Location-Based Services for Homeland Security

By Harry Niedzwiadek

Most of the attention in early stage LBS technology and market development efforts has gone to mass-market offerings for mainstream wireless customers. However, as LBS platforms mature, it is becoming increasingly apparent that LBS is just another step down the road towards the pervasive use of geospatial technology and data for mobile applications in government and private enterprises as well. The Geographic Information System (GIS) industry started marching down this path even before LBS came along, as they built and deployed "Mobile GIS" applications. LBS extends the reach of such GIS-based applications through commercial wireless networks, the Internet and lost cost mobile terminals.

We should not underestimate the value of GIS technology in the LBS equation. Approximately two and a half years ago, just as LBS was emerging, many were claiming that LBS was not at all like GIS due to the wireless mobile customer focus. At that time, Jack Dangermond, President and CEO of ESRI, the global GIS leader, expressed the view that LBS was merely one step further down the GIS evolutionary path. He indicated that he had heard similar claims in the past when new other geospatial market niches emerged, only to find out later that it was indeed an evolutionary step for GIS. Most in the LBS industry now share in this conviction. It is through GIS after all that the full value of location will be realized (anyone who really understands GIS knows this).

To gain insight into how LBS may apply to Home Land Security (HLS) is to first understand the value and application of GIS (geospatial data and technology) to HLS. Knowing this, we can then begin to look at the subset of GIS capabilities that best fits LBS (i.e., all location-based applications for mobile users and assets). The principal value of GIS to HLS can be broadly characterized as: 1) providing "foundation" data for HLS missions, and 2) providing a broad range of spatial-temporal tools to plan, model, analyze, collaborate, monitor, simulate, integrate and visualize HLS problem sets. In short, GIS is fundamentally important to HLS. Ultimately, through a wide variety of applications, GIS supports HLS decisions makers and other active participants in planning, risk assessment, surveillance, intelligence, detection, prevention, protection, preparedness, damage assessment, response, public safety and recovery operations, across all levels of Government, and with the public and industry.

In his July 2002 interview with Potomac Tech Journal, Steve Cooper, CIO of the U.S. Homeland Security Office, identified the following technologies as most crucial to his mission: *geospatial software*, knowledge management, infrastructure, wireless, collaboration, modeling and simulation, middleware and database technology. It shouldn't come as a surprise that he listed geospatial software first, given his mission. And although he didn't specifically mention LBS, he did include all essential component

technologies: geospatial software, infrastructure (Internet), wireless, collaboration, middleware and database technology. Furthermore, Cooper states, "I want new technology. (For example) I'm after the next generation of database technology…" As an emerging, new integrated technology, LBS certainly fits this bill.

More specifically, how does LBS fit into the HLS problem-solution space? To start with, LBS provides the means to exploit wireless networks. This is important for two reasons. First, wireless LBS solutions directly support mobile users and applications that involve mobile assets and other dynamic factors through location-sensitive services. This is especially important in time-critical situations like emergency response where numerous first responders and support personnel are deployed to the field and they need to be supported by a complex, distributed command, control and support system. Second, experience shows that redundant communications are extremely important in crisis situations. Multi-modal communications are crucial to crisis operations. Terrestrial networks may fail during a catastrophic event. Wireless networks provide additional choices, including cellular packet, radio packet, and satellite networks. Add to this the emerging Wi-Fi network (based upon IEEE 802.11b), with nodes that are rapidly popping up across the U.S., and we will have an affordable broadband connection with the field. (Visit Wi-Fi grassroots movement if you are interested in step-by-step instructions on how to build your own inexpensive Linux 802.11b node.)

Public safety and emergency response top the HLS priority list for most state and local jurisdictions. There are important gains to be realized through the application of LBS technology in these areas. The first priority is to equip first responders with the right, timely information they need for their public safety and response efforts. Today most first responders are limited to voice (radio) communications. This dramatically limits their ability to receive the right, timely information, like the location (on a map) of a particular address, driving directions to get there, identifying the best ingress to a building, locating their buddies on the scene, time/location-sensitive security and evacuation information, and much more. Mobile terminals and LBS technology satisfy the requirements for exchanging the right, timely information between responders, emergency operations centers and related command, control and support elements. But are local law-enforcement agencies really ready for these capabilities? Local law-enforcement officials in Memphis and Shelby County, Tennessee, certainly believe so. They have a new program – the Mobile Kiosk – that serves officers in the field with a wireless-Internet one-stop-shop to meet their information needs. Nextel provides this end-to-end solution consisting of Web services delivered over their network to Internet-ready i85s and i90c phones. Similarly, the Center for Disease Control (CDC) believes that wireless mobile terminals equipped with GPS provide a more efficient way to respond to a health threat.

Thanks to a gift by the Marcus Foundation, CDC will soon be able to make broad use of location-based wireless services for mobile field operations through their state-of-the-art operations center.

Critical infrastructure protection is another important application area that will benefit from LBS. “Critical infrastructure” is any infrastructure elements that can cause major economic and social harm if there is an outright failure or disruption in availability of the element. This includes telecommunications, transportation, water supply and electrical power systems; gas and oil production, storage and distribution systems; banking and finance; emergency services; health services; and essential government services. Since infrastructure systems are made up of geographically dispersed physical assets and people, organizations that are responsible for protecting critical infrastructure must be able to quickly compile location-based data in the field, monitor assets, and make these information available when and where needed during time critical crisis events. Applications based upon LBS technology would fulfill many of the needs to collect and disseminate critical infrastructure information.

Bill Schroeder, Homeland Security Industry Manager for ESRI, believes that LBS will have many other useful applications in HLS. A few of the more significant of these applications are security and intelligence operations, notification systems for emergency responders, search and rescue, public notification systems, and emergency preparedness. Mobile security and intelligence operatives can employ LBS to assist in monitoring people and resources in space and time, and they can stay connected with emergency operations centers to receive continuous updates regarding the common operating picture for a situation. These centers can also employ call-down systems to automatically notify all possible first responders based upon the nature of an emergency, and then use LBS to direct and monitor their efforts. Emergency operations centers can similarly coordinate search and rescue operations. Call-down systems can also be employed to notify public in affected disaster areas. Location-based public information services can provide time-sensitive details concerning nearest available shelters, safe evacuation routes, nearest health services, and other public safety information. Finally, LBS can be applied in emergency preparedness training and rehearsal efforts for first responders, security and public safety personnel.

The role of LBS standards is crucial to HLS missions. Technology solutions for HLS must contend with the basic need to interoperate across the spectrum of participants. Within the U.S., this is presently being addressed through many e-Government initiatives that are defining and constructing the standards-based infrastructure required to discover and use distributed data and services. These initiatives seek to be as inclusive as possible, spanning all levels of Government (Local, State, Tribal and Federal), as well as academic, commercial, and other non-Government organizations.

The telecommunications industry is leading efforts to produce the wireless-Internet standards upon which LBS depends. But it is also important to have standards for location-based application services that are based upon proven GIS technology. Through the OpenLS initiative, the Open GIS Consortium will soon release to the public the specifications for their open location services platform, called the *GeoMobility Server*. This platform features specifications for the core services (LBS building blocks) and the information model upon which most common location-based applications would be based. The technology will soon be showcased at events in Washington, DC, October 24th-25th 2002, and Nice, France, November 18th 2002. As an example of the relevance of LBS to HLS, the Washington event will feature a disaster demonstration involving coordinated emergency response and public safety capabilities.

Look to the GIS and LBS industries to be very active in addressing the variety of needs to provide effective geospatial-temporal solutions for HLS. GIS provides a critical baseline technology and foundation data for HLS. LBS extends GIS capabilities to mobile users and applications, especially for time/location-sensitive operations.

(Images are courtesy of ESRI)