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Web 2.0 and GIS: between sinergy effects and oxymoron

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Summary

The growth of new information and communication technologies on the Internet infrastructure is rapidly changing our ways of living. Those new technologies are finding new concepts, ideas and usage all the time. Among them, Web 2.0 is the one that is dominating worldwide among the users in last few years. The other one called GIS is a technology with the respectable history, but the penetration of this concept finds more place also in this period. In this paper author analyzes the potential of GIS in Web 2.0 model environment.

Key words

Web 2.0, GIS.

1. Introduction

The landscape of Internet mapping technologies has changed dramatically since 2005, where new techniques are being used and a whole range of Web sites, communities and applications have emerged (Von Hippel, 2005, p. 25). Potentially, every Web page is a latent community in the future (Shirky, 2008, p. 102). Among new types of Web-based applications we can see that Web-based software products offer strong mechanisms for sharing the information with other users. The main idea for these applications could be found in network effect, the rule which says that a property of a system become more valuable to everybody when more people uses it (Shapiro & Varian, 1998, p. 245). In the core of these new solutions called Web 2.0 we can find social network services, whose focus is the idea of building online communities with people who share interests and activities, or who like to explore interests and activities of the others (Benkler, 2006, p. 72).

The other strong ICT trend is connected with extensive information and resource access and filtering, where very important components are Geographic Information Systems (GIS), Global Positioning Systems (GPS), and Remote Sensing (RS). In the back of these acronyms we find a set of new protocols and tools that are used in innovative ways to deliver and use spatial data effectively.

In this paper authors are analyzing the potential of GIS in Web 2.0 model environment.

2. Web 2.0 concepts

Dale Dougherty and Tim O'Reilly coined the term 'Web 2.0', which is often applied to a heterogeneous mix of relatively familiar and also very emergent technologies, with the idea of harnessing the collective intelligence of crowds to give information a value (O'Reilly, 2007, p. 23). According to the same author, Web 2.0 is the business revolution in the computer industry caused by the move to the Internet as platform, and an attempt to understand the rules for success on that new platform. This new term is far less important than the concepts, projects, and practices included in its scope (Alexander, 2006, p. 33). Although this term suggests a new version of the Web, it does not refer to an update to any technical specifications, but rather to cumulative changes in the ways software developers and end-users utilize the Web. It is more the attempt to conceptualize the significance of a set of outcomes that are enabled by those Web technologies (Anderson, 2007, p. 5).

Web 2.0 is not simply a new technology, although it takes advantages of new protocols and applications, but it is still possible to create a Web 2.0 site by using technologies like HTML JavaScript, while the industry standard technology is AJAX, a method that allows minimal data exchange with servers with Asynchronous JavaScript and XML in the back. Ajax allows development of interactive and responsive Web applications, where each Web page can asynchronously send and receive responses to multiple XML requests, which are dynamically updating the page's content. Thus we have users

who are responsible for contents, as it is presented in Figure 1.

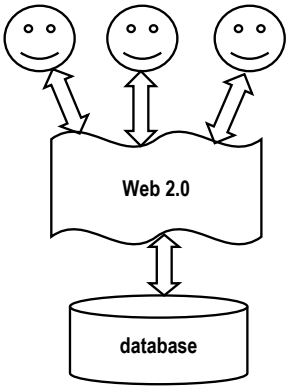

Figure 1 Creation and usage of Web 2.0 contents

Earlier ICTs usually required expensive and lengthy implementations, as well as the realignment of formal business processes. These new tools with the Web 2.0 models in the core are different, they are inherently disruptive and often challenge an organization and its culture, but they are not technically complex to implement.

The content sections of the Web in this new concept make a breakaway from the page metaphor, where users are developing contents, often collaboratively and often open to the world, making this openness crucial for whole concept. Main Web 2.0 concepts - microcontent and openness combine into a larger conceptual strand which sees users as playing more of a foundational role. Miller describes main Web 2.0 principles (Miller, 2005, p. 3):

- freeing of data: allowing it to be exposed, discovered and manipulated in a variety of ways distinct from the purpose of the application originally used to gain access,
- building of virtual applications: drawing data and functionality from a number of different sources as appropriate,
- open participation: while traditional Web has tended to be somewhat one-sided with a flow of content from provider to viewer, Web 2.0 applications are spotting the value of user-generated content,
- work for the user: applications are able to locate and assemble content that meets our needs as users,
- applications are modular: developers and users are able to pick and choose from a set of interoperating components in order to build something that meets their needs,
- sharing: code, content, and ideas in new business models collaborating on the platforms by adding value over that which was built together with the other users,
- communication and facilitating community: on the two-way environment which was made to make easy to contribute as it did to view,
- remix: references and calls upon the service, documents or snippets that we require, incorporating it into something new,
- smart: applications use our knowledge, where we have been and what we are doing to deliver services that meet our needs,
- long tail: cost-effective services with the interests of large numbers of small groups of individuals that will enable them to benefit from the platform while fulfilling their own needs, and
- trust: placed in individuals, assertions, or in the uses and reuses of data.

Many important concepts don't have a hard boundary, but rather, a gravitational core. In the case of Web 2.0, we can find a set of principles and practices that tie together with the Web as a platform for those solutions. Social software has emerged as a major component of the Web 2.0 movement, whose main solutions include wikis, blogs, RSS (Really Simple Syndication), social networks, information tagging, trackback, prediction markets, podcasts, and mash-ups. Their main idea is about social networking, not necessarily profit, while the focus is on connecting people, not computers.

As the origin of Web 2.0 solutions, Google began its life as a native Web application. It was never sold, but delivered as a service, with customers paying, directly or indirectly, for the use of that service. In the back, Google requires database management, because it isn't just a collection of software tools, it's a specialized database. Like a phone call, Google finds the space for the functionality and data between browser and search engine on one side, and destination content server on the other side. Among the most popular social network services we can find Facebook and MySpace, microblogging platform Twitter, multimedia sites YouTube, Flickr, and BitTorrent, and online encyclopedia Wikipedia. We can see how the popularity of this concept in the next few numbers: Facebook has more than 250 million of active users with more than 1 billion of photos uploaded to the site each month, MySpace has more than 60 million of users only in the USA, Twitter exchange more than 3 million of messages

each day, every minute ten hours of video are uploaded to YouTube, more than 200 million of blogs exist on TypePad, BitTorrent has over 160 million clients worldwide, Flickr manage more than 3.6 billion of images, and Wikipedia holds more than 10 million of articles in 27 languages.

Boulos and Wheeler present Web 2.0 sociable technologies and social software as enablers in health and health care for organizations, clinicians, patients and laypersons (Boulos & Wheeler, 2006, p. 2), while Breakenridge analyze the usage of Web 2.0 in public relations domain (Breakenridge, 2008, p. 2008). In geography, these new applications represent a step change in the evolution of the area of Internet geographic applications, termed the GeoWeb (Haklay, Singleton, & Parker, 2008, p. 2012).

3. Main facts about GIS

Geographic information system (GIS) is a technological tool which connects geography and people's relationship with locations, which comprehend geography and helps in process of making new intelligent decisions (DeMers, 2008, p. 5). GIS is not a new tool, it has been present in different forms for a long time. Looking from the management perspective, GIS are information systems that deal with spatial or spatially related information, tied to a specific area of the earth. This term is connected to any information system which integrates, stores, edits, analyzes, shares, and displays geographic information (Longley, Goodchild, Maguire, & Rhind, 2005, p. 106). GIS refers to the software that is used to examine, display and analyze data with regard to its location on the earth. GIS also means computer system for the collection, storage, manipulation, display and management of spatial information and computer representations of some aspect of the real world (Heywood, Cornelius, & Carver, 2006, p. 32). Speed and interoperability are important aspects in the exchange process of large geospatial data sets.

GIS can be viewed in three ways – as a unique kind of geographic database of the world based on a structured information that describes the world in geographic terms, a set of intelligent maps and other views that show features and feature relationships on the earth's surface, and a set of information transformation tools that derive new geographic datasets from the existing with the functionality that take information from existing datasets, apply analytic functions, and write results into new derived datasets. The main part of GIS functionality include mapping software and its application to remote sensing, land surveying, aerial photography, mathematics, photogrammetry, geography, and tools that can be implemented with GIS software (Sherman, 2008, p. 31).

Geographic information used by GIS can be accessed, transferred, transformed, overlaid, processed and displayed using numerous software applications, where the typical tasks usually are: viewing, exploring, creating, editing and storing data, integration of datasets from different sources, transformation of data into different systems, data querying and analyzing and creation of maps from those data (Heywood, Cornelius, & Carver, 2006, p. 26). A good GIS application has to be able not only to create a certain type of map, but also to process geographic data from a variety of sources and integrate them into a map. GIS maps are always interactive. After that, map users can scan a map in any direction, zoom in or out, and change the nature of the information contained in the map.

The geodatabase is the common data storage and management framework for GIS, which combines spatial data with data repository in order to create a central data repository for spatial data storage and management. The primary requirement for the source data consists of knowing the locations for the variables (annotated by its coordinates), but it can also convert existing digital information into recognizable and useful forms. GIS data represents real world objects in the form of digital data, divided into two abstractions: discrete objects and continuous fields. There are two broad methods used to store that data: raster (digital image represented in grids) and vector (geometrical shapes). Relations between GIS objects are analyzed by the topology methods, a set of rules which define the geometric relationship between objects located in space, represented by points, lines and polygons. There are 3 main topology constraints: adjacency, containment, and connectivity, where first 2 constraints describe geometric relationships between area features, while the third describe linkages between line features. Software applications for GIS can recognize and analyze the spatial relationships that exist within digitally stored spatial data, allowing complex functions of spatial modeling and analysis. The majority of modern cartography is usually done using a GIS database and software solutions, but the creation of database is the expert function, as it is presented on figure 2.

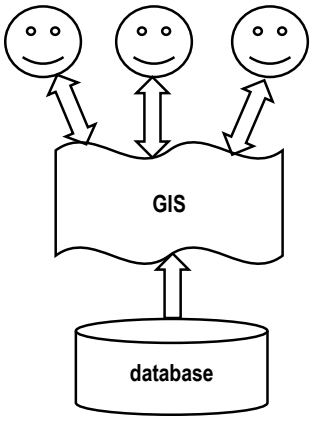

Figure 2 Usage of GIS

GIS industry standards are developed by Open Geospatial Consortium (OGC), which has undertaken multi-phase OGC Web Services (OWS) initiative to specify and standardize geospatial Web services and architecture. First results of this initiative are Geography Markup Language (GML) for vector geographic data and numerous Web services: Web Map Service (WMS), Web Feature Service (WFS), and Web Coverage Service (WCS).

Today we can find different directions for the development of geographic information systems and other visualization tools for helping users in numerous settings from recreational to educational to medical. An important characteristic of GIS is the fact that users can choose the elements for which they want the information in the GIS map: topography, land use, vegetation, roads and other different objects are stored separately and each of them can be chosen for the presentation in map. GIS analysis and modeling are crucial for solving the critical problems of our time such as use of energy, sustainability of natural resources, global climate change, improvement of efficiency across the globe and equitable planning of new cities and transportation systems. The introduction of Google Map in February of 2005 had a major impact not only on spatial map services but on the entire geospatial industry. Google Map's appeal, ease, world coverage, and free cost moved it to immediate prominence and opened a new geospatial era for public consumers (Pick, 2008, p. 142).

4. Bringing GIS to the Web 2.0 environment

According to O'Reilly, Web 2.0 is developed about the idea of harnessing the collective intelligence of crowds to give information more value. Social networking keeps the pace of new development advancing, where the Web 2.0 technologies are developing rapidly and the mapping is in the focus of interest in these days. The proliferation of Google Maps and Virtual Earth has created demand in the GIS community for more user-friendly applications. Google Maps ushered in Web 2.0 and mapping remains of primary interest in the Web 2.0 movement. Tiled mapping, map themes (road, aerial, hybrid, etc) and integrated search provide benefits to GIS application users, using consumer mapping services and Web 2.0 user interfaces to deliver GIS applications, targeting end-user audiences instead of professionals. These kinds of solutions have some challenges: there is a limit to the number of points of interest or shapes, while tile overlays can be slow when they are rendered dynamically.

GIS is not a new technology, but for many years the software and applications were complex, and its use if was extremely difficult. But the Web 2.0 changes that situation. In this new, totally open environment GIS can be incorporated and mastered almost by everyone. As GIS is more than just an electronic map, it allows the display of information in a space and time format, with the features that can interact with Wikis, blogs, Web pages, and other Web 2.0 concepts. Web 2.0 and GIS offer new kind of the community.

Wiki map is a Web site which contains a map that is editable by anyone, where users can go into the map and add information about geographic places and features that they find relevant, including images, Web links, comments, or edit entries of the others, and add comments. There is a huge space of possibilities what features can be added to this kind of maps.

Incorporation of GIS display tools into Web sites and blogs is also an interesting part of GIS new roles. Maps can be easily added to the blogs or Web sites, displaying where everyone who visits the blog or Web site is coming from.

Although Web 2.0 and GIS together are finding a lot of synergetic effects, there are some problems that are coming on the surface from the nature of these technologies. The model of Web 2.0 technologies, based on the "harnessing the collective intelligence", brings a lot of data to the GIS database. Those data has to be checked and confirmed, placed on the right places and properly commented. That process of validation, when millions of information is coming every day, is not easy to organize. Any wrong information can make

an opposite effect to their consumer. Care about the precise contents of GIS is very important, what is not compatible with the nature of Web 2.0, as it is presented on Figure 3. Good solution of this problem will help to the proper use of them in this excellent combination.

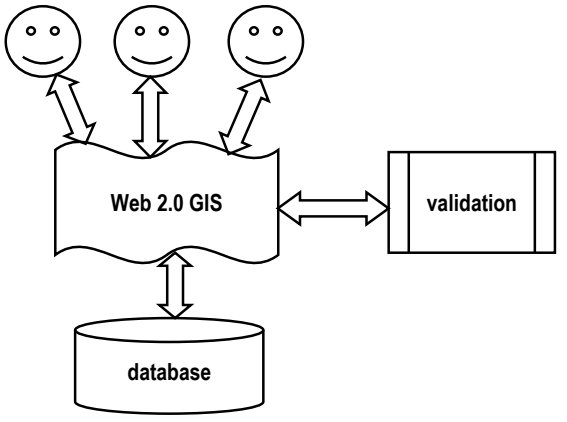

Figure 3 Web 2.0 GIS procedures

The large amounts of collected user data and procedures for creation of user generated contents which are aggregated by Web applications will not stop on this level. As people explore new ideas the scale of this will grow when more people come online and existing users increase their use of Web 2.0 services. The production processes for generation of these online contents will become more sophisticated with the advent of increasingly powerful and easy-to-use software and digital devices. In the GIS environment there are no limits for the content amounts, while the question of their quality is becoming an important topic.

As a kind of final conclusion of this research, we can find that we found significant synergetic effects of GIS usage in Web 2.0 environment, but the expectations of new sophisticated procedures of their validation will help to overcome the problems that are coming from the their nature.

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