Texas Develops Online Geospatial Data Repository to Support Emergency Management

Overview

Country or Region: United States
Industry: Government—Natural resources

Customer Profile
Based in Austin, Texas, the Texas Natural Resources Information System (TNRIS) acts as a centralized repository for geographic information relating to the state's natural resource data.

Business Situation
Following Hurricane Rita in 2005, TNRIS needed to develop a solution that would provide quick, easy access to geospatial data in support of emergency management in Texas.

Solution
TNRIS integrated Bing™ Maps for Enterprise and Microsoft® SQL Server® 2008 technologies with its existing geographic information system investments to create a simple yet robust solution.

Benefits
- Easy, intuitive access to data
- Improved decision making
- Faster time to market
- More room for innovation

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Following the devastation of Hurricane Rita in 2005, the Federal Emergency Management Agency (FEMA) awarded a grant to the Texas Natural Resource Information System (TNRIS) to develop a centralized repository of geospatial data for the state of Texas. Although the repository was intended to support emergency management efforts, TNRIS realized that this was an opportunity to create a system with broader applications. Using Bing™ Maps for Enterprise and Microsoft® SQL Server® 2008 data management software—along with ArcGIS products from Microsoft Gold Certified Partner ESRI—TNRIS created an innovative solution that allows users to easily query, manipulate, and visualize several terabytes of geospatial data through a simple, intuitive user interface.

Situation

The Texas Natural Resources Information System (TNRIS) was established in 1968, and is part of the Texas Water Development Board under the Water Resources Planning and Information Division. TNRIS serves as the clearinghouse for geospatial information for the state of Texas and provides geospatial data for use in emergency management, economic development, planning and engineering, resource development, and environmental studies.

TNRIS has played an important role in support of emergency management events such as the Space Shuttle Columbia disaster in 2003 and Hurricanes Rita and Katrina in 2005. In the aftermath of Hurricane Rita, TNRIS received a grant by the Federal Emergency Management Agency (FEMA) to develop a Hurricane Rita data repository. Now called the Geospatial Emergency Management Support System (GEMSS), the project's primary goal was to establish a geospatial data repository for emergency management in the state of Texas. The principal ongoing activity is to acquire, organize, integrate, and disseminate geospatial data and resources to support mitigation, response, and recovery activities in the state and along its borders.

"The challenge today is to provide people with the ability to access or view geospatial information from anywhere in the world regardless of where the data specifically resides," explains Richard Wade, Team Lead at the Texas Natural Resources Information System. "Assuring that an individual always has access to the latest and most accurate information is critical when it comes to managing an event or crisis."

For a system such as GEMSS to be successful, it needs to be fast, reliable, accurate, and easy to use. TNRIS also wanted to develop a system that would support access to data in a way that was already familiar to GIS users and simplify the organization and use of the data. With this in mind, TNRIS reviewed every option available to begin building a foundation. "We needed a solution that would allow us to access several sources for information and tie it all together in one common viewer," Wade says. "Our main challenge was how to discover and visualize those vast amounts of geospatial data through a simple interface.

According to a survey on GISjobs.com, nearly 80 percent of all GIS users worldwide work with ArcGIS software and spatial database management applications developed by Microsoft® Gold Certified Partner ESRI. So TNRIS began looking for a flexible, robust, and reliable technology that would interface easily with existing ESRI investments.

Solution

In 2006, TNRIS began working on a new Web-based mapping environment called ATLAS. This new foundation will serve as the basis for all future mapping projects developed by TNRIS, including the GEMSS project. ATLAS will incorporate the latest online Web-viewing applications and the latest database technology into a common platform that could be used for multiple purposes. "We knew that we'd be using ESRI tools to develop our data," says Wade. "But we also realized that integrating other technologies into our existing GIS environment would make Web-based mapping applications accessible to more people.
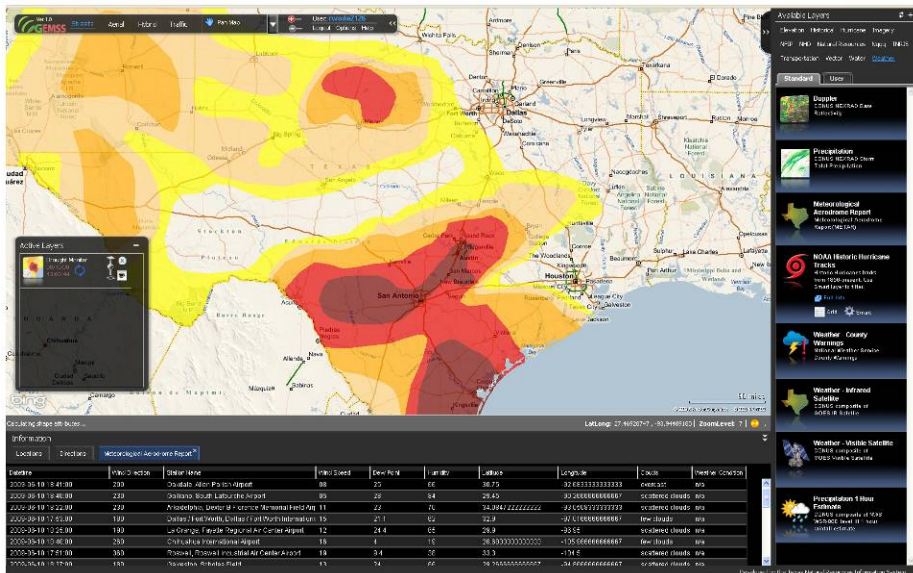
The technology stack for the ATLAS system includes the Bing™ Maps for Enterprise and Microsoft SQL Server® 2008 Enterprise data management software. "Bing Maps is a powerful resource," Wade says. "The technology behind the application is very complex, but it is incredibly simple to use. It's also a browser-based system, which means it can be accessed by anyone who has access to the Internet. This is exactly what we were looking for."

Bing Maps provides an interactive user experience with a dynamic combination of three-dimensional, aerial, and satellite imagery. Other features include geocoding, distance and area measuring functions, customizable raster and vector layers, customizable buttons, and the ability to incorporate map services from third-party sources.

TNRIS uses the customizable application programming interfaces (APIs) in Bing Maps to build applications that pull data from the TNRIS GIS database and from existing services—for instance, those pertaining to weather conditions and warnings, agricultural imagery, and drought monitoring—and overlay that information in the Bing Maps viewer. In other words, TNRIS can create, manage, maintain, and analyze data in its existing GIS and then visualize that data using Bing Maps. "From a GIS perspective, almost anything that we would want to develop is a possibility through Bing Maps," says Ragunath Jayabalakrishnan, Lead Developer for the Texas Natural Resources Information System. "The developer can use the API to take total control of the Bing Maps components and drive the map seamlessly. We used the API to quickly develop the interactive mapping components and integrate them with the analytical abilities to display all types of geospatial information."

TNRIS has tightly integrated the spatial management capabilities of SQL Server 2008 into the ATLAS system. Chris Williams, Database Administrator for the Texas Natural Resources Information System, has worked with Microsoft SQL Server products for 10 years and has been testing the spatial capabilities of SQL Server 2008 since the early beta releases. "One of the understated aspects of ATLAS is that TNRIS has drawn upon all of our years of experience with traditional GIS fundamentals with the new spatial offerings found in SQL Server 2008," says Williams. "The new ability of SQL Server 2008 to manage spatial data is really the backbone of this application, not to mention the future of data management at TNRIS."

In addition to data management, the ATLAS system uses SQL Server 2008 to perform distance calculations, proximity searches, and sophisticated spatial queries. SQL Server 2008 contains more than 80 different spatial methods, all of which comply with Open Geospatial Consortium (OGC) standards.
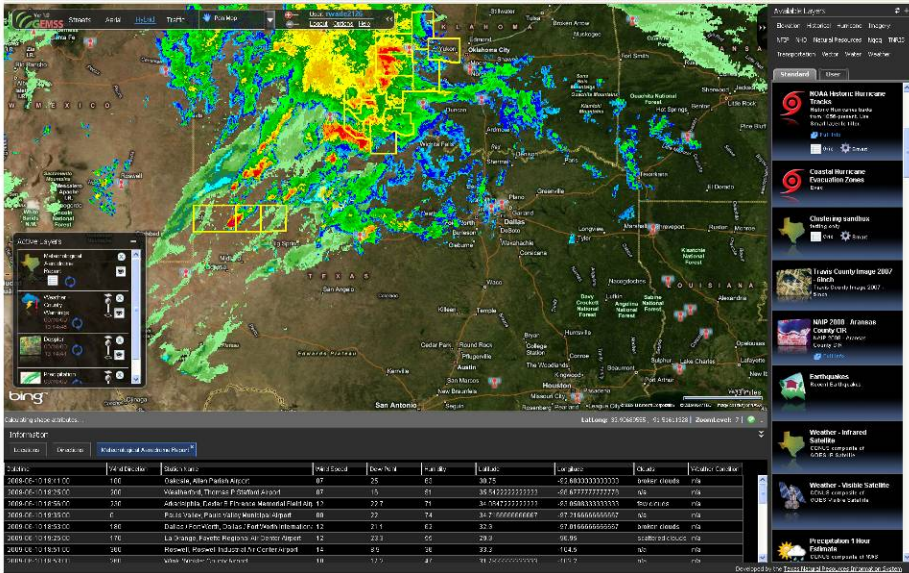
Figure 2. GEMSS monitoring heavy storms in the Texas hill country while displaying real-time Doppler and airport weather conditions.

The overall design and functionality of the user interface is another important aspect of the application, and includes five functional areas:

- **Map window** - The map window is the Bing Maps portion of the application. It displays all the map data and allows users to add information and spatially evaluate layers as part of the analytical process.

- **Available Layers Panel** – A collapsible panel that displays the available layers to be placed in the map window. It incorporates a drag-and-drop interface and contains access links to data categories, user defined layers, metadata, and additional information about each layer.

- **Active Layers Panel** – A collapsible panel that displays the current layers displayed in the map window. It contains controls to adjust layer transparency and visibility, layer refresh, and tabular display options. Layers can also be reordered by dragging

layers above or below other layers for proper display order.

- **Information Panel** – A collapsible panel that provides a tabular or spreadsheet style listing of information that is currently displayed in the map window. It allows users to visualize the database content of specific layers in the map, display results from data queries, get travel directions, and track location markers.

- **Toolbar** – The toolbar allows users to access various administration functions such as changing passwords, as well as the Layer Administration Panel and User Administration Panel (for administrators only), graphic placement features, and measurement tools.

"We made a conscious effort to maximize the user experience by minimizing the user interaction with the systems interface," Wade explains. "With these five functional areas, we were able to identify the user requirement and make the system more intuitive."

Jim Scott, Director of the Texas Natural Resources Information System, adds, "We have reached a watershed moment in accessibility and utility of geospatial technologies allowing us to deliver intuitive and creative solutions that reach a broader audience than traditionally served. ATLAS has become the catalyst for our future applications development platform by its capacity to integrate services, perform spatial analysis, and give average users simple but powerful tools a fraction of the time and cost normally required."

Benefits

By integrating the latest Bing Maps mapping technologies and SQL Server 2008 spatial management capabilities with its existing GIS investments, TNRIS is creating a simple yet

robust solution that will enhance situational awareness, spur innovation, and speed time to market.

Easy, Intuitive Access to Data

With Bing Maps and SQL Server as the foundation, ATLAS-based solutions will be easy for anyone to use. GIS and non-GIS professionals will be able to access information over the Internet with the click of a mouse. "We plan to use the ATLAS foundation to build the next evolution for data access at TNRIS," says Wade. "The application will incorporate new ways to access and download data as well as discover new data and services available online." Currently, the TNRIS Web site, www.tnris.org, handles more than 30,000 users and processes 1.4 terabytes of downloaded information each month.

Improved Decision Support

With ATLAS, decision makers will have instant access to mission-critical data. They will be able to review and analyze information quickly so that decisions can be made without delay. Prior to this solution, decision makers had to rely on teams of people to compile data for geospatial maps before they could assess a scenario or develop a plan of action.

Faster Time to Market

TNRIS has developed an integrated solution that will be easily customizable, increasing the speed with which the agency can bring tools such as GEMSS to the marketplace. The same foundation can be used for multiple projects, dramatically cutting down the development time for each project.

TNRIS can also make its solutions available more quickly and to a broader market because Bing Maps is a browser-based system. This means users will not need to install or maintain any additional software onsite.

More Room for Innovation

TNRIS looked beyond the status quo to develop an innovative solution to a complex challenge. "When you have flexible tools that create new options, you don't have to think traditionally," says Wade. "Once we knew what we wanted to accomplish and understood all that Bing Maps and SQL Server 2008 had to offer, we began to see new ways to turn our vision into reality. We've been building this solution for nearly two years, and every month we get together and ask, 'What's new? What do we need to understand to continue developing this technology?' Microsoft gives us the tools to think outside the box."

Wade concludes, "We've used Bing Maps, SQL Server 2008, and our existing GIS environment to create a very intuitive and flexible platform that allows us to visualize and centralize geospatial information in one simple application. It's extremely powerful, yet everything can be done with one or two clicks of the mouse. All the functionality that makes Bing Maps so easy to use is right at our fingertips."

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For more information about ESRI products and services, call 800-447-9778 or visit the Web site at:
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For more information about Texas Natural Resources Information System products and services, call 512-463-8337 or visit the Web site at:
www.tnris.org

Bing Maps for Enterprise

Bing Maps for Enterprise is the mapping platform from Microsoft, used by thousands of companies, governments, developers, individuals, and communities around the globe. The platform, previously known as Microsoft Virtual Earth™, delivers global maps coverage with enterprise-class reliability, availability, and scalability.

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