The GeoWeb: Spatially Enabling the Next-Generation Web

An ESRI® White Paper • April 2006

ESRI 380 New York St., Redlands, CA 92373-8100, USA • TEL 909-793-2853 • FAX 909-793-5953 • E-MAIL info@esri.com • WEB www.esri.com

The GeoWeb: Spatially Enabling the Next-Generation Web

An ESRI White Paper

Contents **Page**

The GeoWeb: Spatially Enabling the Next-Generation Web

As we in the geoinformation community move into 2006, a new age in our industry has already begun. Over the last two years, both consumer and commercial awareness of geospatial abilities and applicability has increased exponentially, catching up with, if not exceeding, governmental awareness and valuation of geoinformation. Geoinformation represents the use of geographic information to provide context for discussion, analysis, and decision making. Hardly a newscast, podcast, blog, newspaper, or Web site has not touched on, in one form or another, the use of geoinformation over the last year. Whether it is the direct use of 3D map visualizations in newscasts; map mashups in personal Web sites; or the furthering of discussion regarding phenomenal interest and implications of using maps to visualize our respective lives, communities, and organizations, the geoinformation industry has never had this much of a spotlight.

Many new businesses have recently generated buzz because of their unparalleled commercial investments in geoinformation content and infrastructure. Governments also continue to make investments in geoinformation a priority; witness the rapidly evolving standards from the Open Geospatial Consortium, expanding activities on defining a global spatial data infrastructure (SDI), and national SDI initiatives in Europe and North America. These initiatives show that both business and government understand the critical value of geoinformation.

It appears that the first steps of an industry transformation have begun, a transformation that will profoundly and permanently change how the geoinformation industry will operate as our work becomes an integrated part of the Web—the GeoWeb.

Industry Transformations

Tim O'Reilly of O'Reilly Publishing defines the current evolutionary state of the Internet as "the Web 2.0." Through a series of examples, O'Reilly illustrates the changes that have transformed Web 1.0 into Web 2.0 (http://www.oreillynet.com/lpt/a/6228). For instance, in the Web 1.0 world, people created personal Web sites. In the Web 2.0 world, people are now blogging. These blogs, or weblogs, represent journals that can be updated easily, and readers can also leave comments on these blogs. Shown below is a comparison of Web 1.0 and Web 2.0 World Wide Web features.

World Wide Web

Web 1.0	Web 2.0
Personal Web sites	Blogging
Domain name speculation	Search engine optimization
Page views	Cost per click
Screen scraping	Web services
Publishing	Participation
Content management systems	Wikis
Directories (taxonomy)	Tagging ("folksonomy")
Stickiness	Syndication

Similarly, the transformation of geoinformation on the Web can be illustrated by comparing first generation versus second generation geoinformation Web capabilities.

Geoinformation

Web 1.0	Web 2.0
Find your location	Know your location
Search for what is near you	Know what is near you
Get directions	Navigate to a location

The transformation from Geoinformation 1.0 to Geoinformation 2.0 was a question of find versus know. In the Geoinformation 1.0 world, users needed to find, or specify, their location. Geoinformation 1.0 devices and applications have a limited way of interacting with geography. For example, a user would enter an address, then ask the application to find all the restaurants nearest that address. But in many instances, finding an exact address is not practical. For example, restaurant addresses will not be useful to a sales representative who is on business in an unfamiliar town and looking for a place to eat.

In the Geoinformation 2.0 world, mobile devices and their associated applications use geoinformation in a dynamic manner. The device automatically "knows" where it is, what direction it is traveling, and how fast it is moving. Geoinformation 2.0 applications are able to use this information to determine where the device has been over a period of time, and this information can be used to analyze trends on a geographic timescale. In the past, Geoinformation 1.0 applications relied on users knowing their current location or knowing an address as a starting point for getting directions. Geoinformation 2.0 applications have changed the paradigm, and now these applications can be tasked to dynamically describe semantic relationships relative to a location, area, and time.

Using the traveling sales representative example, the cell phone will know where it is, and a route can be automatically generated to a restaurant.

GeoWeb: Definition and Critical Elements

What is the GeoWeb, and how is it transforming the geoinformation industry? The GeoWeb is continuously available geoinformation content (e.g., spatial data, functions, and location-aware devices/sensors) and geospatial capabilities accessed through a services-based interface. These GeoWeb-based services, or geoservices, are becoming a part of the fabric of the Web—the GeoWeb. Map mashups are evidence of the GeoWeb as are applications such as friend/buddy finders and E-911 locators in the wireless world. Mashups are applications within Web sites that enable content from multiple sources to be combined in a way that is seamless to the user. These are a few examples but more show up every day.

Geoinformation, in the form of semantic relationships, can be shared with other systems that know how to apply this knowledge. The implications are especially important for industries that rely on geoinformation trends such as retail and real estate, transportation industries, and emergency services. Retail and real estate companies will be able to build applications that know, to a greater level of accuracy, where people travel with a purpose of siting new stores, building new houses, or bringing in new customers using location-aware advertising. Traffic management organizations will be better able to understand traffic patterns over time. This information can be used in studies to better design roadways and other traffic management systems such as public transportation. Emergency service organizations will be able to better pinpoint a mobile caller's physical address and even locate an emergency cell phone caller in a specific room in a building.

The GeoWeb transformation is not happening all at once. There are three critical elements that support the transformation: geocommunities, location presence, and sensors. Supporting the formation of these critical elements are "technology enablers," or catalysts, whose availability and maturity will affect the formation of the GeoWeb's critical elements and rate of transformation.

Geocommunities

The concept of digital communities has been a phenomenon on the Web for many years. As geography affects the definition of real communities, geoinformation is being used to define geocommunities on the Web.

Newly formed Web companies such as Platial.com are building Web sites that allow users to form digital communities focused on specific areas of interest such as open-air theater, dog-friendly parks, or good mountain biking trails. Like-minded individuals can then use the site to search and find geotagged locations within these digital communities using geographic, keyword, or attribute searches. Users can also choose to join a community of interest focused on a specific geographic area or aspect.

Likewise, the geoinformation industry is using similar techniques to great effect. Geodata.gov, the U.S. government's geoinformation clearinghouse, has built a marketplace function into its portal that allows its users and publishers to collaborate on data acquisition activities. Users of the portal can register their interest in data acquisition activities for a specific geography. As data acquisition events are published, interested users are contacted automatically via e-mail to participate and support the acquisition.

These two examples are only the beginning of the use of digital geocommunities in both commercial and governmental sectors. As geocommunity applications grow in use, so will the need for more accurate geoinformation and functionality.

Location Presence

The ability to pinpoint the location of places and things is rapidly becoming an important commodity. Increasingly, one location is being associated with many identities based on specific community interests. For example, coffee shops with WI-FI connections will be tagged as locations where coffee is served as well as where WI-FI is available.

The ability to locate mobile devices is getting better. This is important in a Geoinformation 2.0 world because pinpointing the locations of nearby places and things is dependent on the ability to accurately locate a mobile device. By the close of 2005, U.S. wireless operators must be compliant with E-911 regulations requiring them to be able to locate wireless handsets within 150 meters, or approximately 492 feet for

95 percent of all calls. However, current wireless infrastructure is only marginally effective in meeting these requirements for a variety of reasons.

GPS capabilities are helping overcome these limitations through miniaturization at a level where it can be included in cell phones. Also, new technologies such as TV-GPS are being developed that overcome the limitations of GPS to locate devices inside a structure. The standard GPS everyone is familiar with was designed for use in wide-open areas, and using GPS to accurately determine locations indoors is practically impossible. TV-GPS uses commercial TV signals, which were designed to be received indoors, to provide reliable location positioning inside buildings and structures.

U.S. wireless operators have increased their efforts to deliver efficient device location services as they come to understand that these will be as valuable as the dial tone they now deliver. And, as these services become more accurate, location presence will become a reality.

Sensors

The third critical element of the GeoWeb involves the syndication of both static and temporal knowledge about places and things. This means information will be collected about places through a wide range of sensors and sensor networks that selectively and continuously stream syndicated information about a location to the Web.

The publishing of raw information of many types on the Web could result in information overload or information noise. A filter is needed to provide selective streaming of syndicated information. This filter is semantic context. Semantic context is described by three prime criteria: time, location, and interest. Time is already present in systems or easily accessed. Location will be provided by location-aware devices and network-based infrastructure. The third element, interest, will be provided by selected community/ geocommunity orientation.

Systems using the GeoWeb will evaluate a user's local time, location, and interests to distribute/push selective services to the user. These systems will not wait to be interacted with but, based on their intended function, will be capable of pushing information and services appropriate to the user's current semantic context.

GeoWeb Impacts

The impact of GeoWeb will be seen in many systems including personal, retail, health, business, and governance systems. It will allow individuals and organizations using any connected application or device to have access to built-in location semantics and geoservices. These capabilities will enrich, enhance, and accelerate both personal experiences as well as business processes. GeoWeb capabilities will be delivered and utilized via any device connected to the Web.

The following is an example use case that has many possible applications.

Use Case

Notification of location or proximity to specific services, relationships, and events

Potential Applications

- Coffee shop geoservice—This application notifies users when they are within one mile of a specific type of coffee shop.

Benefits to coffee shop establishments include increased customer awareness, sales, and advanced notification of special sales that are time based.

- Buddy finder geoservice—This application notifies users when they are near people with similar interests.

  Benefits include making it easier to meet people with similar interests.

- Local bus tracker geoservice—If a user is within one mile of a bus stop, this geoservice will automatically notify the user when the next bus will be arriving.

  Benefits for the user include more accurate arrival time predictions that factor in traffic patterns and weather conditions.

- E-911 cell phone tracker geoservice—This application provides accurate geospatial location services specifically for the purpose of locating mobile users who are reporting an emergency.

  Benefits include faster emergency services response times, especially for incidents within office buildings and other multiperson/unit dwellings.

Each of the applications in this use case will be available on demand and also as a continuous feed of time-based information related to where, when, and what a user is doing.

Implications for the Geoinformation Community

What are the implications of the GeoWeb for the geoinformation community? The prime enabler for the GeoWeb to fully evolve will be ubiquitous, current, accurate, complete, and standardized geoinformation. The degree to which we in the geoinformation community are successful in delivering geoinformation that meets these criteria is the degree to which the GeoWeb will be realized. The more successful we are in delivering geoinformation, the more successful applications will be built, and the more GeoWeb will become a part of the fabric of the World Wide Web.

For more than 35 years, ESRI has been helping people manage and analyze geographic information. ESRI offers a framework for implementing GIS technology in any organization with a seamless link from personal GIS on the desktop to enterprise-wide GIS client/server and data management systems. ESRI GIS solutions are flexible and can be customized to meet the needs of our users. ESRI is a full-service GIS company, ready to help you begin, grow, and build success with GIS.

Corporate

ESRI
380 New York Street
Redlands, California
92373-8100, USA
Telephone: 909-793-2853
Fax: 909-793-5953

For more information on ESRI, call

1-800-447-9778

(1-800-GIS-XPRT)

or contact an ESRI value-added reseller near you.

Send e-mail inquiries to

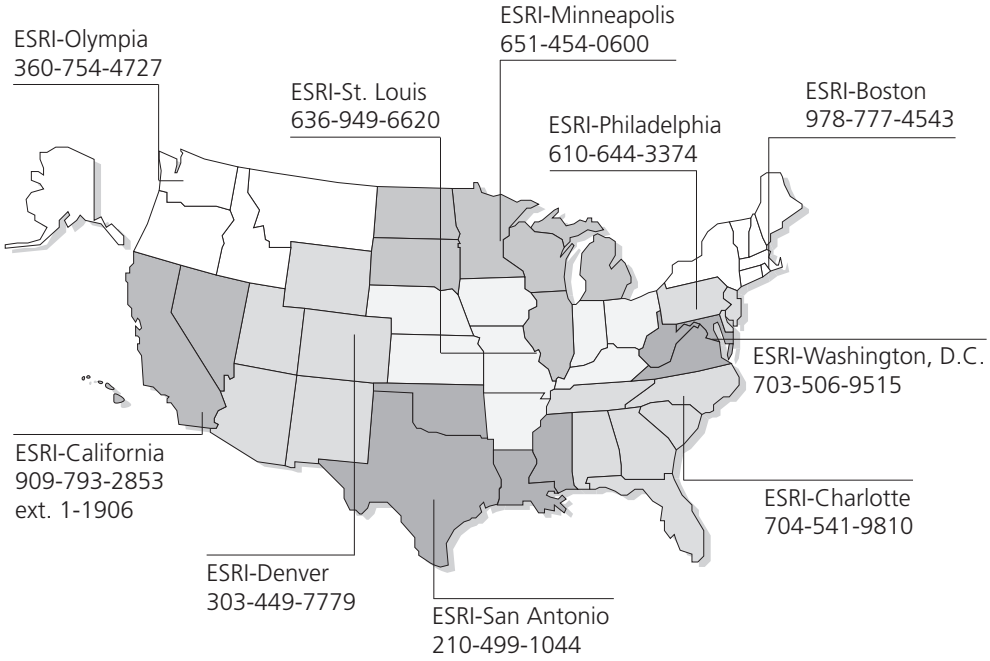
info@esri.com

Visit ESRI's Web site at

www.esri.com

Outside the United States, contact your local ESRI distributor. For the number of your distributor, call ESRI at 909-793-2853, ext. 1-1235, or visit our Web site at **www.esri.com/distributors**

Regional Offices



International Offices

Australia
www.esriaustralia.com.au

Belgium/Luxembourg
www.esribelux.com

Bulgaria
www.esribulgaria.com

Canada
www.esricanada.com

China (Beijing)
www.esrichina-bj.cn

China (Hong Kong)
www.esrichina-hk.com

Finland
www.esri-finland.com

France
www.esrifrance.fr

Germany/Switzerland
www.esri-germany.de
www.esri-suisse.ch

Hungary
www.esrihu.hu

India
www.esriindia.com

Indonesia/Malaysia
62-21-527-1023
603-7874-9930

Italy
www.esriitalia.it

Japan
www.esrij.com

Korea
www.esrikr.co.kr

Netherlands
www.esrinl.com

Poland
www.esripolska.com.pl

Portugal
www.esri-portugal.pt

Romania
www.esriro.ro

Singapore
www.esrisa.com

Spain
www.esri-es.com

Sweden
www.esri-sweden.com

Thailand
www.esrith.com

United Kingdom
www.esriuk.com

Venezuela
www.esriven.com

Place ESRI business partner or distributor address here.

GSA Federal Supply Schedule
No. GS-35F-5086H

3/06dh

Printed in USA