kind of interoperability.

As Dimitri Monie of IONIC reported after the Plugfest, “We were impressed to discover that WMS interoperability overall is a reality, and with the exception of a few minor issues, everything interoperated immediately." This is a typical comment about implementations of the OpenGIS Web Map Server Specification, which might be said to specify "http://[parameters for a query to get a raster map]," where the raster map might be produced by a GIS, a remote sensing system, or another kind of "map server". Parameters for a WMS http query include such things as location of a data file, bounding box in a particular coordinate reference system, image type (JPEG, TIFF, etc.), pixel resolution, and others.

Simplicity makes interoperability easier to accomplish. WMS is relatively simple, and it delivers images that are standard for display in Web browsers and other applications. Thus, programmers without geospatial experience who know how to write programs that plug parameters into an http query can build Web applications with very nice vendor neutral map access and display capabilities. For this reason, implementations of this standard are rapidly appearing all around the world.

Eleven other OGC standards besides WMS are implemented in popular commercial products. The "hooks" are in place to provide the interoperability described in the introduction above, and much more. Integrators and solution providers are actively exploiting these to build solutions that employ software components from multiple vendors.

Challenges and drivers for future interoperability

Indeed, the future of geospatial interoperability is defined by the larger information technology world's commitment to web services and service oriented architectures. In this world, standards-compliant components can be linked "on demand" to build solutions. Most of the standards coming out of OGC fall into the category of "OGC Web Services" (OWS). Your full service desktop GIS is a collection of smaller programs that work together. Imagine those smaller programs spread across the Web and operating together as if they were all on your computer, and you get the idea of Web Services.

The Ordnance Survey and the national mapping agencies of the US, Canada, Australia, Norway and other countries see that problems such as incompatible data models, security, intellectual property rights, and data lineage cannot be addressed without both technical standards and organizational cooperation. OGC Web Services are the key to meeting the technical challenges they face.

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