Telecom Connections

ESRI • Fall 2007

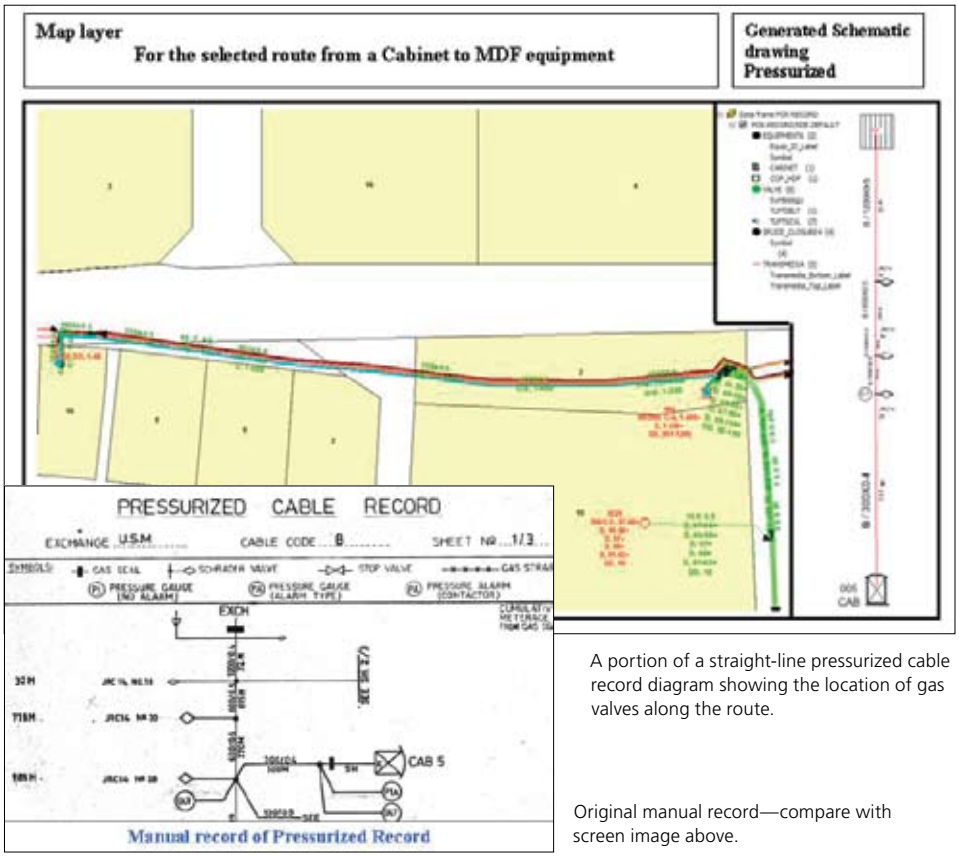
GIS for Telecommunications

# Qatar Telecom Connects with Instant Access to Infrastructure Records

*By Krishna Kumar, Qatar Telecom, and William Chesser, ESRI*

Pretend for a moment that you are an engineer at a large telecommunications company and you are notified that there has been a service interruption that affects 12 square miles of your city. You need to examine the network for the most likely location of the failure. Unfortunately, if your only recourse is to examine archives of hundreds of paper network drawings to diagnose the problem, you will have a difficult task restoring service. Where there is a high density of buildings, drawings are difficult to read because devices are crowded together and details become almost indecipherable. Further compounding the problem, drawings are often out of date.

Accessing accurate network information is a typical problem for most telecom providers but not difficult for Qatar Telecom (Qtel), the telecommunications provider for the State of Qatar. Qtel started using geographic information system (GIS) technology in 1996 to develop applications that track the location and characteristics of its outside infrastructure and improve access to information about new engineering projects. During an outage, engineers have access to current, detailed infrastructure information by computer.




A portion of a straight-line pressurized cable record diagram showing the location of gas valves along the route.

Original manual record—compare with screen image above.

Qtel serves approximately 863,000 people, about 400,000 of whom live in Doha, the capital city of Qatar, a nation strategically located on the tip of the Arabian Peninsula and fortunate to have the third-largest natural gas reserves in the world. The telecommunications company offers comprehensive services that include wireless and wire line voice communications and Internet and cable television services. It is expanding to provide various telecom services in other parts of the Middle East.

Qtel uses its enterprise GIS to improve customer service with applications that manage different aspects of the company's services such as its residential wire line, cable TV, and ADSL coverage. These capabilities help keep the people of Qatar connected and offer higher levels of customer service.

Qtel worked with ESRI business partner Telcordia Technologies, Inc., to implement Network Engineer (NE), an application based on ArcGIS Desktop. Network Engineer is a telecommunications network management tool that provides a geospatial environment for the comprehensive design, documentation, and management of the physical network and its associated

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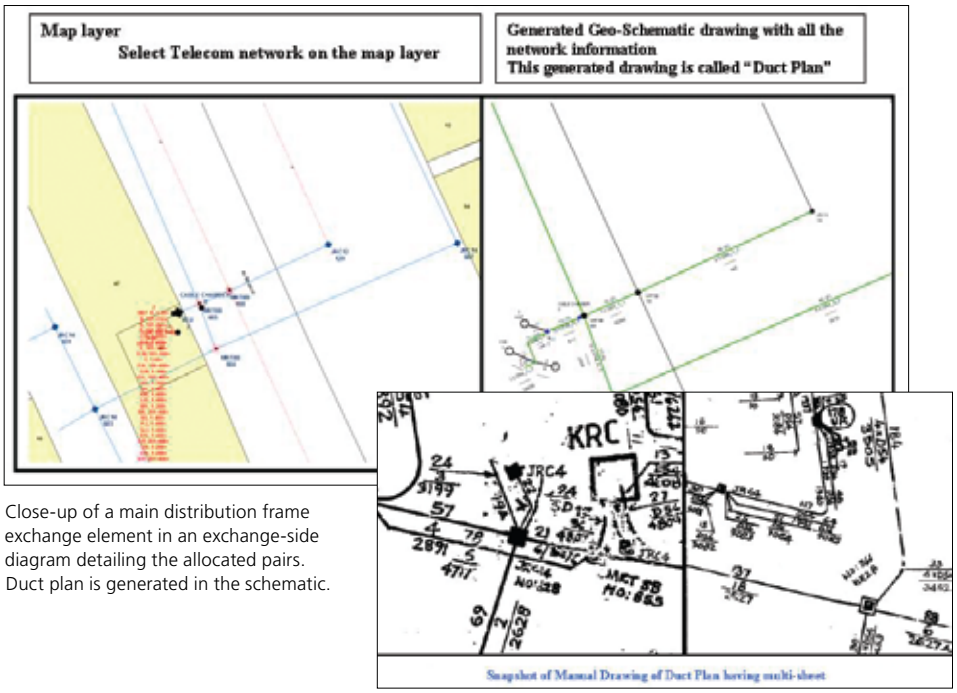
## Qatar Telecom Connects with Instant Access to Infrastructure Records

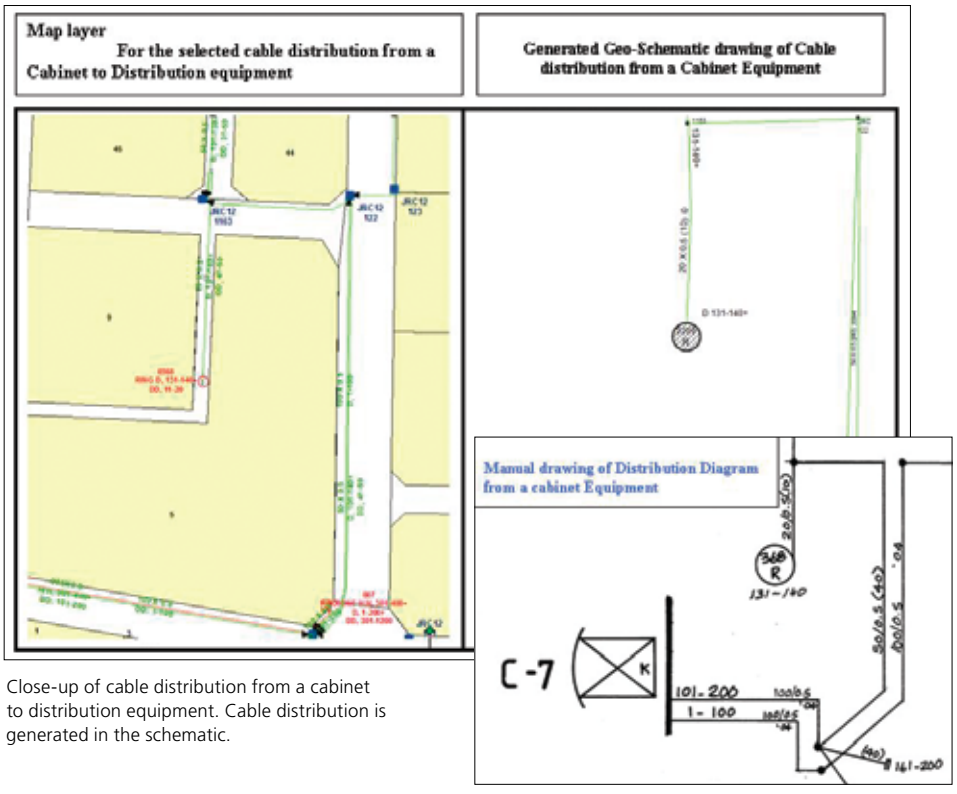
inventory. In addition, Telcordia developed a set of custom tools to meet specific Qtel requirements and collected data for the entire country's fiber and copper network features for loading to an ArcSDE 9 geodatabase on Oracle9*i*.

The Telcordia effort laid the data foundation for a subsequent ESRI ArcGIS Schematics engineering project. ArcGIS Schematics is software that generates schematic diagrams directly from a GIS geodatabase. Its direct access to underlying, native GIS data sources eliminates the need to maintain libraries of individual schematic drawings and consolidates data edits to a single source. The consolidation of source data in a single repository, the GIS database, offers Qtel a compelling time-saving and accuracy advantage. The ability to derive schematic products directly from the database essentially eliminates schematic update lag time and errors.




Close-up of a main distribution frame exchange element in an exchange-side diagram detailing the allocated pairs. Duct plan is generated in the schematic.

Original manual record—compare with screen image above.




Close-up of cable distribution from a cabinet to distribution equipment. Cable distribution is generated in the schematic.

Original manual record—compare with screen image above.

Schematic advantages are

- Feature expansion—Some schematics the software generates, such as straight-line duct diagrams, are completely divorced from geography, allowing the network drawing to expand and clearly show feature connectivity.
- Underlying basemap—Other schematics are geoschematic in nature and allow network trace results to be viewed over the underlying basemap so breaks in connectivity can be quickly identified and understood.
- Queries—Still other schematics are generated by querying on attributes (e.g., Display all copper lines laid in 1975 or earlier). Common to all these diagrams is the direct derivation of connectivity from NE geodatabase geometric networks—the structure/span network for elements such as joint boxes, conduits, and ducts—and the telecommunications network for equipment features.

Customizations for Qtel fell into three general categories:

- Work order system integration—The software was integrated with the NE work order system, making it possible to create "snapshots" in time of relevant schematics for each of the various phases of a work order.
- Custom layout algorithms—These provided automated routines to place and arrange elements in the schematic diagrams in keeping with the aesthetics of existing Qtel schematic drawings.
- Re-creation and automation of standardized Qtel schematic diagram marginalia—These quickly embed ArcGIS Schematics diagrams in a standardized Qtel layout template to develop a rich and attractive hard-copy product. This provides the modern equivalent of the legacy diagrams' update logs, which were previously maintained manually by draftsmen.

Qtel received an ESRI 2006 Special Achievement in GIS award for improving customer service by using ArcGIS Schematics. For more information, contact Krishna Kumar, Qatar Telecom (e-mail: krishnak@qtel.com.qa), or William Chesser, ESRI (e-mail: wchesser@esri.com).

# Telecom and LBS Groups Win 2007 Special Achievement in GIS Awards

Telecommunications and location-based services (LBS) groups received ESRI top honors during the 2007 ESRI International User Conference (ESRI UC) this summer in San Diego, California. Their innovative uses of GIS technology in location and communications systems, bandwidth modeling, and integrated services management cover a wide range of possibilities for using GIS to integrate information and improve efficiencies in the telecommunications industry.

2007 Special Achievement in GIS award winners include the following:

**Air-Trak, Inc.** (California) develops GIS-based automated vehicle location and mobile resource management solutions. Air-Trak provides real-time vehicle location and tracking data for the ESRI Advanced Emergency GIS (AEGIS), at Loma Linda University Medical Center. With AEGIS, the medical center emergency staff can locate and track air ambulances, rescue helicopters, and other emergency vehicles and direct them to the proper location and around traffic-congested roadways, ensuring the fastest routing to the most appropriate hospital.

The Cullman Electric Cooperative (CEC) utility (Alabama) equips 50 vehicles with an Air-Trak automatic vehicle location system that enables company dispatchers to locate every truck in the fleet. Both systems track vehicles using in-vehicle cellular units and satellite communications to ensure that resources are never out of range. (www.Air-trak.com)


Paul Shanayda, president of afterimage GIS (left), and Bizhan Nasseh, head of Ball State University's Office of Wireless Research and Mapping (right), accept a 2007 Special Achievement in GIS award from ESRI president Jack Dangermond.

**Ball State University's Office of Wireless Research and Mapping (OWRM)** and its spin-off company, **afterimage GIS** (Indiana) pioneered the Digital Middletown project to test the value and impact of long-distance, high-bandwidth wireless technology in a community setting and create visual representations that reveal where signal strength is strong, weak, or blocked. This approach helps service providers locate ideal places to build communication towers, pinpoint potential trouble spots, and indicate which residents can receive service in an area. (www.bsu.edu/owrm or www.afterimagegis.com)


From left, Carlos Tapia (IBM), Alfonso de la Puente (Sitesa), Miguel Angel Sancho (Telefónica de España), Jack Dangermond (ESRI president), Alfonso Rubio (ESRI España) and Juan Herranz (ESRI España) enjoy the spotlight during presentation of a 2007 Special Achievement in GIS award to Telefónica de España.

**Softbank BB Corporation and Softbank Mobile Corporation** (Japan) developed an integrated marketing strategy based on GIS analysis to support a multiservice business expansion for Softbank's ADSL, fiber, and mobile phone services. Softbank's automated GIS area analysis system maps areas of potential customer demand in support of the business expansion. Softbank also uses GIS for integrated infrastructure planning and network traffic-management activities. (www.softbank.co.jp/en, www.softbankmobile.co.jp/en, or www.softbankbb.co.jp/en)

**Telefónica de España** (Spain) provides fixed line and broadband services to the Spanish market and is the largest wholly owned subsidiary of the Telefónica S.A. Group, the second largest integrated telecommunications operator by market capitalization. (www.telefonica.es/accionistaseinversores)

**Verizon Wireless Network Geographics** (New Jersey) has developed and deployed an enterprise GIS that includes a large geodatabase (ArcSDE). The geodatabase is fed by multiple enterprise databases and utilizes ArcIMS as well as the ArcSDE Java API to display a myriad of information about the Verizon Wireless network. (www.verizonwireless.com)


Verizon Wireless Network Geographics team member James Boehmer (left) and team manager Andrew Hendrickson (right) receive the 2007 Special Achievement in GIS award from ESRI president Jack Dangermond.

## ESRI on the Road

**GSM Mobile World Congress**
February 11–14, 2008
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www.mobileworldcongress.com

**ESRI Worldwide Business Partner Conference**
March 15–18, 2008
Palm Springs, California
www.esri.com/bpc

**ESRI Developer Summit**
March 17–20, 2008
Palm Springs, California
www.esri.com/devsummit

**CTIA Wireless 2008**
**International Association for the Wireless Telecommunications Industry**
April 1–3, 2008
Las Vegas, Nevada
www.wirelessit.com

**Location Intelligence Conference**
April 28–30, 2008
Santa Clara, California
www.locationintelligence.net

**2008 ESRI International User Conference**
August 4–8, 2008
San Diego, California
www.esri.com/uc

### Submit Your Abstract for 2008 ESRI UC Consideration

**Abstract deadline is November 2, 2007**

Submit an abstract of your GIS successes and innovations for possible presentation at the 2008 ESRI International User Conference, to be held August 4–8, 2008, in San Diego, California. The event, the largest GIS conference in the world, convenes ESRI GIS users interested in learning about your innovative ideas and solutions for meeting your organization's GIS challenges.

More than 14,000 ESRI software and data service customers from around the globe will attend the conference. Share your knowledge and experience by giving a presentation that communicates your real-world GIS solutions and insights directly to this respected audience.

The following are benefits of presenting a paper:

- Make your expertise known.
- Broaden your professional experience.
- Meet and influence your peers.
- Stimulate discussion and exchange ideas.

Visit www.esri.com/ucpapers to submit your presentation idea by November 2, 2007.

# Enterprise GIS Performs for the Integrated Cable Service Provider

## Cable Can Build on Lessons Learned by Energy Utilities

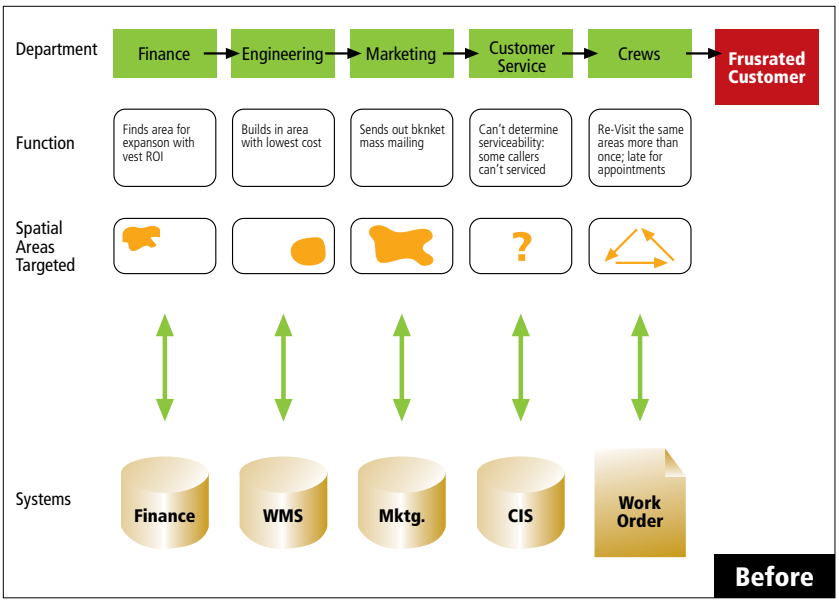
*By Will Shepard, Ph.D., PMP, Senior Consultant, Enspiria Solutions*

Cable operators faced with intensified competition from other telecommunications companies are moving into new markets and building a customer-centric organization to maximize marketing efficiency. GIS provides an ideal platform to integrate seemingly disparate applications and work processes and to create an enterprise that is more efficient, reliable, and responsive to customer needs. GIS provides a logical platform for integrating all these components because of the inherent spatial nature of an infrastructure-based business.

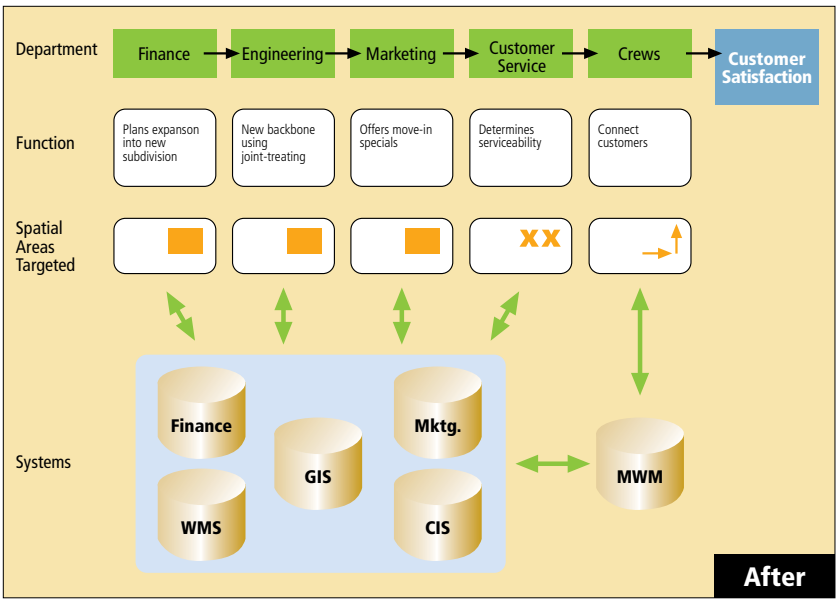
Energy utilities already use GIS applications to support end-to-end workflows all the way from finance and investment to customer service. Despite the cable and energy businesses having different drivers, cable operations can capitalize on lessons learned by energy utilities when developing successful enterprise GIS platforms.

Let's see how a hypothetical cable company, CableSmart, can leverage GIS and profitably grow its market using the following three lessons from the energy industry:

- Cooperative GIS data development and consolidated systems provide greater opportunities for synergy than does fragmented, ad hoc GIS development. The benefit is the ability to leverage combined departmental GIS development budgets and to attain better functionality, value, and timely updates than can be achieved with redundant systems in multiple departments.
- A consolidated, enterprise GIS provides a platform for integrating cross-departmental workflows, providing the ability to integrate value-added applications to support finance, marketing, and customer service.
- Enterprise GIS development is an undertaking that provides not only centralized technical GIS data and systems but also social and cultural benefits such as centralized workflows for creating, updating, and managing the GIS. By establishing dedicated resources to manage the GIS, the company allows other departments to focus on their specific contributions to the organization.




Departments that use isolated information miss out on efficiencies that data sharing and integration create.




The enterprise facility database integrates financial, engineering, marketing, customer, workforce, and location databases to enable efficient, coordinated efforts across the organization.

CableSmart's immediate tasks are to locate new high-revenue customers, determine their serviceability based on existing infrastructure, and efficiently connect them while optimizing investment in new network construction. CableSmart's current systems and data only support stand-alone applications developed on an ad hoc basis to address highly specific needs. CableSmart has some departmental GIS applications for specific engineering projects, but none are integrated with the company's sophisticated customer information system and thus cannot extract customer location details.

To plan the network expansion, the finance department develops a revenue forecast. It locates several high-revenue potential areas and, based on the analysis, determines that the selected areas will provide an acceptable return on investment (ROI). With the new network in place, a mass mailing campaign announcing the new services generates a high customer call volume, but actual sales results are much lower than forecasted. Investigation reveals that the engineering department chose to build in areas with lower construction costs, instead of in areas identified by the marketing plan. The inability of the marketing and engineering departments to work together cooperatively is part of the problem, but the ratio of high call volume to low sales has additional causes.

It turns out that indiscriminate mass-marketing mailings significantly increased the number of nonproductive calls to the sales center. Customers are calling from outside the serviceable area so these calls do not result in a sale. The high call volume also makes it harder for qualified customers to reach a sales representative.

Additionally, because facilities data is not available to the call center, potential customers sometimes have to wait days

just to learn whether they can be connected. Often, an expensive truck roll is required to determine serviceability.

In the field, installation costs rise when work orders are not scheduled with optimal routing and crews have to retrace routes across town. Inefficient routing also results in late or missed appointments that frustrate customers.

In summary, all of CableSmart's workgroups need access to accurate, up-to-date records. They need consistent marketing, facility, and customer information to correlate newly activated service areas with qualified customer locations. Overall, the company needs to improve workflows through an integration of systems and a common operating picture of the data.

Cooperative development and use of GIS data resolve many of these integration and data-sharing challenges. Information contained in an enterprise geodatabase provides controlled access for multiple user groups so that data owners continue to manage the quality of their own data but also share it. Server-based environments, such as ESRI's ArcGIS Server, publish enterprise GIS data in a shared Internet or intranet environment to workgroups that need it.

These are technical solutions. However, from a cultural perspective, departmental groups must overcome natural tendencies to focus on individual needs and start adopting a strategic, enterprise-focused viewpoint.

When CableSmart centralizes spatial data access and management in a geodatabase with ArcGIS Server, the opportunity for enterprise-focused, value-added applications becomes available. These applications allow the cable operator to leverage its enterprise GIS investment to support end-to-end workflows for finding, connecting, and serving customers.

CableSmart's resulting enterprise facility database contains the locations of assets such as the cable, repeaters, and multiplexers; demographic data for profiling high-potential locations for investment; and property records for identifying new construction and thus opportunities for new customers. Expanding into a new housing development using its new enterprise GIS, CableSmart uses property records to engineer a new backbone into the subdivision and determines that joint-use trenching with the local electric company will reduce costs. Engineering specifications, customized using existing facility records and individual property records, are used to generate work packages for field crews. A mobile workforce management (MWM) application provides field crews with detailed drawings and driving directions to the work site. The crew installs the backbone, uses mobile GIS with integrated GPS receivers to record precise locations and joint-use trenching information, and sends the installation report to the main office via the MWM.

Next, CableSmart tailors a new marketing campaign to offer a move-in special only to those in serviceable areas. This substantially reduces marketing costs by targeting only serviceable customers.

During just one phone call, the customer service representative quickly validates whether the customer's address is serviceable by viewing mapped facility records online, offers a customized channel package designed specifically to fit the customer's demographic profile, then schedules an installation date. The service request automatically generates a connection work order through the GIS-based integrated MWM and schedules the crew. After the crew connects the customer, the completed work order is transmitted from the field through a wireless device to update the customer information system and initiate billing.

Using the energy utility model as a launching pad, cable operators can thus maximize return on investment in GIS data and systems development and achieve a truly integrated enterprise that helps meet the goals of growing markets and obtaining and retaining satisfied customers.

For more information on Enspiria Solutions, visit www.enspiria.com.

Will Shepard, Ph.D., PMP, is a senior consultant with Enspiria Solutions. He offers expertise in enterprise and mobile GIS and geospatially enabled applications including work and asset management, land management, graphic work design, outage management, and network analysis. He holds a B.S. in mathematics and an M.S. and Ph.D. in geography.

## Telecom Trends

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

**GIS—We're Going Mobile**

Multimedia-capable cell phones currently dominate the mobile technology headlines, exemplified by long lines of people waiting outside stores in June to buy a new Apple iPhone. However, a more subtle and less publicized revolution that can have a greater impact on our lives is also taking place—the integration of GIS with wireless communications.

As an example, a month ago, a friend of mine who recently purchased a new home was in the midst of the dreaded phase of waiting for new appliance and service deliveries. Attempting to empathize, I cautiously asked her how it was progressing. In a rather exasperated voice, she told me of that morning's fiasco of a promised washer and dryer delivery; she waited well past the promised four-hour delivery window but the appliances never arrived.

She was even more depressed at the prospect of another long wait for the new refrigerator's delivery. When she mentioned she had purchased the refrigerator from Sears, I told her, "Don't despair, Sears is a longtime ESRI customer and has a great delivery record. It uses a combination of ESRI's GIS technology and wireless communications to schedule and optimize the routing of its delivery and service trucks." When I checked back with her later, she happily told me that, indeed, Sears had met the scheduled delivery time.

Increasingly, companies with mobile assets, such as Sears, are streamlining their field operations with GIS technology that optimizes scheduling and routing and incorporates wireless devices for monitoring and communications. Companies are reducing their previously unachievable four-hour delivery commitment windows to two hours—and are routinely meeting them. With this improved efficiency, technicians are handling up to one additional call per shift. Some companies are even going so far as to allow their technicians to take their vehicles home at night. This reduces miles driven as well as fuel and maintenance costs. These companies do not worry about unauthorized private use of the vehicle since they can monitor the vehicle's whereabouts 24 hours a day.

Wireless and GIS combinations are also helping save lives. This issue of *Telecom Connections* features an article about how the Loma Linda University Medical Center is tracking and managing its emergency resources using GIS and wireless communications.

Whether improving efficiency or saving time and lives, mobile GIS has just begun to deliver new benefits to our businesses and communities.

Best regards, Randy

# Location Tracking and Communications Systems Give Emergency Responders Vital Time-Saving Advantages

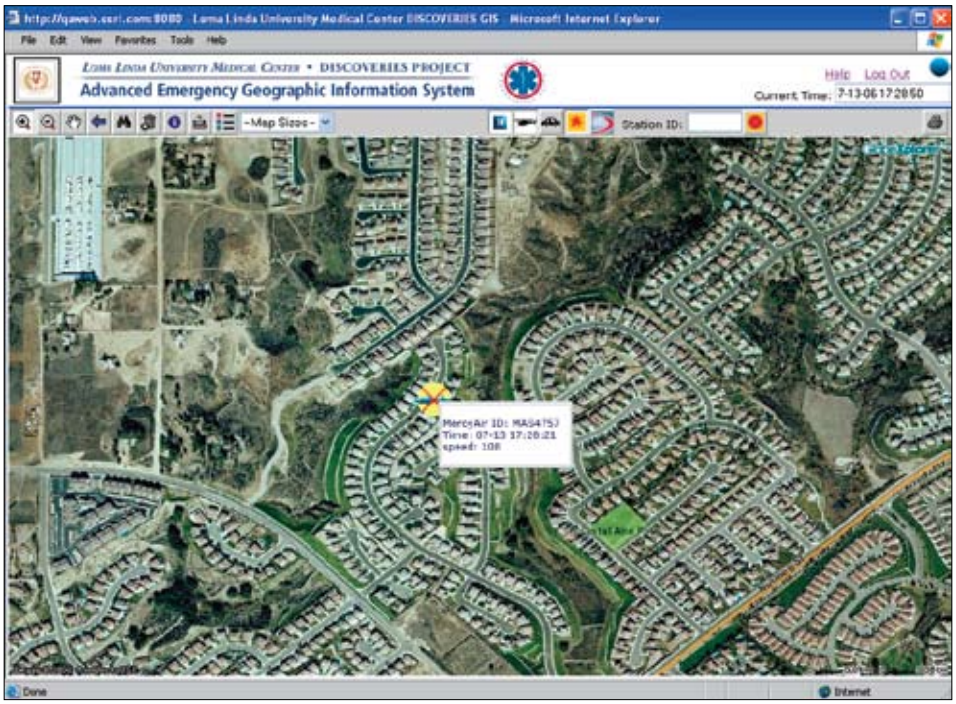
Loma Linda University Medical Center (LLUMC), strategically located in the center of Southern California, serves a vast area with a population of more than 3.3 million. This geographically diverse region spans some of the largest urban, rural, and wilderness areas in the country. LLUMC is the only level-one regional trauma center for San Bernardino County, where it is located, as well as Inyo, Mono, and Riverside counties.

In emergency response—especially medical situations—every second counts. Often, the most critical time factor is the availability of basic information: Where is the patient located? Where are the nearest and most appropriate emergency resources (ambulances, helicopters, hospitals, firefighters, police officers)? How quickly can they get to the patient?

Collecting this information can use valuable time. As emergency medical services director for LLUMC, Dr. Jeff Grange has often witnessed the problem firsthand. "In addition to working at Loma Linda, I fly with the San Bernardino County Sheriff's Air Rescue Team and work as their medical director," says Grange. "I was on the helicopter one day when we had just dropped off a patient. As we were flying back, a little 6-year-old girl was run over by a car and we were only about 30 seconds away. But the County Communications Center didn't know we were right there, so they dispatched a helicopter from Anaheim that was more like 30 minutes away. It became clear that we weren't getting the right information to the right people to make the right decisions in a timely manner."

Recognizing that the challenge was fundamentally geospatial in nature, Grange and his LLUMC colleagues contacted ESRI to discuss some general concepts. ESRI then developed a Web-based system (the Advanced Emergency GIS, or AEGIS) that monitors and maps the location and status of emergency resources such as hospitals, air ambulances, and rescue helicopters. Real-time vehicle location and tracking data is provided through Air-Trak.

The LLUMC Center for Prehospital Care's new 30-foot-long mobile telemedicine vehicle, seen here on display during the 2006 ESRI International User Conference, is a high-tech disaster response vehicle that contains an X-ray machine, computers running the Advanced Emergency GIS system, a satellite television that provides a video link to the medical center, and more.




The Loma Linda University Medical Center's AEGIS system uses ESRI and Air-Trak, Inc., technology to display a combined map and satellite image on a computer screen and indicate the date and time and a helicopter's location, identification number, and air speed. Location, tracking, and communications systems combine GPS data with wireless and Internet technologies to collect and display real-time information.

The AEGIS server receives continuous data feeds and photos that show where air ambulances are dispatched and freeways are congested. At the medical center, a mobile intensive care nurse can see the information on a digital map displayed on a 40-inch LCD monitor. The map layers also include road, school, and shopping mall locations.

By glancing at the screen or clicking a button marked with symbols, the nurse can see an instant snapshot of

- Which hospital emergency rooms in San Bernardino and Riverside counties can accept more ambulances. A green H symbol on the map indicates emergency room availability, while a yellow H means the emergency room is busy and requesting diversion of ambulance patients to a different hospital.
- The current location of air ambulances, rescue helicopters, and other emergency vehicles.
- Traffic congestion and accidents on area freeways.

"Those features and others on the AEGIS system help emergency personnel—whether they're at a hospital or in a communications center—route patients faster and to a hospital that specializes in the care they need," says Grange. "In the past, emergency vehicles have occasionally run into traffic jams. By consulting the freeway camera feeds and traffic incident reports on the computerized map, emergency personnel can plan alternate routes to the hospital."

After exploring some general concepts with ESRI, Grange and others obtained federal funding to build the AEGIS system.

Part of the challenge in developing AEGIS was the fact that emergency medical services (EMS) are fragmented, with numerous fire departments, police departments, ambulance companies, hospitals, and other resources involved. LLUMC wanted to build one system that could become a community resource for all these EMS organizations, enabling them to be fully coordinated, with each one having situational awareness of what the others were doing.

"I think the unique aspect here is the number of sources of information we've brought together in one user-friendly system," Grange explains. "We integrated the hospital diversion statuses and the locations of all the fire departments, schools, and law enforcement officers. We integrated real-time traffic and weather conditions."

"This is the first time that a hospital emergency department has had the tools to achieve situational awareness from multiple sources in one view," says Bill Davenhall, Health and Human Services Solutions manager for ESRI.

Real-time vehicle location and tracking information is also a central component, according to Grange. "We looked all over the country for somebody that had current, off-the-shelf technology that could be integrated with the ESRI system, but also something that would be flexible. Air-Trak stood out because it really has it all. You have the options of using a basic cell phone or an in-vehicle unit with a cellular antenna or even satellite communications, so we literally have coverage everywhere."

Air-Trak also has a relationship with ESRI and a history of working with ESRI software. Integrating the Air-Trak service was very smooth, and it happened very quickly.

The ESRI application can also be replicated elsewhere, according to Davenhall. "This unique system has been developed for LLUMC, but the solution can be implemented for any hospital or EMS organization in the world."

Grange agrees that much of the system's power lies in its flexibility. "If you're an EMS organization and you want to add where your hazmat teams are or your caches of antibiotics or anything else, you can add those as additional layers.

"We've already built the software and now we'd like to see it be a community resource not just here, but regionally and nationwide," says Grange. "This is basically current, off-the-shelf technology, so someone can take this system today and start using it anywhere in the country. We'd love to collaborate with other organizations."

From hospitals to dispatch centers to field personnel, the AEGIS system fills a critical need for EMS users everywhere. In the past, an ambulance might have been directed through bad traffic or even through another accident scene. Now, with AEGIS, the base hospital can see everything in real time. When someone makes an emergency (911) call from a cell phone, the location shows up on the map and the team can respond accordingly.

Grange concludes, "To put it simply, this is a powerful tool that can help save lives."

For more information, contact Gregory White by writing to gwhite@air-trak.com or visit the Web site www.Air-trak.com. Air-Trak, Inc., provides location, tracking, and communications systems that combine GPS data with wireless and Internet technologies for real-time, historical, and exception-based reporting. Operating over cellular and satellite networks, the Air-Trak system facilitates the development of custom applications and integration of real-time tracking data into enterprise applications.


A real-time traffic camera's view of a busy freeway is displayed on top of a street map marked with the locations of hospitals (indicated by an H), camera locations (red camera icons), and traffic speed and volume sensors (green flags). A user can hover the mouse over map features to display additional information such as traffic collision status.

## LBS Competition Challenges Developers

*Registration is now open.*

ESRI is again a sponsor for this year's North America NAVTEQ Global LBS Challenge, an annual competition that provides developers with the opportunity to showcase their location-based solutions and win a variety of prizes. Entrants register solutions in one of five categories: Enterprise, Entertainment/Leisure, Navigation, Social Networking, or Third-Party Content. Prizes include cash, licenses for the use of NAVTEQ data, and licenses for ESRI's ArcWeb Services.

"ESRI's ArcWeb Services offer the perfect set of interfaces for mobile application developers looking to build winning solutions for the LBS Challenge," says Randy Frantz, telecommunications and LBS industry solutions manager for ESRI. "Because the APIs go well beyond basic maps and directions, developers can focus on solving business problems rather than spend precious development cycles building complex mapping functionality from scratch."

Winners will be announced at the CTIA Wireless 2008 show, to be held April 1–3, 2008, in Las Vegas, Nevada.

To register, visit www.esri.com/events/challenges/lbs.

## Thanks to Our 2007 ESRI UC Sponsors

Telcordia Technologies is a leading provider of telecommunications networking software and professional services. Telcordia helps customers optimize existing networks, transition to higher levels of service, and build new networks. The Network Engineer application, developed using ESRI's ArcEditor, allows telecommunications network providers to design, document, and maintain inside plant/outside plant fiber, copper, and coaxial networks.

Tele Atlas North America, Inc., delivers the digital maps and dynamic content that power some of the world's most essential navigation and location-based services. The company collaborates with pioneers in the personal navigation, Internet, wireless, automotive, enterprise, and public sector markets. Tele Atlas Connect provides digital map coverage of more than 200 countries and territories worldwide.

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