Opensource GIS - A Disruptive Force or Driver of Innovation?

In order to better understand the increasing availability and emerging popularity of opensource GIS options, you first of all need to place it in a wider evolutionary context. From the 5th Century's Babylonian stone carving map, through to the creation of the Mercator navigational Projection, and later on to the development of the printing press, the power of mapping has always been about its ability to communicate and disseminate knowledge and ideas about our world. GIS is the most recent phase of mapping evolution which carries on this tradition. Prior to its commercialisation in the 1980s and 1990s, GIS was a form of computer modelling and visualisation which was most often pioneered in university laboratories. It was only after maps experienced an emergence in mainstream, thanks to Google Maps, that the opensource GIS movement really started to gain momentum.

Before discussing this movement however, it's important to be aware of what GIS is and what it is not. GIS is much more than just software. Rather, it is a system for working with maps and geographic information. A GIS, therefore, consists of 5 distinct but interdependent components. Along with the software, GIS refers to the hardware, the information which is used and captured by the software, the people who use GIS as well as the procedures for doing so. This considered, although the era of opensource GIS is a relatively new one, the truth is that the ethos behind opensource predates any organised movement at a particular period in time. Rather, opensource is a manifestation of the natural urge to belong to and contribute towards a community.

While a large motivation for opensource is to develop a technological counter-balance in a world driven by proprietary licenses and exclusive ownership, opensource GIS is, just as importantly, driven by a need to innovate and to make required tools and systems available and/or accessible. One good example is the scientific spatial analysis software GRASS (Geographic Resources Analysis Support System), which was initially developed to meet land management and environmental planning needs of a number of federal agencies, universities, and private companies in the United States in the early 1980s. In a similar regard, Global Mapper was initially an opensource project which was developed by the USGS before it was later commercialised in 2001.

Although opensource is a community-driven movement it is important to point out that, just like the commercial arena, it is in actual fact a dynamic and fast-changing one which contains many different and often competing niches. Perhaps the most popular opensource GIS software is QGIS (formerly known as Quantum GIS), a cross-platform desktop GIS application which was founded by Alaskan native Gary Sherman in 2002. QGIS, which is written in C++, has a large and active user and developer community and an easy to use interface which rivals that of commercial software alternatives. QGIS is commonly used in the fields of network design, spatial analysis and business analytics; it includes many plugins which are developed by the community. The software integrates well with R and Python programming languages, Google Earth, Openlayers, GRASS GIS, and MapServer as well as with a range of databases such as SpatiaLite, PostgreSQL/PostGIS, SpatiaLite and MySQL. Austrian computer scientist, author and data visualisation expert, Anita Graser, who serves on the QGIS Steering Committee, attributes the rise of the software to the project's focus on user needs, its welcoming and diverse community of volunteers and to the growing number of sponsors and donors who fund its continuous improvement. Looking forward to the release of QGIS version 3.0, Anita says big improvements will be phased in over time. "[A]mongst the most exciting [improvements] for me are faster spatial data analysis, further improved map design options and real 3D support."

However, QGIS is not the only option available to opensource enthusiasts. Another popular software is gvSIG ('gv' stands for Generalitat Valenciana, the Spanish regional authority which the system was originally developed for, while 'SIG' is the Spanish equivalent for GIS). The association has clients in more than 30 countries, whose goal is to join together companies from all over the world to offer quality professional services related to free geomatics. Alvaro Anguix, the CEO of gvSIG Association, explains how the project goes beyond the initial development of a Desktop GIS to include a suite of programmes. "Currently it is a catalog of products used in more than 160 countries including gvSIG Desktop, gvSIG Online (solution to implement Spatial Data Infrastructures), gvSIG Mobile (a mobile application for Android to take field data) and sectorial solutions like gvSIG Roads (roads management), gvSIG Crime (crime analysis) and gvSIG Educa (oriented to education)."

A New Opensource Era?

While most opensource projects continue to uphold their inherent principles and underground edge, they are nevertheless run by communities which fully understand their potential in terms of delivering commercial solutions. US company Boundless is a good example of this. The company provides comprehensive commercial support and maintenance for the world's most popular opensource GIS applications (including PostGIS, GeoServer, OpenLayers, QGIS) at the database, server, desktop, web, mobile and cloud levels. Fresh from winning a massive contract with the National Geospatial Agency (NGA), Andy Dearing, the CEO of Boundless explains: "We're entering a new geospatial era in which countless organisations, from agriculture to government, are turning to open source software for their location-based data. Whether they're motivated by freedom from vendor lock-in, or the massive increase in location data resulting from the Internet of Things, open source is increasingly becoming the answer for companies across a broad range of industries.

Opensource software offers modern geospatial professionals a platform that scales, both in technology performance and in price, and integrates with other systems through open and interoperable interfaces and standards."

GIS is now moving in new and exciting directions with the fields of big-data analytics and visualisation representing a major opportunity for geo-spatialists. In order to engage with these new fields, GIS is changing. The software is being augmented by a range of powerful new opensource online tools which help deliver deeper insights from data. GeoWave, for example, a tool which was initially developed by the NGA, is "an open-source library for storage, index, and search of multi-dimensional data on top of sorted key-value datastores and popular big data frameworks." Other emerging opensource projects include GeoTrellis, a geographic imagery and raster data processing engine for high-performance applications, and GeoMesa, an open-source, distributed, spatio-temporal database built on a number of distributed cloud data storage systems for use with a variety of data storage and retrieval systems.

Standards - The Secret Behind the Success of Opensource

Of course the popularity and success of the opensource movement would be nothing if it were not for the system of standards which have developed alongside it. Geospatial data interoperability standards, particularly those which have been developed by the OGC, have enabled opensource software to support a large number of geospatial data types and have contributed greatly to the development of Spatial Data Infrastructures (SDI) globally. The Java-based Geoserver software server is a good example of this. Widely considered the mapping equivalent to the opensource Apache HTTP Server, Geoserver publishes data to and from any major spatial data source (e.g. Google Earth, OpenLayers etc.) using open standards such as WMS and WFS.

Now that opensource is moving into the mainstream, the proprietary GIS software industry will most certainly experience some disruption - particularly as certain organisations attempt to attract customers to opensource (or at least hybrid) alternatives. Although this is a genuine possibility, it is important for the GIS community as a whole to remember that it still remains a niche field which is largely misunderstood by those operating outside of it. The most likely outlook for the industry is that as new markets for GIS tools and services start to emerge, both the opensource and proprietary communities will continue to co-exist and grow. Opensource GIS, for reasons such as cost, extensibility and openness will always be required. However, so too will proprietary software (in some form). After all, just as humans possess a natural need to form communities and collaborate, they also possess an urge to compete and to create products which are valued and acquired by others.

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