Participatory Free and Open Source GIS in the Web 2.0 - Exploring trends in GIS in times of Collaborative Creation.

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Abstract

The integration of Geospatial and Web technologies has enabled visualization and management of content in a new dimension: the rapidly evolving world of multi-dimensional (Geo-tagged) content generation and management. Open Source Geospatial (OSGeo) has gained success and strength by inheriting the favorable traits of openness and participation. Geospatial technologies are witnessing a "Wikification" trend with functionalities of mapping tools and "Geodata" contents, shifting from an "Expert Level" to a "People Level" mode. It is therefore, important to evaluate nature of these changes identifying trends that can contribute to the raising the awareness and to provide further democratization of these technologies. This paper will examine the development of these technologies and identify changes, in order to understand what are the major challenges for the future. The work will be focused on: a) Exploring the development of GIS tools through Web 2.0 and Wiki-based applications; b) Examining how these tools are being used in innovative ways to deliver and use spatial data effectively and c) Present relevant applications that are helping to shape a geographically rich future.

Keywords: Geospatial Trends, Free and Open Source Web GSTs, Ubiquitous GSTs, Location Aware Technologies

1. Introduction and Objectives

In the late 1990's when the Internet was becoming popular, "to browse the web" was to go on line to read text and view static images. That was however, a limited data sharing model. In the web of the 2000's, the use of the web for collaborative work has become increasingly popular. This form of collaborative framework is now denominated Web2.0.

Web 2.0 technology has opened up opportunities for the use of Geospatial Technologies (GSTs) taking advantage of these collaborative features. "Geospatial Technology" is a broad term that refers to Geographical Information Systems (GIS), Global Positioning Systems (GPS), and Remote Sensing (RS) and wireless communications, which are technologies that help users when collecting,

analyzing, and interpreting spatial data. GSTs as a field, enables other disciplines and sectors of the economy to improve profitability, productivity, and efficiency and also helps evaluating impacts on the ecosystems.

The Integration of Geospatial and Web technologies has enabled visualization and management of content in a new dimension as the Web offers an open platform for collaboration and participation in content and knowledge management. In the rapidly evolving world of multi-dimensional (Geo-tagged) content generation and management, Free and Open Source for Geospatial (FOSS4G) has gained success and strength by inheriting the favorable traits of openness and participation.

Geospatial technologies are witnessing a "Wikification" trend with functionalities of mapping tools such “GIS through WEB2.0” and Geodata contents. These developments are probably the most exciting since its creation and have generated a revolution in the nature of these technologies (Sui, 2008). It has caused a shift of mode in terms of development and creation from an "Expert Level" to "People Level". Therefore, it is important to evaluate nature of these changes so as to identify trends that can contribute to the raising the awareness and to provide further democratization of these technologies.

In order to raise the awareness of the GSTs it is critical to expand the use of these technologies. In an increasing way, Geospatial Technology is converging with information technology. In addition, web-based maps, such as Open Street Maps, Google Earth, MapQuest, Wikimapia, and MSN Virtual Earth, are communicating spatial information to the general public in levels not experienced before.

This paper is focused on: Exploring the how Free and Open Source GST have developed in Web 2.0 environments, Examining how these tools have been used in innovative ways to deliver and use spatial data effectively and exemplify relevant applications that are helping to shape a geospatially rich future.

2. Web 2.0 and FOSS for Geography

2.1. The Web 2.0

Enhancing creativity, information sharing and collaboration among users are terms which describe the Web 2.0. It is not only a trend in the use of the World Wide Web technology and web design, it is a revolution in the computer industry that has put the Internet as a platform for building applications that harness collective intelligence.

The Web 2.0 has transformed the internet into a platform, with software above the level of a single device (O'Reilly, 2005). It has leveraged the appearance of innovative business models such as the *Long Tail*[1] coined by companies like the Amazon.com and Ebay.com. This is architecture of participation where users can contribute to a website's content; it creates network effects enriching information sharing. Web 2.0 technologies foster innovation in the assembly of systems and sites. The Web has become a "Distributed Operating System", which allows developers from diverse backgrounds to build new applications by mixing and matching (Mash-ups) information in ways original designers had not considered before (Erle, 2006).

The Web 2.0 environment has enabled the emergence of an important phenomenon: a new production mechanism propelled by Open Source Collaboration. Open Source development and user communities have interacted with organizations and thus created a demand for spatial information which can provide tools that facilitate decision making in strategic planning processes (Michell, 2005). This is a world of multiple dimensions and geographic information is a tool that can help businesses, individuals and governments. This evolution has made geographical information become a part of everything and anywhere. Location is becoming as ubiquitous as time.

2.2. Maps and Web 2.0

The Web 2.0 has helped the creation and publishing of online maps making the process easier and more accessible to average users. Information technology has incorporated Geospatial information. Businesses can post maps for easier access to their offices. Governments can present maps showing demographical data by area for better understanding of the state's development. A city guide web site can use maps to show the location of restaurants, museums, and art venues.

Websites such as Google, Amazon and eBay have become platforms that support complex user systems (Erle, 2006). They have applied to their businesses, openly published APIs[2] which allow users to migrate within websites without a direct interaction between each other.

Developers who want to publish maps on the web often discover that commercial tools cost too much and hunting down the free tools scattered across Internet can use up too much of your time and resources. Web Mapping is a growing field that goes beyond collecting and analyzing GIS data, it is important to combine free geographic data, GPS, and data management tools into one resource for mapping information.

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[1] **Long Tail:** was a term first used by Chris Anderson in a Wired Magazine article to describe the business strategy of companies such as Amazon.com or Netflix. This model is based on the sale of a large number of unique items in relatively small quantities (http://www.wired.com/wired/archive/12.10/tail.html).

[2] **Application Programming Interface:** A set of functions that can be called from an application program to access features of another program. (http://www.studiodog.com/glossary_terms.html)

2.2. Trends in GSTs FOSS and Web 2.0

Trend 1: Cloud Computing

Cloud computing, refers to management of documents and business through online applications. Google is rapidly building user friendly platforms for on-demand applications on a worldwide scale. Not long from will Google Apps be an adequate solution for small business to solve document management and collaboration problems.

Google Maps is an example of an endeavor that has reached a considerable public. Baring in mind this, how will FOSS for GSTs presence be in relation to this.

Trend 2: Mash-ups

The year two thousand and seven was denominated as “the year of the widget” by Business Week magazine. Widgets are small embeddable components that can be integrated into third party sites and deliver content from beyond the realm of the original site. To help users create widgets, a growing number of companies have developed mash-up building tools.

Trend 3: Ubiquitous technologies

Ubiquitous Computing (UbiComp) is seen as one of the important trends in computing. It refers to distributed and mobile computer systems, which may cause the disappearance of the computer through a range of new devices and interaction possibilities. In Technology it is defined as a model beyond desktop computing that allows human-computer interaction integrated into everyday objects and activities. As opposed to the desktop in which a single user engages one device for a specialized purpose, someone "using" ubiquitous computing use many computational devices and systems simultaneously, in the course of ordinary activities.

Geospatial information and GSTs are becoming accessible in various new forms and through a wide range of applications as well as new classes of devices. As the technology develops it is important to discuss the potentials, problems and technical issues of emerging ubiquitous GI services.

Ubiquitous computing is an interdisciplinary field that requires input from communities both within the Geospatial community and from the broader field of ubiquitous computing. It is important to explore what are the possible contributions of these fields and how can they benefit from each other in order to build and utilize Ubiquitous GSTs.

Trend 4: Mobile and GSTs

Google is currently developing (community generated) Geospatial Applications for its mobile device platform, the Android. It is a software stack for mobile devices, it includes an operating system, middleware and key applications. Developers create applications for the platform using the Android Software Development Kit API. Applications use Java as the programming language and run on Dalvik, a custom virtual machine designed for embedded use running on a Linux kernel. For this Google launched the Android Developer Challenge, which provided USD $10 million in awards for mobile applications, built on the Android platform. During this competition, 50 applications were elected best within the first round, of those 22 applications (nearly half) involved Geospatial information.

Trend 5: Semantic Web

The Semantic Web is a trend in the World Wide Web in which information and services on the web are semantically defined, making it possible for the web to understand and satisfy the requests of people and machines to use the web content. The vision of the Semantic Web is to extend principles of the Web from documents to data. It means the creation of a common framework that allows data to be shared and reused across application, enterprise, and community boundaries, to be processed automatically by tools as well as manually, including revealing possible new relationships among pieces of data.

Semantics has an impotant role for interoperability. The idea of a Semantic Web proposes a web of data that can be processed and understood directly or indirectly by machines, bringing a higher degree of automation in exploiting data in a meaningful way. The future Semantic Geospatial web may be a situation where discovery, query, and consumption of geospatial content are based on formal semantic specification (Open Geospatial Consortium, 2008).

Trend 6: Argumented Reality

Augmented reality (AR) is an area of computer research which deals with the combination of real-world and computer-generated data. It represents a form of computer graphics that is displayed, usually with a headset in front of a user. At present, most AR research is concerned with the use of live video imagery which is digitally processed and "augmented" by the addition of computer-generated graphics.

AR can have many utilities, such as viewing the location of an airstrip while looking down from an airplane in the dark or viewing names of places in a tourist location (Mitchell, 2004). AR has strong ties to geospatial information it could serve important purposes a number of industries that use GSTs.

3. Methodology

This research is essentially a technology foresight study, adopting a data analysis method with bibliographical research techniques as to produce a synopsis of the current state of the critical issues concerning Web-based Geospatial Technologies and foresee what will be the key aspects will be part of the future of FOSS4G. The main objective of this research is to study the trends which are shaping the future of FOSS GSTs and as to do so the approach used in this endeavor consists of a Technology Assessment tool called The Delphi Method.

The Delphi is a robust research methodology with a substantial literature to support it. The Delphi approach involves identifying experts and obtaining their views anonymously. This provides qualitative and quantitative information on expert views. This is done as to build a description of what FOSS GSTs will look like in the future, beyond Web 2.0. This approach consists of three phases:

1. Collection of an initial set data through bibliographical research
2. A Delphi study applied on Geospatial Technology Experts
3. Application and verification of results

The Delphi exercise will involve a wide-ranging consensus-building exercise with a panel of experts including academics, practitioners and organizations providing services for or representing users of Free and Open Source Geospatial Software. Focusing especially on Free and Open Source Geospatial, this will be done by consulting with key stakeholders about what works in the FOSS Geospatial Software Industry and its development in WEB 2.0 environments.

This research with the panel of experts will consist of 3 rounds. In Round One experts will be sent a list of open ended questions designed to gain their views about the key issues relevant to their area of expertise. The responses are analyzed, summarized. The Analysis of round 1 will then be fed back anonymously to the group of experts for further comment. Using a rating scale, experts will be asked to rank their level of agreement with the issues identified in Round One.

From the results obtained from round 1 a new questionnaire will be formulated, building Round 2 of the Delphi exercise. The experts will be sent a new list of questions designed to gain their views about the key issues relevant to their area of expertise. Then responses will be analyzed and summarized. Again, the answers from round 2 will be fed back anonymously to the group of experts for further comment.

Finally in Round 3 results will be synthesized and circulated for the last time aiming towards a consensus. This will be the round in which convergences will be found in the answers obtained from the experts and they will be asked to rank their level of agreement with the issues identified all the rounds. Aiming towards conclusion from all the panels taken beforehand.

5. Conclusions

The Web faces many evolutions; the present trends in community content generation and management have given space to a variety of new endeavors for the GSTs. Free and Open Source Geospatial (FOSS4G) have also gained presence and strength in this environment of collective innovation through openness and participation. Geospatial and Web technology integration has enabled management of content in a new dimension: Geospatial technologies are witnessing new trends, accompanying current web trends such as Ubiquitous computing, Augmented Reality, Mash-ups, Cloud Computing and etc. It is important to evaluate nature of these changes identifying trends that can contribute to the raising the awareness and to provide further democratization of Geospatial Technologies. This paper aimed to examine these technologies and identify changes, in order to understand what the major challenges are for the future of GSTs. However, it is still early in the process of the research to take conclusions about what in fact lays ahead for FOSS4G. Therefore, the Delphi Method is used here as a means to obtain the views of experts in GSTs as to provide qualitative and quantitative information on the future of GSTs, beyond Web 2.0.

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