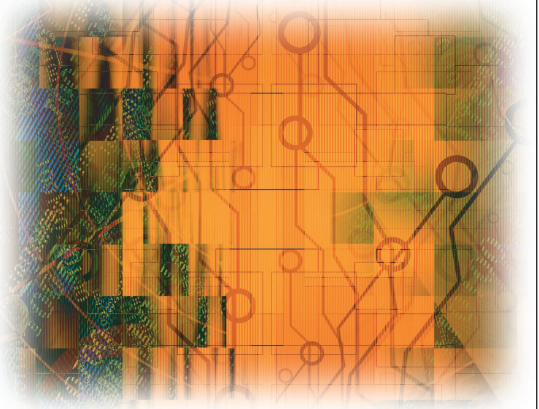


# Will Mobile Computing's Future Be Location, Location, Location?

➔ Steven J. Vaughan-Nichols



**A**s mobile computing has become more popular over the past decade, experts have touted the future of location-based services.

LBS systems could determine mobile users' locations. Proponents say they could thus enable applications that would not only tell people where they are and how best to get to their destinations, but also whether friends are nearby, what the local weather forecast is, and where businesses of interest in the area are located.

The technology could also help companies track packages or vehicles, noted Brent Iadarola, research director for mobile and wireless technology with Frost & Sullivan, a market research firm.

"As far as the mobile industry is concerned, LBS is of utmost importance as it is the key feature that differentiates a mobile device from traditional fixed devices," said Laurent Perche, head of solutions for strategy and marketing at telecommunications vendor Alcatel-Lucent.

With this in mind, telecommunications, device, and software companies throughout the world have invested large amounts of money in developing technologies and acquiring businesses that would let them provide LBS.

However, despite the technology's enormous promise, it has not taken off in the marketplace, said Larry

Delaney, general manager for Pitney Bowes MapInfo's LBS Business Unit.

According to Iadarola, "We're seeing an overall market penetration of less than 5 percent of all mobile devices [worldwide]."

Adoption, Delaney said, has grown slowly because of the weak economy; competing investment priorities for potential users; and until recently, a lack of compelling applications.

Other contributing factors include security and privacy concerns.

Vendors are working to deal with these issues. Some industry observers say this will make LBS commercially successful quickly. However, others say the technology could take more than five years to become a mainstream technology.

## INSIDE LBS

For landline users, the first LBS systems emerged in the mid-1970s in the US and identified the location of callers who dial the 9-1-1 emergency phone number.

The first mobile LBS application was the US Department of Defense's NAVSTAR Global Positioning System, a navigation-oriented project that began in the early 1970s, went fully operational with all 24 satellites in 1995, and was made fully available for civilian use in 2000.

GPS's initial consumer deployment was the Magellan Corp.'s 1989 release of a handheld receiver to help with user navigation.

Several countries, such as the Russian Federation with its Russian Global Navigation Satellite System, as well as the European Union with Galileo, have introduced their own GPS-like networks.

By 2001, LBS applications were becoming more sophisticated, offering advanced services such as those that determine whether a user's friends are nearby, said ABI Research principal analyst Kenneth Hyers.

## Today's marketplace

Most major telecommunications providers worldwide offer LBS.

Numerous companies—such as Garmin, Magellan, and TomTom International—sell dedicated GPS devices, principally for navigation.

Several manufacturers—including Nokia and Research in Motion—sell mobile phones that provide LBS.

Various chip makers manufacture processors that provide devices with LBS functionality. For example, Qualcomm makes the gpsOne chipset for cell phones, noted Leslie Presutti, the company's director of GPS product management.

Many software vendors—such as Google—offer applications that utilize location-related information, primarily to provide basic navigation functionality.

These companies' products and services work together to provide location-based services, as Figure 1 shows.

## Under GPS's hood

Most LBS is based on GPS or similar systems. Each of a system's satellites transmits low-power, ultra-high-frequency, line-of-sight radio signals.

When a GPS-enabled phone, vehicle, or other host connects to three or more satellites, the system analyzes factors such as signal timing and strength and then uses triangulation to determine the device's location based on its distance and direction from the satellites.

## Augmenting GPS

Because GPS-like systems use low-power signals, to avoid interference with ground-based radar, they don't penetrate buildings or mountains well. This can cause accuracy problems in some areas.

Therefore, LBS devices frequently augment GPS with other technologies, such as the national and regional Differential GPS Systems throughout the world.

The Wide Area Augmentation System serves just the Western Hemisphere.

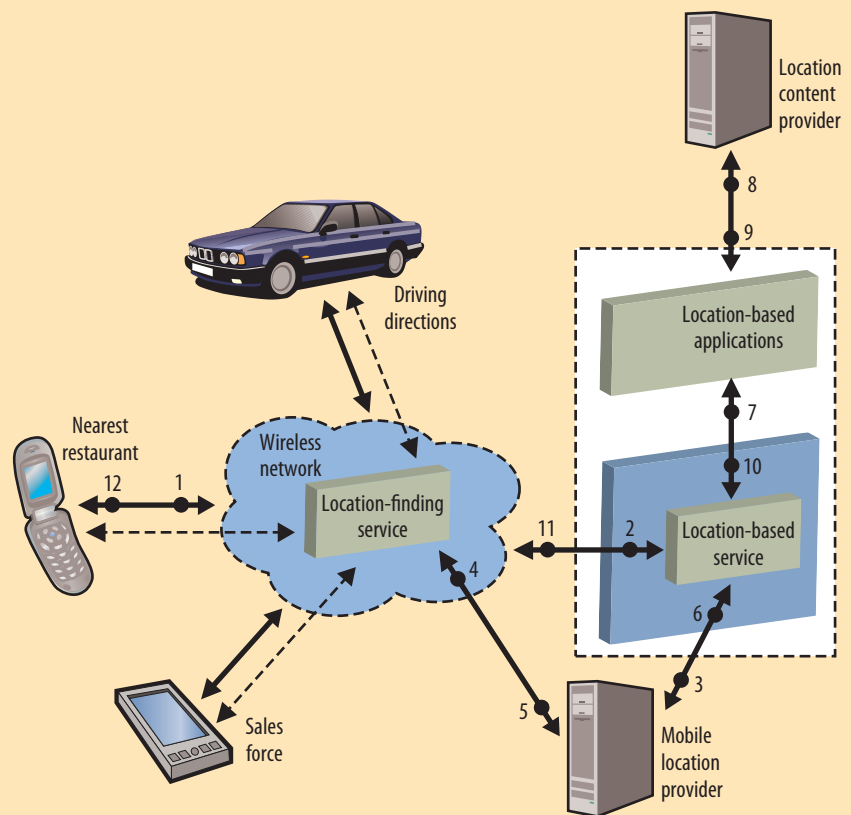
These systems, in essence, access ground-based reference stations—whose exact locations are already known—to measure inaccuracies in GPS readings. The systems then send corrective information to make GPS readings more accurate.

**Cellular or Wi-fi triangulation.** Cellular systems can provide location services via triangulation based on a phone's distance from the cell towers to which it connects at a given time.

Wireless systems can also employ triangulation to determine a user's location based on a device's distance from Wi-fi access points.

These approaches determine distance via calculations based on signal strength.

Systems can execute these techniques by themselves or, to improve accuracy, with each other or also with GPS.



**Figure 1.** Diagram shows how various products and services work together to provide location-based services.

The service provider can perform the necessary computations on its servers. However, as mobile devices have become more powerful, their CPUs have increasingly been handling the processing.

Skyhook has LBS software that determines location via the triangulation of cellular and Wi-fi signals, without using GPS. Apple's iPhone and iPod Touch include the software.

Other companies are also exploring this approach. For example, Google's My Location service for mobile devices, currently in beta, uses the company's database of cell tower positions to triangulate locations, noted software engineer Mike Chu, who is working on the project.

Google has also introduced a My Location version that triangulates Wi-fi signals.

With the Google and Skyhook services, the software will also use GPS

to improve accuracy if the host device can work with the technology.

**Assisted GPS.** Today's GPS-enabled devices often don't have the processing power to do the calculations necessary to determine their location.

In this case, the LBS systems use Assisted GPS. They send GPS- and cell-based location information via a cellular or Wi-fi link to a service provider's assistance server.

The server then helps calculate the location and transmits the information to the device.

**Skyhook's XPS.** Skyhook Wireless' Hybrid Positioning System (XPS) software triangulates data from Wi-fi access points and combines it with information from GPS and cellular capabilities to provide LBS.

Leveraging GPS and Wi-fi capabilities yields LBS readings faster than using GPS alone, reducing response times from up to a minute to just a

few seconds. With additional data points, the system doesn't have to use less reliable and more calculation-intensive approaches to determine location.

Skyhook's use of many data readings and database of precise locations for about 50 million Wi-fi access points adds accuracy to the process.

In fact, XPS is accurate to within 10 to 20 meters, according to company chief technology officer Nick Brachet.

Skyhook is working with chip makers—including Broadcom, CSR, and SiRF Technology—to include XPS capabilities in their mobile-device processors, said Chris Hazelton, an analyst for The 451 Group, a market research firm.

are on an online map.

Developers can use the free Google Geolocation API to create their own applications using the company's location-related data.

Another increasingly popular approach links LBS and the mobile Web browser.

For example, Skyhook offers its Loki Wi-fi-based LBS plug-in for Mozilla browsers. Loki lets users check maps to find their locations and the locations of nearby businesses that have Loki-enabled Web sites.

Mozilla plans to integrate Loki into its Firefox 3.1 browser.

Mozilla's Geode is a Firefox add-on that provides similar services but with more privacy options. With Geode, when a website requests users' loca-

platforms. Transforming the software so that it can work with other applications is taking time.

### Interoperability

According to Frost & Sullivan's Iadrola, carrier interoperability issues will delay LBS infrastructure rollouts. For example, Verizon Wireless users can't currently employ a buddy-finder application to locate a friend who's on the Sprint Nextel network.

This is because there is no real-time mechanism to share geospatial information between carriers' networks.

Until LBS data use is standardized between services, said ABI Research's Hyers, interoperability will be a concern.

The W3C's Geolocation Specification, which Geode works with, is a potential standard but currently is just an informal proposal with no adoption timetable.

The specification would define an open API that provides applications with access to a host device's location, determined by GPS or other means.

## Several issues, such as security and privacy concerns, have contributed to location-based services' slow adoption.

### A few implementations

Some software-development companies have created applications that work with LBS information, said Colleen Parent, a senior project manager for GlobalConnex network services at Intelsat, a fixed-satellite service provider.

For example, Xora's GPS TimeTrack business-productivity application lets companies determine the most efficient way to route drivers and also monitors the location of equipment and field workers.

AT&T offers Xora applications, which work via software run on GPS devices within vehicles or equipment, or on workers' GPS-enabled phones, said Igor Glubochansky, AT&T's director of industry solutions.

For consumers, Loopt—which works with QPoint's location-based server software—is offering the Buddy Beacon application that lets users see where participating friends

tions, a notification bar lets them specify whether they want to provide specific, general, or no information.

Microsoft will include LBS capabilities in its upcoming Windows 7. According to company program manager Alec Berntson, "Windows 7 will have an LBS API and will use all available location data, including GPS, Wi-fi, and cellular triangulation."

### SLOW ADOPTION

Several issues, such as security and privacy concerns, have contributed to LBS's slow adoption. The ability of LBS users to easily find out the location of one another could lead to privacy-related problems, said Matthew McCormick, president of telecommunications consultancy Technology Decisions.

Also hurting adoption is the ongoing transformation of LBS software from being single-purpose applications to being part of multiprogram

### Low demand in Europe

Mobile navigation is more widely used in the US, which will require all phones and networks to be able to tell police and fire personnel the location of mobile callers dialing 9-1-1 by 2012. This e911 directive has prompted cellphone makers to include GPS chips on all new US handsets.

In Europe, where there is no similar government mandate and perhaps less perceived demand, the technology has been slower to take off.

### Miscellaneous

The location industry hasn't settled on important issues such as preferred business models, ideal types of host devices, and the best technical approaches.

Also, developers have had trouble bringing LBS applications to the mass market because of the complex coordination they must perform with

wireless-service providers and phone makers. They must make sure their software works not only with a set of devices but also with carriers.

## LBS FUTURE

Over time, technology improvements and economies of scale will make LBS less expensive to provide, which could help its adoption.

Also, Google, Nokia, and several start-ups that produce LBS software are working with service providers and phone makers to develop a universal way to access location data. This way, their applications could work with multiple carriers and devices.

According to industry observers, LBS will continue to be most widely used in dedicated navigation devices and cell phones.

The technology will also increasingly become an embedded or plug-in feature in vehicles, according to Chris Smith, director of optimization strategies, including those involving LBS, at search-engine-placement marketing firm KeyRelevance.

"We've already seen a huge rise in GPS devices in vehicles in recent years," he noted, "and the competition, coupled with reduced costs, indicates it'll soon be affordable enough to be included in all cars."

He said mobile computers such as laptops and mini-notebooks may begin to use LBS extensively, too.

The industry's principal business models will be the sale of stand-alone devices, such as those used for navigation, and fees from telecommunications carriers and other service providers for individual transactions, said Claudio Schapsis, vice president of business development for the Isaac Daniel Group, an LBS vendor.

Services could also aggregate LBS data from mobile-device users in an area, without including details that identify individuals, he noted. They could then sell the information to companies to help them target broad local advertising and marketing,

both directly to cell phones and on other media such as billboards, he explained.

"The hot area for LBS will be in mobile advertising. The ability to serve relevant ads based on a person's location will be massive," predicted Abelson Group CEO and telecommunications-marketing expert Jennifer Abelson.

Schapsis added that mobile location-based social networking—such as buddy finders—will also become important.

**F**rost & Sullivan's Iadarola predicted that 20 percent of mobile-device users globally will utilize LBS by 2012.

ABI Research director Dominique Bonte predicts LBS will generate \$13 billion in revenue in the US alone by 2013, up from \$515 million in 2008.

Alcatel-Lucent's Perche observed, "Nokia has already spent big bucks on LBS with the acquisition of Navteq for more than \$8 billion."


Apple has added LBS capabilities to the iPhone 3G, he added, and Sprint has signed a deal with uLocate Communications to provide an LBS platform for Sprint's WiMax-based wireless service.

According to Iadarola, LBS will become commonplace eventually but not necessarily soon because of the sour global economy and the technical and marketplace challenges the approach still must overcome.

For the technology to succeed, demand will have to increase outside the US, and vendors will have to find successful business models and address issues such as interoperability and privacy. **■**

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