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Kentucky's Geography Network:
"Sharing GIS data with the people"

Executive Summary

Geographic information wants to be set free…and in Kentucky, that's just what we're doing! After years of research and data collection by various governmental agencies, GIS data is now available to the masses, and not just for those with a robust high-powered workstation, but to anyone with a browser and the ability to follow a simple set of instructions.

In June of 2002, the Commonwealth of Kentucky unveiled the Kentucky Geography Network (KYGEONET) (http://kygeonet.state.ky.us/), a dynamic website devoted to enhancing the appreciation and understanding of the Commonwealth's unique geography through the use of internet mapping. An ever-growing collection of static map images, internet mapping applications, and downloadable data for cartographic and analytical use with Geographic Information System (GIS) Software can be accessed via the site. KYGEONET brings together access to numerous sets of geographic data in a way that effectively multiplies their individual value by the ease with which the user can combine information to investigate new interactions. Users can search for maps and information by entering a city, county, or even a commonplace name, or by simply using a tool to outline an area of interest on the map of Kentucky. The ability to browse categories such as boundaries, geophysical, fish & wildlife, utilities, and transportation, coupled with pull-down lists that permit the user to limit searches based on content type, content theme, and keywords make it a powerful geographic search utility. Kentucky's citizens, students, teachers, engineering community, land surveyors, GIS professionals, and anyone who loves maps and the Commonwealth have been fascinated with the site.

Kentucky is one of only a few states that has worked to develop and make this type of website and associated tools available to the public. The Commonwealth is also a member of the Geography Network (GN) (http://www.geographynetwork.com/), a website created and hosted by a joint partnership between Environmental Research Systems Institute (ESRI) (http://www.esri.com/) and Sun Microsystems, Inc. (http://www.sun.com/). The Geography Network (GN) maintains maps and information regarding the entire planet. Kentucky has been the featured site on the GN and the KYGEONET was exhibited in the plenary session at ESRI's Annual GIS Conference.

The KYGEONET is a collaborative effort between the Governor's Office for Technology, Kentucky Natural Resources and Environmental Protection Cabinet, Kentucky Infrastructure Authority, Kentucky Geological Survey, and the Office for Geographic Information to build and stock a clearinghouse of Kentucky's rich and growing inventory of geographic data. A variety of state agencies, including the Kentucky Transportation Cabinet, Louisville/Jefferson County Information Consortium, and the Department for Fish & Wildlife Resources, have published to the KYGEONET and several other entities have pledged to participate as well. All Kentucky universities, colleges, and primary and secondary education providers, cities, counties, and their associated agencies have been invited to publish any map-based geographic information that they may have regarding Kentucky.

Project Description

Geographic information system technology is typically a complex and powerful set of tools, and it is often only available to specialist. KYGEONET "shares data with the people" by providing a simple easy to use interface that provides robust functionality.

For several years, the Commonwealth of Kentucky has benefited from its wide variety of geospatial datasets and an active GIS community that shares, utilizes, and maintains the data for the benefit of all users. The vast majority of these datasets are accessible through websites created by the Kentucky Office of Geographic Information (KYOGI), Kentucky Geological Survey (KGS), Kentucky Infrastructure Authority (KIA), and the Kentucky Natural Resource & Environmental Protection Cabinet (NREPC). However, none of these websites maintain all the data resources nor do they offer keyword or geographic search capabilities. There was a great need to make this wealth of data more accessible to the Kentucky GIS, engineering, planning, and research communities, while at the same time, providing public-access to the Commonwealth's citizens.

Over the past few years there were many meetings held and proposals tendered regarding the establishment of a Kentucky geospatial data clearinghouse but it seemed that these options were resource intensive, not dynamic, and offered little in terms of user experience. Seeing the need to make the clearinghouse a reality, in April of 2002, representatives from the Governor's Office for Technology and the Kentucky Geographic Information Advisory Council (GIAC) invited a core group consisting of KYOGI, KGS, KIA, and NREPC to the table to discuss what it would take to develop a GIS clearinghouse. It was then decided collectively that the newly available Metadata Services should be leveraged. Several state agencies in Kentucky were already actively maintaining metadata for the geospatial data available on the web, and much of this was being done with ESRI's ArcCatalog or other FGDC compliant metadata tools. Additionally, it was noted that several ArcIMS services were in production and a wide array of static map images were already being distributed via the web. Bringing all of this rich content together under one Metadata Service was the vision and out of this vision was born the Kentucky Geography Network (KYGEONET).

With assistance from ESRI, and a collaborative effort from Kentucky participants, an introductory webpage (http://kygeonet.state.ky.us/) was designed to greet the user and provide a front-end to the metadata explorer web page
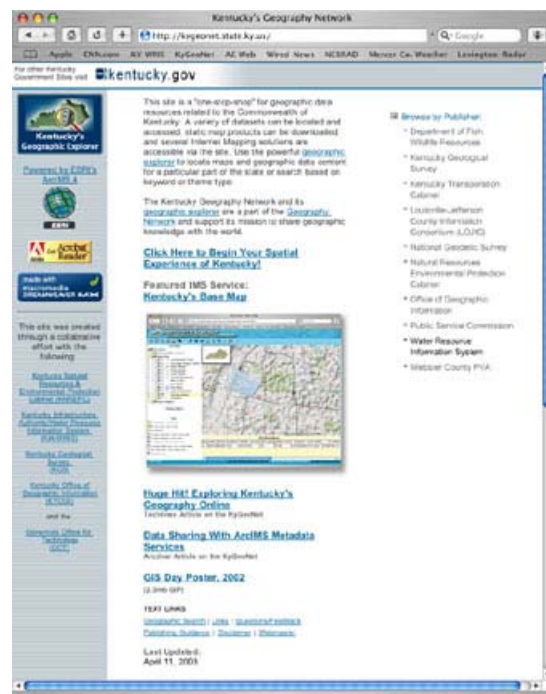
(http://kygeonet.state.ky.us/metadataexplorer/). In May 2002, ESRI's staff assisted in setting up the metadata explorer Java Server Page (JSP) application and customized the gazetter service specifically for Kentucky and upon completion, the service was put into production.
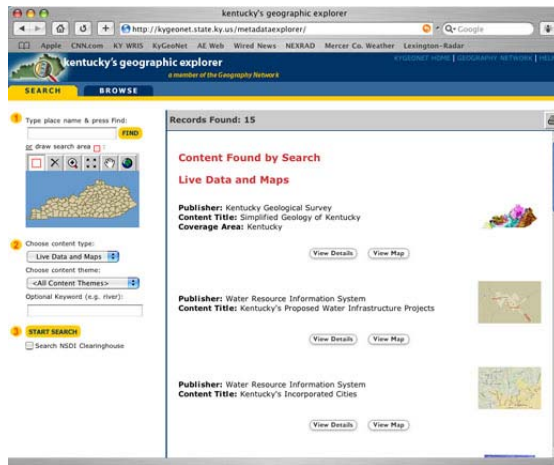
Because of its flexibility and ease of use, within 4 hours there were 12 items published to the service, 4 ArcIMS services and their associated HTML Viewers and 8 downloadable datasets. By the end of the following week, 44 items were available and several state, regional and local agencies had committed to becoming publishers. By mid-July 2002, over 70 items were available, including a growing number of static map images. This wealth of geographic information can be explored with the metadata explorer webpage by searching based upon keywords, geographic extent within Kentucky, content type, and content theme; a very powerful tool!

The metadata explorer application was modified to add a Kentucky flavor to the site. Advanced graphics software was utilized to design the appropriate graphics, and make alterations to the web pages. The changes gave the site a Kentucky identity without compromising functionality. Once modifications were complete, the KYGEONET was registered with the Geography Network (http://www.geographynetwork.com/) and was selected as a featured clearinghouse site.

A late-July 2002 press release by the Governor's Office formally unveiled the Kentucky Geography Network. The media's coverage raised awareness of its existence and extended an invitation to explore its contents to citizens, educational institutions, professional disciplines, and anyone else interested in the unique geography of Kentucky. A presentation was made at the annual Kentucky GIS Conference in August 2002 and an invitation to publish was extended to the entire GIS community; the reception was overwhelming!

Contributing agencies have found publishing GIS data to be fast and easy. A publisher's guide containing pertinent information for publishing to the KYGEONET is available to interested parties in a downloadable format. Items that can be published are generally separated into three categories: 1) Live Data and Maps and their associated browser-based viewers; 2) Downloadable Data Resources such as GIS export files and adopted KY GIS Standards Documents; and 3) Static Map Images. After reviewing the guide, users remotely connect to the metadata server using ArcCatalog, select the item locally that they want to publish, review the metadata to ensure all required fields have been populated, make a thumbnail image with the available tool, and simply copy the item to the appropriate content theme folder on the metadata server, …and the system does the rest!.. Publishers have found the user's guide and the associated process to be quite straightforward and can publish a well-documented data resource in a matter of minutes.

An important note is that every publisher to the KYGEONET maintains their own webpage and/or ftp site for distribution of data and detailed metadata. That gives the publishers the control they need to keep both the data and metadata components current and secure at their own site with their own identity, and under their own direction. Another benefit to this arrangement is that it distributes the load for GIS data downloads and reduces the computing resources needed at the application and database server that run the KYGEONET. A public FTP server was donated to the KYGEONET by the Kentucky Department for Fish & Wildlife and is being used to host data for cities, counties, educational institutions, state agencies and other related entities that don't have data serving capabilities. This is one more example of the collaborative nature of this effort.

Kentucky is now well positioned to expand GIS data sharing and provide continued public access to spatial data through the use of ArcIMS Metadata Services. There is a growing and committed publishing community and many interested parties utilizing the service. Site traffic has grown from a few thousand hits per month in mid to late 2002 to over 254,000 in February 2003 and to nearly 500,000 in March 2003.

Operational Improvements within Kentucky State Government

The most significant improvements to governmental operations as a result of this effort are two-fold. First, there is now an ever-growing "pool" of GIS data and associated spatial resources that are based on a standard metadata framework. Previously, a few agencies had some form of metadata regarding their holdings, but much of it was maintained in a text-format, PDF, or other non-standard metadata format. Even worse, many agencies had no metadata at all! These desperate forms of metadata hindered data sharing amongst government agencies and with the public at large. The implementation of the KYGEONET has fostered a keen interest in maintaining metadata in an FGDC-compliant format that eases data sharing from the local to the federal level, while requiring publishers to create a minimum set of metadata for each published item in order to facilitate the powerful search capabilities.

Secondly, GIS data and other spatial resources are now more accessible than ever before. In the past, government-based GIS users in Kentucky had to be quite familiar with several websites in order to "track down" the data they required for a specific project. It was cumbersome at best. Users would go to one site to obtain road network data, another site for city and county boundaries, another site for geology, and yet another site for utility data. Each site had a different interface, provided the data in different coordinate systems, and utilized non-standard metadata formats in many cases. Now the user has a one-stop-shop for GIS data resources and countless hours of staff time are being saved as a result. GIS staff and their managers are moving quickly to leverage this resource as more and more agencies use GIS in their daily programmatic routines.

Benefits realized by Citizens and KY GIS Community

Benefits to the Commonwealth's citizens are still being realized at this point. Web site log files indicate that many users of the site are not from government agencies at all. Now, via the Internet, citizens and businesses have ready access to a different view of

their "Kentucky world". Knowledge of sophisticated GIS tools is not required, and users can build their own data "layer cake" quite simply through the use of a browser. The engineering community, universities, the private sector, and the public at-large make up an increasingly significant part of the site's traffic. It is hoped that this trend continues as more citizens learn of this valuable resource. It is expected that usage by the public will eventually outweigh use by GIS professionals and associated disciplines.

Some items that are of great interest to the public include the dozens of static map images ranging from an "1871 Bird's Eye View of Frankfort" to "Areas that are Suitable for Conventional Septic Systems" to the "Detailed Geology of the Harrodsburg 100k Quadrangle". Having this growing number of ready-made maps at the public's disposal for use both in public and private settings is proving to be a tremendous resource, especially from an educational perspective.

Also of interest are the nearly 20 interactive mapping sites available on the KYGEONET. These sites provide quick access to a number of thematic services all within a standard web browser. Tools to zoom, pan, identify, view legend, print, and so forth are provided on these sites giving the user a powerful interface to explore the Commonwealth. Most of these sites deal with a specific theme such as Kentucky's Incorporated Cities, Kentucky's Coal Data, Generalized Geology of Kentucky, Kentucky Area Water Management Planning, and Kentucky's Six Year Highway Plan, to name a few.

The Kentucky Base Map service that was started in January 2003 is also attracting much attention. This service (http://kygeonet.state.ky.us/kybasemap/viewer.htm), along with its advanced user interface, provides access to Kentucky's most crucial GIS base map layers. These layers as identified and adopted by the Kentucky Geographic Information Advisory Council (GIAC) are crucial to the GIS community as "base layers" but are also of great interest to the citizens and a variety of professional disciplines. This service is the Commonwealth's contribution to the USGS National Map (http://nationalmap.usgs.gov/) effort and Kentucky is the first state in the nation to put such a site into production. Interactive access is provided to layers such as aerial images (DOQ), topographic maps (KRG),
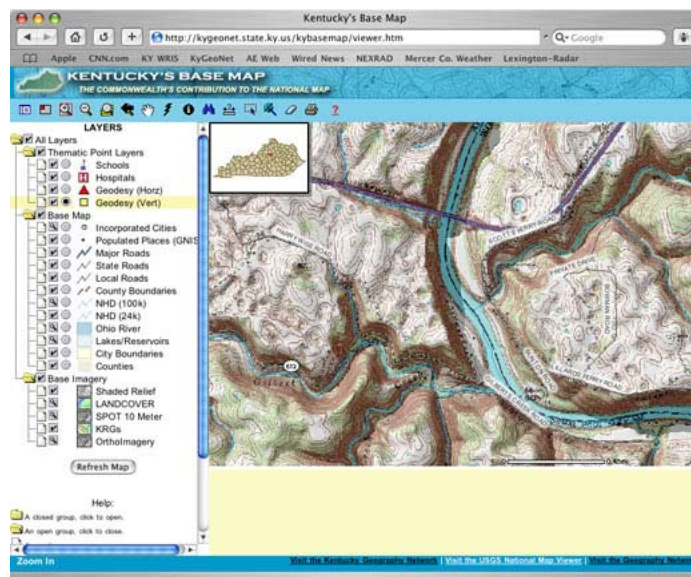
SPOT Imagery, hillshades based on 10 meter DEMs, transportation network, detailed hydrography (NHD), city and county boundaries, geodesy, hospitals, and schools. Additionally, the HTML Viewer for this service is totally integrated with the KYGEONET. Using the hotlink tool in the viewer allows the user to select any geographic feature and spawn a new window showing that item's details directly in the metadataexplorer. Of

course the most common use for this service (outside the GIS industry that is) is that of finding one's home . . . Everyone wants to see his or her house!

Return on Investment

Much of the hardware and software that supports the KYGEONET was in place and ready for service prior to implementation of the facility. Several agencies already had various ArcIMS and SDE services in production on a set of dedicated application and database servers. The metadata service itself consumes only 20mb of memory resources on the application server and less than 40mb of disk space on the database server. To date, the performance impact on those servers has been negligible.

Upgrades have been made to the server infrastructure since it went into production in May, 2002, but those upgrades were to help balance the load of a growing number of thematic ArcIMS services and to increase storage capacity, which again, was planned regardless of whether KYGEONET was implemented. Essentially, there has been little capital investment made in the KYGEONET other than that of staff time. Many agencies have taken the time needed to prepare their data holdings for publishing, and in so doing, have created a standardized metadata product that is useful for their programmatic functions and for publishing to the KYGEONET. As a result, the extra time taken to properly prepare the data has brought increased value to the published product which has offset the added cost of resources to the publishing entity.

Efforts to quantify the startup costs for KYGEONET have been difficult due to the fact that Kentucky had already invested heavily into GIS efforts, though the efforts had not been collaborative. Once the decision was made to implement KYGEONET, most of the cost came in the form of man-hours with some nominal equipment costs. Startup costs have been estimated at approximately $50,000.00 total.

The Commonwealth is ecstatic about the unlimited potential and enormous growth of utilization thus far. In an effort to extrapolate the benefits and ROI, experts have estimated the value to be huge, and growing! With the enormous number of users coupled with estimates that the system potentially increases efficiency by at least 15% for users, due to the ease of use and ability to locate information in such a timely and efficient manner, cost savings has been estimated to be as much as $450,000.00 annually.   As users, information, and efficiency increase over time, the ROI potential becomes unlimited.

In terms of maintenance, the metadata service runs alongside many other thematic ArcIMS services and is maintained accordingly on a routine basis with the other services, which again, caused little or no impact on the daily maintenance routines currently in place. Data for the service consumes little space on the database server and is backed up daily with all other data resources. Currently, there are nearly 150 published items on the KYGEONET each of which took approximately 15 minutes to publish. The number of hours spent publishing far outweighs the number of hours spent on maintenance and oversight of the service since going into production.