Telecom Connections

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GIS for Telecommunications

GIS Fills the Gaps for State-Based Broadband Initiative

By Susan Harp, ESRI Writer

Connected Nation is a national nonprofit organization dedicated to improving broadband access and computer literacy across the United States with the ultimate goal of promoting technology growth and economic development. As part of its first initiative in Kentucky, Connected Nation developed detailed maps of broadband coverage across the state. Geographic information system (GIS) technology allows Connected Nation to generate the maps and integrate detailed community information to create a picture of broadband and local development potential.

Connected Nation facilitates public-private partnerships to promote statewide technology expansion. ConnectKentucky, Connected Nation's pilot program, sought to improve broadband connectivity in the state by filling the gaps where service was not available. The first challenge was to identify exactly where the gaps were, in both rural and urban areas, to promote new service expansion. A product was also needed to help decision makers visualize an overall picture of both community and service-provider information.

Acknowledging that detailed connectivity maps would provide the first step in the mission to accelerate broadband, Connected Nation decided to use ESRI's ArcGIS products to create highly accurate coverage maps and integrate survey questionnaire results with the maps for planning purposes.

However, new and detailed data had to be collected before creating any maps. At the time,

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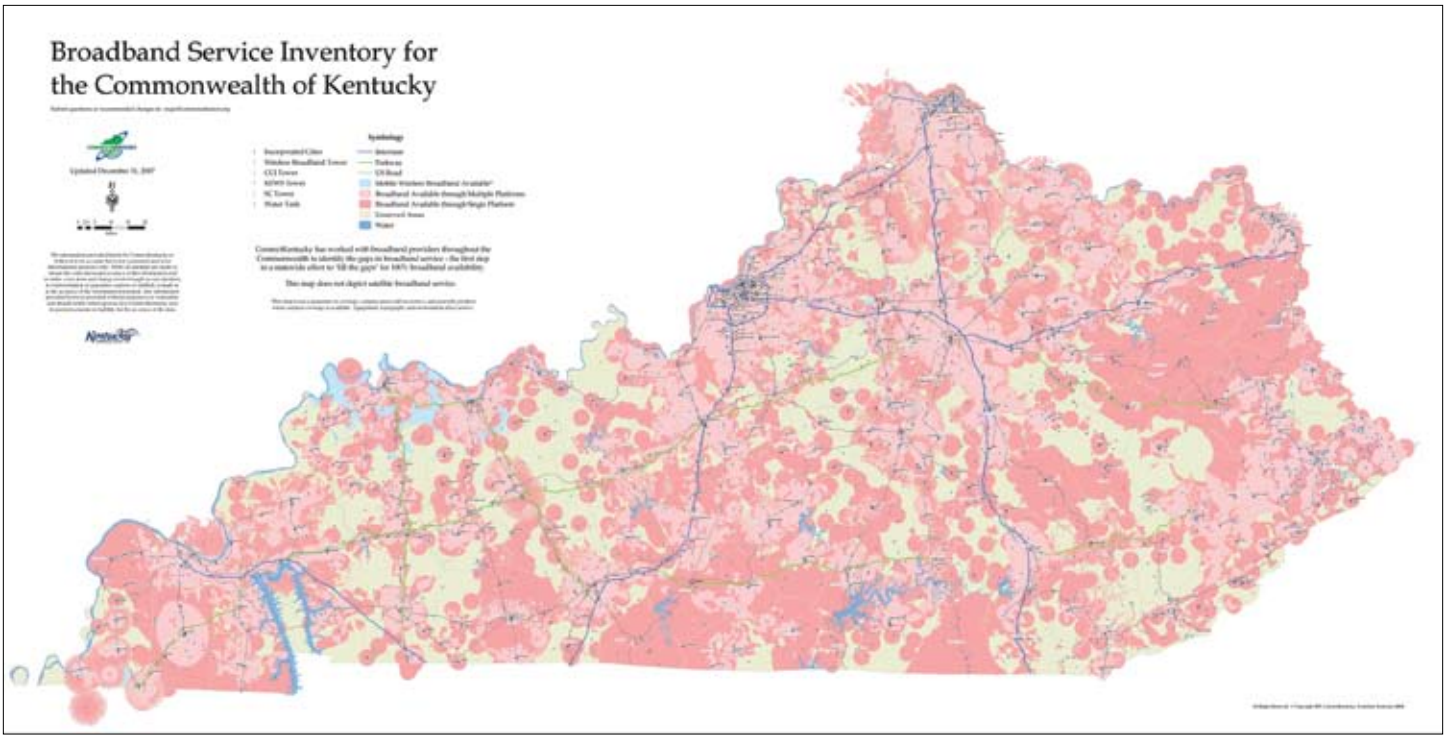

ConnectKentucky map shows broadband availability (pink colors) and nonavailability (beige) to provide a visual representation and the precise locations of unserved areas.

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broadband coverage detail was primarily available only at a very general ZIP Code level. For example, a company that provided connectivity in any part of a ZIP Code was reported as providing connectivity over the entire ZIP Code area even though gaps existed. However, getting this detailed information from service providers posed an obstacle because they usually protect their market information from competitors.

Connected Nation was able to access the data because of its nonprofit status and by providing nondisclosure agreements for protecting proprietary information. To ensure a true representation of each company's coverage, time was spent consulting with each provider to refine exact coverage areas. Then, additional time was spent consulting with clients in the communities for more feedback on map accuracy, since clients could report whether or not they were actually able to sign up for broadband service where they lived.

In addition to identifying broadband availability, specific household demographic information was added to create a complete picture of current technology use and development potential for each county. Survey questionnaires provided information about household Internet adoption as well as detailed Internet usage and, thus, a highly accurate picture of community technology use.

The resulting coverage maps now benefit service providers by giving them access to detailed market information that they use to make decisions. According to Wes Kerr, Connected Nation senior manager, GIS, "It gives leaders in those companies the ability to see where potential business may be and where new opportunities exist."

"ConnectKentucky's GIS maps have helped us serve Kentucky residents better," says Greg Ballard, president of KyWiMAX, a Kentucky wireless broadband provider. "The maps allow us to monitor growth within our counties and expansion opportunities that may exist in neighboring counties. These maps help us analyze communities across the state with more accuracy and efficiency."

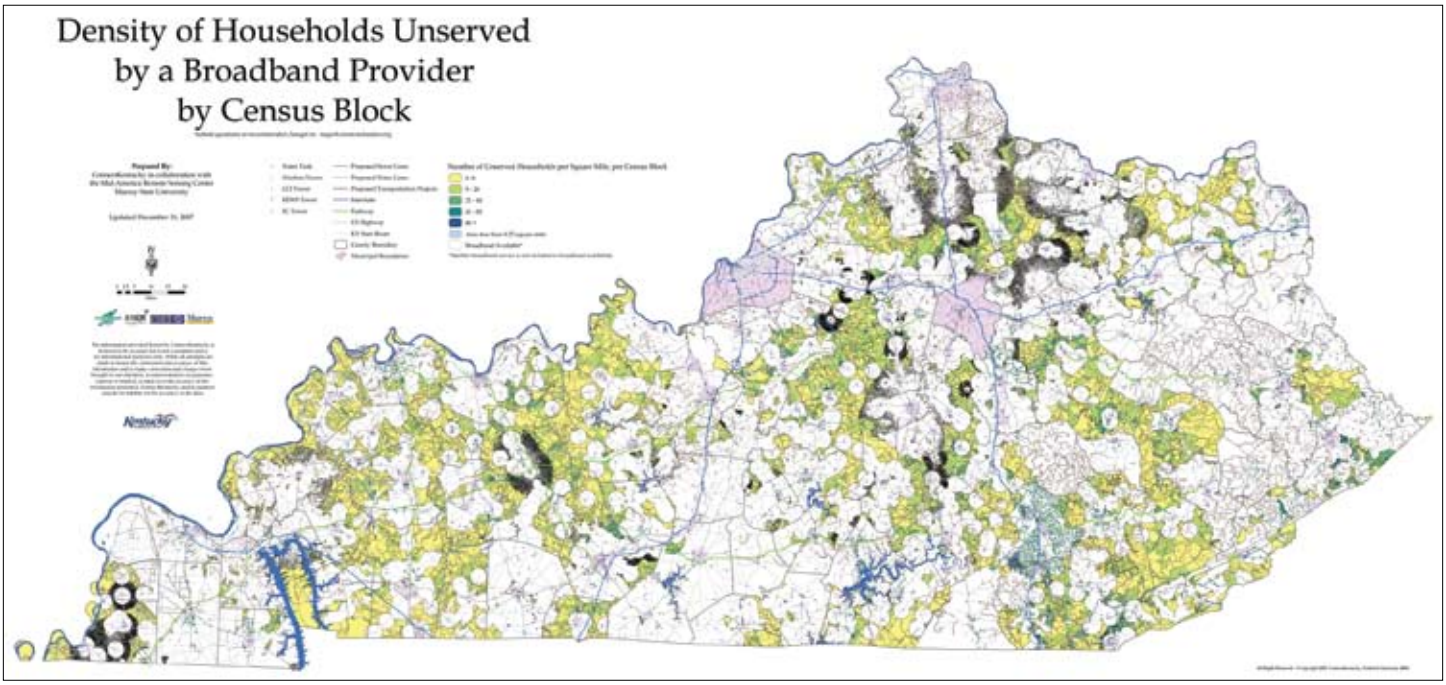
The results showed clear growth. From January 2004 to December 2007, broadband availability in Kentucky grew from 60 percent of households to 95 percent, making Kentucky the number-one ranked state in the nation for expanding broadband. "It is amazing to see where the providers stepped up and filled the gaps. They recognized the value of the holes we were mapping," says Kerr.

During that same four-year period, Kentucky home computer ownership grew 24 percent. Increased technology growth contributed to the creation of 18,400 new high-tech jobs in the state. Information technology jobs enjoyed a growth rate of 4.5 percent, compared to 1 percent nationally, and private investment in Kentucky telecommunications topped $743 million.

In 2007, Connected Nation made Web-based access to interactive maps possible with the addition of ESRI's ArcGIS Server software. This gives legislators, service providers, businesses, and consumers Internet access to broadband coverage information. Coverage maps are updated on a quarterly basis, which makes it possible to track broadband service growth.

"Bringing together a vast majority of providers from multiple provider types to create a singular product that will benefit the industry, as well as the public, is something that had never happened prior to the ConnectKentucky approach," says Kerr.

ConnectKentucky has garnered national, industry-wide recognition as a best-practice model for broadband expansion. Connected Nation's model has been replicated in Tennessee and Ohio as well as in mapping efforts in West Virginia and South Carolina. For more information about Connected Nation and its state programs, visit www.connectednation.org.



This map represents the density of the households in unserved census blocks.

Telecom Trends

Randy Frantz
Telecommunications and
Location-Based Services Industry
Solutions Manager, ESRI

Support Emergency Services with GIS

February 16, 2008, marked the 40th anniversary of the first 911 call, so I thought it appropriate to reflect on the role GIS plays in ensuring our telecommunications infrastructure meets communication needs during emergency situations. These needs include accurate location reporting for 911 calls as well as the use of real-time, GIS-based monitoring during disasters that threaten critical telecom infrastructure.

The U.S. Federal Communications Commission has mandated that wireless carriers must meet Enhanced 911 (E-911) Phase II requirements so that at least 95 percent of all wireless 911 calls deliver a call-origin location accurate to within 150 meters. However, for the most part, the 911 system is not GIS based and therefore is limited in its ability to provide this level of accuracy for wireless calls. The problems of correct location identification and proper Public Safety Answer Point (PSAP) routing extend to Voice over Internet Protocol (VoIP) calls as well. As users migrate toward more mobile wireless and VoIP communications systems, carriers must develop solutions that meet emergency response requirements.

Fortunately, more organizations are recognizing the importance of upgrading our communications systems to support emergency response capabilities. The National Emergency Number Association is evaluating technologies and systems that will be capable of delivering the next-generation 911 service including VoIP, wireless, and possibly even text messages. The Industry Trend Advisory Group (ITAG) meeting during the 2008 Geospatial Information and Technology Association (GITA) Conference, held recently in Seattle, focused on critical infrastructure and emphasized that our ability to respond to emergencies and disasters is dependent on the telecommunications infrastructure.

Other important aspects of emergency response needs are exemplified by GIS contributions during recent extreme flood and fire disasters. In the aftermath of Hurricane Katrina, U.S. Coast Guard helicopter crews used GPS to find stranded people because submerged streets and landmarks obscured addresses and normal navigational references. The full impact of GIS in helping those in distress really hit home when I attended the CTIA Wireless Association's Wireless IT & Entertainment conference last fall.

CTIA took place in San Jose, California, at the same time that relentless wildfires in Southern California caused the evacuation of more than half a million residents. ESRI teams supported firefighting crews by creating a display of burn areas and providing a satellite feed of fire hot spots. Crews used the display of real-time information on wind, weather, and hot spots paired with terrain and vegetation maps to predict the fires' progress and plan strategies and movements. We displayed this live fire information in our booth at the show. I was amazed at the number of attendees who stopped by the booth to see the live feed and monitor the fires' progress; many were critically connected to the event because they lived in the fires' paths. I learned that telecommunications companies used similar tools to monitor the fires and predict the potential impact on their fiber infrastructure. They could use a similar setup for storm and flood monitoring.

I am positive that GIS will continue to play a major role in creating and maintaining telecommunication systems that ensure accurate location information is provided for both emergency response and critical infrastructure monitoring. After all, the ability to communicate is essential when we need to call for help.

Best regards, Randy

ESRI News

ESRI UC Returns to San Diego in August

Join us at the San Diego Convention Center, August 4–8, 2008

The annual ESRI International User Conference (ESRI UC), the largest GIS conference in the world, offers innovation at its best.

This year's ESRI UC includes one- and two-day preconference seminars, with more than 40 topics ranging from analysis, development, enterprise GIS, fundamentals, and industry focus to mobile and server GIS, visualization, and cartography. Pre- and postconference instructor-led training classes will be offered at the ESRI headquarters in Redlands, California, during the weeks before and after the 2008 ESRI UC. Register for training classes at www.esri.com/training.

Join us to be part of this extraordinary experience. Register online at www.esri.com/uc.

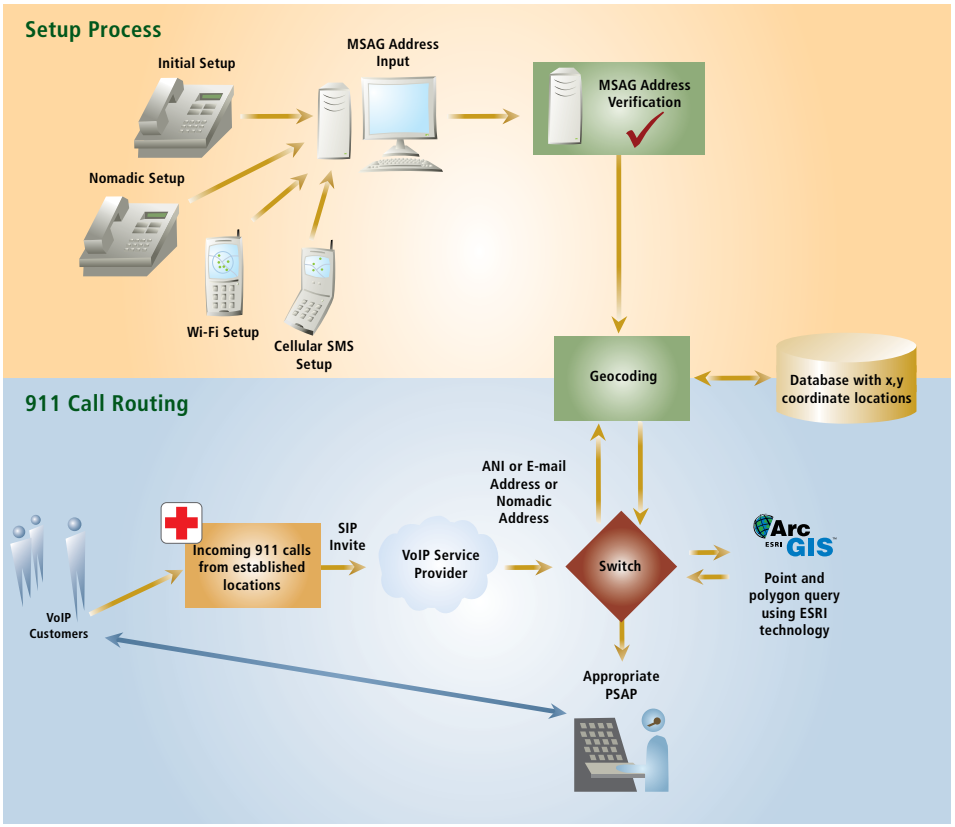
Telecom and LBS at the 2008 ESRI User Conference Wednesday, August 6

Join the ESRI mobile and LBS teams on Wednesday evening for the Mobile and LBS Special Interest Group meeting, sponsored by AT&T and Trimble. This is your chance to network with mobile GIS users and discuss your interests with industry leaders. During this event, you will have the opportunity to take the ArcGIS Mobile Urban Challenge for a chance to win AT&T mobile devices and other exciting prizes.

VIXXI Solutions Uses Georeferencing Switch to Deliver E-911 Call Routing Solution

With the mobile telecommunications revolution in full swing, providers are searching for ways to connect their mobile services with the 911 emergency response telephone system that serves the United States, Canada, and Puerto Rico. VIXXI Solutions, Inc., helps providers meet this responsibility with an Internet-enabled solution that provides seamless services for networking environments by routing calls according to geographic coordinates.

The VIXXI router uses ESRI ArcIMS technology to create geospatial (e.g., x,y or x,y,z) coordinates that are used to route 911 emergency telephone calls to the closest emergency service provider. The VIXXI router gathers and verifies customer user information, matches transmission formats with telephone company-provided equipment for 911 Public Safety Answer Points (PSAPs), routes calls based on their existing location, and terminates the phone call in the appropriate PSAP with the proper automatic number identification (ANI). The VIXXI router provides technology appropriate for meeting the 1998 Federal Communications Commission (FCC) Traditional Enhanced 911 (E-911) Wireless Phase II requirement for wireless providers to provide an origin x,y coordinate of the telephone call accurate to within 50 meters for 67 percent of all calls and 150 meters for 95 percent of all calls. VIXXI-LINK includes a Web portal for end-user registration, total automatic location identification (ALI) management with Master Street Address Guide (MSAG) validation and Emergency Service Zone Routing Database (ERDB) functions, and emergency call routing. The VIXXI Geospatial E911 Routing System received a 2007 Product of the Year award from *Internet Telephony* magazine.



This diagram represents the setup and call flow for VoIP 911 calls utilizing the VIXXI solution. When initially setting up a VoIP line, the end user is required to enter information that lets the 911 call center find the user in an emergency location. This process is initiated whenever the user sets up a new location. The address from setup goes into the MSAG, where it is verified, geocoded to an x,y coordinate, and entered into a database with x,y coordinates. When the VoIP customer places a 911 call, the VoIP service provider uses the registered information to pull the x,y coordinate from the lookup database and then runs a spatial query with ESRI's ArcGIS to find the appropriate PSAP and forward the call, connecting the emergency operator with the caller.

Calls are routed based on the geospatial location instead of using ALI to determine a one-to-one telephone-to-destination trunk matching. The geospatial location method has several advantages over the traditional system. It allows any NPA or NXX to be routed through any office so that numbers that are Local Number Portability (LNP) in service can move to any part of the country. It accommodates nomadic VoIP users by generating an x,y coordinate for switching their services to the appropriate provider and uses the x,y coordinate (such as that developed in Phase II Wireless) to switch cellular customers to the appropriate provider. It does this quickly and allows for immediate changes to the routing system without having to change telephone numbers and end trunk ties.

Address Registry

A geographic reference telephone switching system is shown in the call flow diagram. The system facilitates several setup processes: Initial when a user first signs up for the service, Nomadic when the customer moves to a new location, and Wi-Fi and Cellular SMS when the user is operating in a mobile environment. Under the Initial Setup, an interface is presented to an end user for registering their location in the system. When using the Initial or Nomadic Setup, a user will be directed to a screen that asks them to provide their address before the customer is assigned a telephone number or a call can be processed. The address is then sent to an MSAG comparator, which verifies the address against the community's list of valid addresses to ensure that it is a valid service address and make corrections, if necessary.

Once validated during the preimplementation process, the user's address is geocoded and a record is generated that shows the user's name, address, telephone number, and emergency service number zone and is tied to a geospatial (x,y

or x,y,z) coordinate. That information is then stored in the ALI database, and the user's information is formatted for that particular PSAP's end-user equipment.

Call Routing

The second type of process is the postimplementation input of an actual emergency call. The call arrives at the ANI in any one of several formats; one call might arrive through IP, or what is called a SIP-to-SIP in byte, for example. The received call format is decoded using the ANI and passed to the geospatial coordinate generator, which uses the ANI to produce the geospatial (x,y or x,y,z) coordinate. The geospatial coordinate is then matched in the ALI format comparator against the boundary and point data file of the PSAP. Identification (ID) matching provides the appropriate trunk group. Trunk routing information is matched to the correct trunk ID, and the call is completed to the PSAP.

The geospatial switch system is able to accommodate three-dimensional drawings of buildings to provide the address and appropriate vertical and horizontal location such as fourth floor, rear left corner. Private industry may also use it for VoIP PBXs and VoIP Citrix.

For more information, visit VIXXI on the Web at www.vixxisolutions.com.

Coming Soon: Business Analyst with Telecom Data

Learn how to gain the geographic advantage in your marketing research, customer acquisition, and business operations with a new offering from ESRI. ArcGIS Business Analyst with Telecom Data combines business and network data with customer profiles and marketing analytics to locate your best customers and find more like them. This powerful combination provides unique insights into market dynamics and helps you develop successful network expansions, competitive analysis, and marketing campaigns. To learn more, visit www.esri.com/telecom.

Next-Generation E-911 Link Fits the Bill for Excel Telecommunications Business Expansion

Excel Telecommunications is a leading provider of long distance, wireless, and data services to businesses, resellers, and telecommunications dealers worldwide and has expanded its commercial division by providing Internet protocol solutions designed specifically for business customers. As a result, Excel is a leading provider of SIP trunking services for small- to medium-sized businesses in the United States and offers a near-ubiquitous Voice over Internet Protocol (VoIP) network for the VoIP market. To provide cost-effective E-911 services, Excel chose a solution that included ESRI GIS technology to geolocate the position of the caller.

In 2007, Excel faced a decision about which technology to use for providing E-911 emergency call service for its VoIP product line. The company needed a platform that would be cost-effective and still meet regulatory requirements for its VoIP customers. In addition, Excel needed a system that would make it possible to offer E-911 coverage nationwide. Excel chose and deployed VIXXI Solutions, Inc.'s VIXXI-LINK, a national IP-based E-911 solution that includes ESRI GIS technology.

In the past, traditional legacy systems have required large capital expenditures without the requisite flexibility for firms in the process of expanding their VoIP customer base. To piece together nationwide E-911 coverage, contracts had to be maintained with a large number of local exchange carriers. These legacy E-911 systems used a selective router switch that manually tied the automatic number identification (ANI) or telephone numbers to a particular trunk group and routed the call to the correct emergency operator at the Public Safety Answer Point (PSAP). Consequently, support of exchanges with just a few customers required a large investment for little return.

The VIXXI Geospatial E911 Routing System offered Excel a single service for complete nationwide coverage, streamlining the implementation process. "We can simplify the process by working with just one supplier with less chance for error," says Steve Weltner, director of product development at Excel. "We have an emergency gateway that simulates a CAMA trunk over IP."

Since implementing this service, Excel has doubled its installed base of commercial VoIP customers with E-911 service each month, and the ramp-up continues. Weltner reports that an additional benefit of the VIXXI solution is that it gives Excel the ability to offer E-911 services to clients who require a local telephone number appearance in remote markets by utilizing Excel's virtual Direct Inward Dials (DID). Excel's VoIP offerings make it possible, for example, for a call center in Chicago to maintain phone lines with area codes and exchanges that are local to New York or Los Angeles or any small town in between. However, because the phone user is sitting at a desk in Chicago, all E-911 calls must be routed to the closest local responder. Explains Weltner, "We no longer have to associate our clients' DIDs to the geography from where they originate."

A further plus, according to Weltner, is the positive business experience he had with VIXXI. He says, "We were not just looking for a vendor but for a partner to consult with us as part of our business, and we obtained that through the expertise of Richard Peters [VIXXI chief technical officer], who has 20 years' experience in emergency call routing and management."

For more information about Excel, visit www.excel.com or contact Steve Weltner at steve.weltner@excel.com.

Check Out ESRI Careers

LBS Industry Marketing Specialist

Utilize your experience in location-based services (LBS) to collaborate with ESRI's industry manager on LBS product sales and services. This position requires two to five years of practical industry experience along with specific, in-depth knowledge of GIS and its practical industry applications.

Account Executives

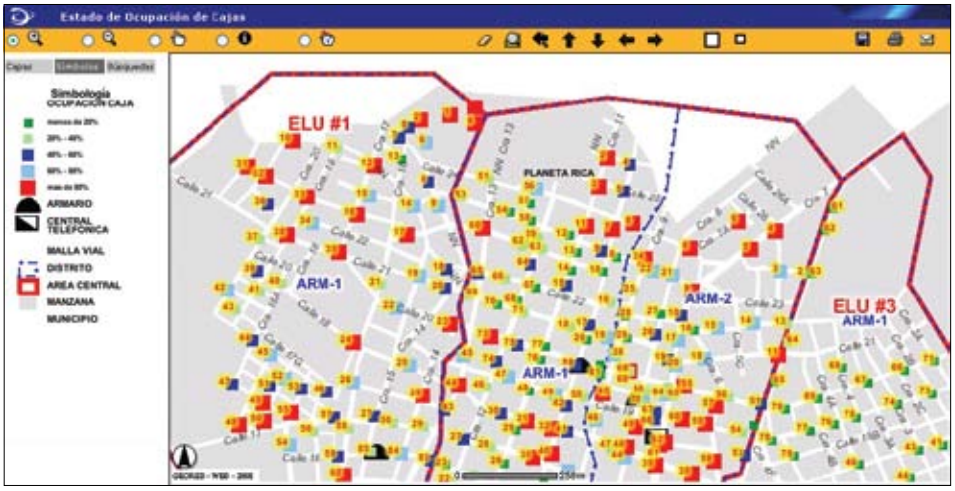
Energetic, driven sales professionals are needed to manage ESRI's relationships with U.S. telecommunication companies and existing high-value partners within the utilities industry. Requirements are a bachelor's or master's degree in GIS, engineering component, or equivalent; at least five years of sales experience in a technical field; and telecommunications industry experience. Opportunities are available in a number of our regional offices.

Learn more about these positions and apply online at **www.esri.com/utilitycareers**.

Colombian Telecommunications Company Solves Data Bottleneck with GIS

EDATEL, a telecommunications company based in Colombia's second-largest city, Medellín, provides service to about 450,000 inhabitants in an area covering about 153,000 square kilometers. To succeed in Colombia's competitive telecommunications market, the company needed a way to manage outside plant data quickly and efficiently, better serve customers, and improve workflow efficiencies. Their solution is a GIS that interfaces with the company's business management systems and provides new abilities to design, plan, and manage the outside plant as well as serve customers and plan marketing strategies.

EDATEL is owned by Colombia's largest public utilities group, Empresas Públicas de Medellín (EPM). It provides basic and prepaid telephone, rural wireless telephone, PBX, public phone, switched Internet, prepaid Internet, broadband access, and data transmission services. Prior to developing its GIS solution, EDATEL used a CAD-based tool to spatially manage service center calls and allocate network resources.



This map provides visualization of the percentage of use for each service box according to district and network center. Numbers indicate the box number, and colors indicate percentage of current usage, from green (less than 20 percent) to red (more than 80 percent). The black half-moon indicates a cabinet location; black-and-white rectangles indicate the district boundaries.

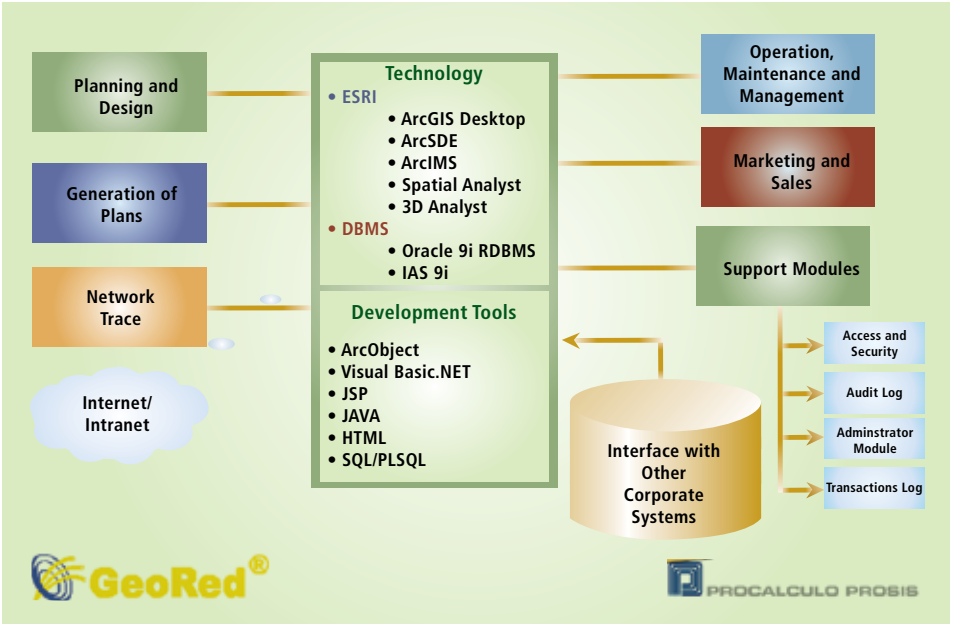


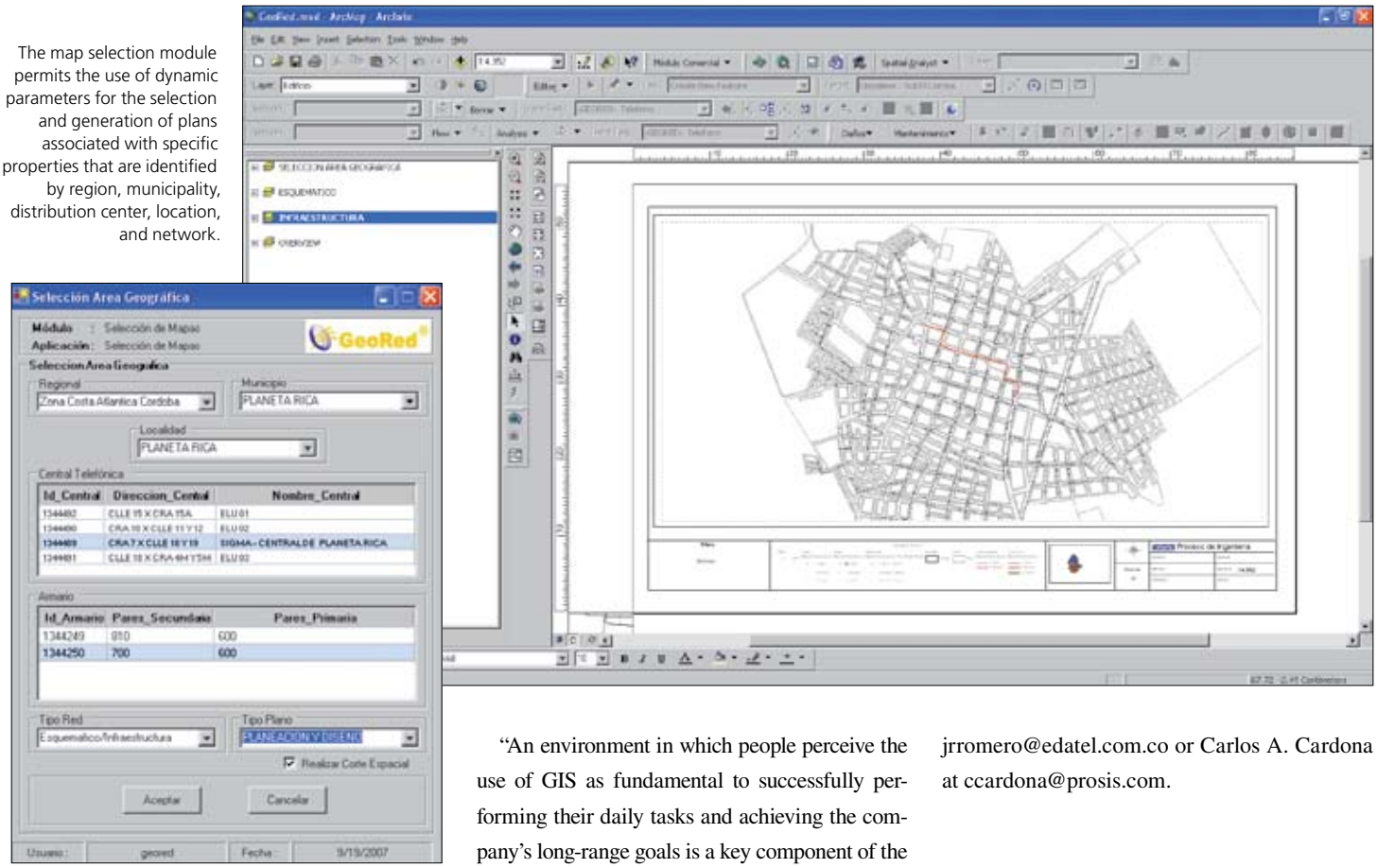
Diagram of the Technological Structure of EDATEL's Enterprise GIS

To demonstrate how GIS could manage the company's data bottleneck, EDATEL sought support from ProCálculo Prosis, S.A., ESRI's distributor in Colombia, to conduct a pilot study. The results convinced the company's executive board to fund an enterprise project based on ESRI ArcGIS technology. The resulting system is called GeoRED (red translates into English as network). ProCálculo Prosis converted the company's data into a georeferenced database and developed several intranet-accessible user modules for specific activities such as planning and design, operations maintenance and management, network tracing, map generation, and customer service and marketing.

Based on ArcGIS Desktop, data is managed by ArcSDE Server technology running on an Oracle database management system. ArcIMS technology supports easy access through the company intranet. Analysis tools include network tracing and the use of ESRI's ArcGIS Spatial Analyst for analyzing current and potential customer densities and commercial service demand. Development tools used include ArcObjects, Visual Basic .NET, and Java.

The different modules allow users to select the information they need for specific tasks. For example, the infrastructure module allows them to drill down from a view of the subterranean duct network to information about the copper and fiber wire inside the duct. In the operations maintenance and management module, they can view an inventory of the network and infrastructure and schedule automated notifications for maintenance and lifetime limits. In the plan generation module, drop-down menus help them select a specific geographic area of interest and produce a map of the selection showing details about the installed network and infrastructure as well as street and plot information. The map can be shared over the intranet or printed out for field use.

Customer service employees use the customer module to search for customers who have not paid their bills and can open up a screen that shows each customer's service details. This information is also used as a basis for estimat-



The map selection module permits the use of dynamic parameters for the selection and generation of plans associated with specific properties that are identified by region, municipality, distribution center, location, and network.

ing risk when considering new service areas. Also supporting expansion decision making is the ability to show details of where company expenses and returns are optimal and to identify specific areas to target. For expansion cost estimations, engineers use GIS network design and cost-estimating tools to create the technical studies. Because of these new technical and marketing tools, expansion planning that previously took eight months now takes only two to three months. This new ability has helped the company to confidently grow its services.

Comments José René Romero Blandón, GIS manager at EDATEL, "Since implementing our GIS solution, the company has both significantly improved its customer response time and increased its inventory management capabilities. In addition, GeoRED has been very useful in helping us plan and implement our sales campaigns."

In addition, intranet access lets EDATEL employees create dynamic maps in real time, giving them fast access to the information they need. This has created a new "GIS culture" among many employees who now incorporate geography into their problem-solving processes.

"An environment in which people perceive the use of GIS as fundamental to successfully performing their daily tasks and achieving the company's long-range goals is a key component of the successful implementation of the system and preserves performance and reliability," says Romero.

Implementing the GIS has also allowed the company to incorporate tools such as handheld computers and GPS devices that make information gathering in the field easier. Additionally, integration with other enterprise systems, such as billing, inventory, and commercial EDATEL systems, helps promote productivity throughout the entire organization, particularly in the engineering and operations divisions. For example, time dedicated to compliance reporting (operating standards and customer response times) was greatly reduced from about three weeks to just five minutes.

Centralized data storage that provides easy information processing and access has made the company's design, operation, and maintenance activities more efficient and reduced transportation time and costs when working in the field. Increased reliability of technical information has reduced hidden costs of using outdated information and improved timely response to customer calls.

For more information on this project, contact José René Romero Blandón at jrromero@edatel.com.co or Carlos A. Cardona at ccardona@prosis.com.

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San Francisco, CA
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OSP Expo 2008
October 22–23, 2008
Baltimore, MD
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