Location–Based Services

Not as simple as they sound

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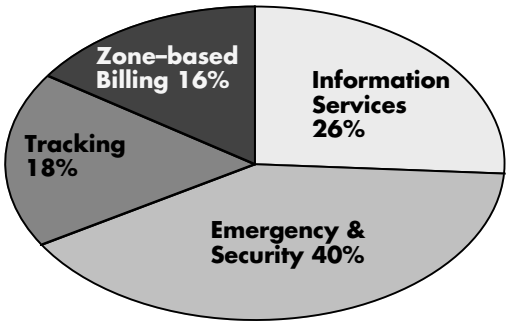
Many people, and I'm one of them, think that location–based services (LBS) will be central to the future mobile proposition and essential to mobile commerce. The magnitude of the LBS revolution that's about to hit is impossible to overstate. As Michael Specter put it in *The New Yorker* [1]:

> *Our children may never fully understand the word 'lost', just as few people under the age of ten have any idea what it means to 'dial' a phone number.*

The advent of LBS has immediate implications for business. It could well be, for example, that the most important factor in established mobile operators' positions in the m–commerce value chain will come from their control over the location information that merchants and others will need to provide effective mobile services. Strategy Analytics predicts annual revenue from location–based services in Western Europe will reach $9 billion in 2005 (and another $7 billion in North America) but the m–commerce revenues dependent on these services may be significantly higher [2]. Ovum forecast something similar (22 billion worldwide, but only 9 billion of that to operators) [3]. Gartner forecast $12 billion in 2006 in Western Europe alone, with the revenue breakdown as shown in Figure 1.



Source: Garner (5/01).

Figure 1. LBS Market 2006 (Source: Gartner, 5/01).

For mobile service providers, the various location technologies (as listed in Table 1) enable products and services that simply cannot be emulated on the fixed Internet.

Technology	Description
User Input	User enters a post/zip code or some similar location identification information.

Cell ID	The network knows which "cell" the handset is in. Works well in cities where cells are small.
GPS	Global Positioning System. Satellites enable a receiver to work out exactly where it is. The GPS receiver then (manually or automatically) tells the handset where it is and this information can be passed on.
A–GPS	Assisted GPS. Network sends rough location to handset so that it can use small number of appropriate GPS satellites to get a much quicker fix.
TDOA	Time Difference of Arrival. The network uses its base stations to triangulate a fix on the handset, based the time of arrival of signals from the handset.
E–OTD	Enhanced Observed Time Difference of Arrival. The handset calculates its position by triangulating signals from base stations or reports the triangulation measurements to the network (this known as assisted mode), which then calculates its position.

Table 1. Mobile Location Technologies.

As Table 1 indicates, location might be established through a GPS unit built in to (for example) the handset or some other piece of equipment (eg, the Casio GPS watch, shown in Figure 2) or it might be through the mobile network: the handset can work out where it is by triangulating from base stations (which requires hardware in the handset) or the network can work out where the handset is through a similar process. There is, however, another way of classifying LBS and that is as 'active' or 'passive':

- Active LBS. The handset, and potentially the subscriber, have to do something to work out where they are and then pass that information on under their control.
- Passive LBS. The subscriber, and handset, do nothing. The network works out where they are and can pass the information on without bothering them.

Figure 2. The Casio GPS Watch.

The implementation of mass–market location–based services (LBS) is imminent. In the UK, for example, Vodafone has already launched basic LBS[1] through its Vizzavi portal (so that users can search for their nearest ATM and so on) and Genie plans to launch a similar service early next year [4]. Cell ID can be reasonably useful in cities, where cells are small, but it rapidly becomes inaccurate as subscribers move away from city centres. Also, since cell IDs are not standardised, it's difficult to build third–party services that work across all operators.

Help! Call 999, 911 or 112

In addition to the technological and business pressures for LBS, there are good reasons why law enforcement and government agencies want to see it introduced. The first successful UK prosecution on the basis of mobile phone location evidence has already happened, in regard to the 1995 murder of three drug dealers [5].

In the U.S., federal law will require mobile operators to be able to identify the position of anyone making a call to the emergency services by the end of 2002. This "E–911" law has two phases: phase I (based on cell ID) and phase II. Phase I is already being deployed. In phase II, the technology must cover 95% of all handsets in service by 2005 to the accuracy shown in Table 2. The European equivalent, the E–112 Proposal, originally had a 1st January 2003 deadline but that has since been scrapped and the European Union has no plans to enforce any LBS specifications.

Type of Solution	Accuracy
Handset–based	50m, 57% of time.
	150m, 97% of time.
Network–based	100m, 67% of time.
	300m, 90% of time.

Table 2. FCC LBS Accuracy Requirements.

There is a natural temptation for mobile operators to implement LBS using network services rather than having to deploy new handsets or "add on" GPS devices and, in fact, this is exactly how the first deployments work (eg, the TimesThree service that is already live in Canada [6]). The US carriers, all of whom fear they may not meet the FCC accuracy requirements [7] and have been lobbying for an extension to the deadline, have opted for a variety of solutions (see Table 3).

Operators	Technology	Notes
AT&T Wireless	Evaluating choices	
Cingular GSM	handset–based, GPS	choices based on equipment availability
Cingular TDMA	network–based	
Nextel	handset–based, GPS	Seeking extension to FCC deadline.
Sprint PCS	handset–based, GPS	

[1] These basic services use cell ID data to locate subscribers to within around 500m in city centres and around 5km in rural areas

Voicestream	handset–based, EOTD	Already running in Houston and will sell **only** handsets with this technology by 31st Dec. 2002.

Table 3. Examples of US Operator Technology Choices.

Many observers think, however, that no single handset–based solution will meet the requirements and therefore carriers will implement network–based solutions as well.

The E–911 initiative will create an instant mass–market for LBS in the US: the US operators originally saw E–911 as a bit of a nuisance, but last year it began to dawn that it might be the platform for an entirely new range of services [8]. One might expect to see synergy between the emerging US LBS mass–market and the embryonic European mass–market to kick start some really interesting business models.

The Network Knows

Things are moving along smartly. There is already a proposed IETF protocol for location information—the Spatial Location Protocol, SloP—that gives a standard format (basically a location–time–accuracy triple) for communicating location from a device [9] and the usual suspects (Motorola, Ericsson and Nokia) have formed the Location Interoperability Forum (LIF) to advance subject area[2]. Other vendors have come together to form the Wireless Location Industry Association. The main European body in the mobile standards field, the European Telecommunications Standards Insitutue (ETSI), has already agreed standards for LBS based on EOTD and GPS. So far as 3G is concerned, all handsets will implement what's known as CellID+RTT from day one [10] and with 3G's smaller cell sizes this will deliver pretty good accuracy.

What's not covered by current protocols or initiatives is the really big issue: who is allowed to access LBS and under what circumstances. Here, there is a vast difference between active and passive LBS, between using GPS and using mobile networks because the GPS satellites don't know where you are but the mobile networks do. In other words, it is one thing for my device to obtain its location from GPS and then communicate this under my control (eg, using the Airbiquity battery–replacement GPS for Nokia handsets). In the mobile case, however, the network can figure out where I am and pass it on to other people without having me in the loop at any point. If I call in sick, should my boss be able to call up a web page and see where I am?

If the paparazzi get Tom Cruise's mobile phone number will they be able to track him wherever he goes? In South Korea there is already a mobile service that gives subscribers a list of celebrities, prioritised by their distance from the subscriber! (eg, "No. 1: Gwyneth Paltrow")! In the US, there's already the *New York Celebrity Sightings* service that works through a network of celebrity–spotting amateur sleuths and text messages ("Sep. 12th, 2:35pm. Comedian Dennis Miller in shorts and sandals at 5th Ave & 58th St.") [11]. It won't be long before the text messages become real–time video and LBS provide automatic map fixes.

The legislative environment does not necessarily hold all of the answers. The European legislation is not specific to mobile services anyway (Table 5). In the US,

[2] See http://www.locationforum.org/

where the pending legislation is extensive (see Table 4), just because a consumer's location is considered Customer Proprietary Network Information (CPNI) under FCC rules and cannot be disclosed to a third party without prior consent [12] does not mean that semi–skilled hackers won't be able to obtain this data from operator systems with minimum effort. In Europe, although the infrastructure of data protection and privacy legislation is more advanced, it doesn't necessarily follow that consumers will be more comfortable with the idea of being tracked and traced.

S809 Online Privacy Protection Act of 1999	Limits the collection and dissemination of personal data by web sites.	HR1685 Internet Growth & Development Act	Web sites have to disclose what they collect and what they do with it.
S854 Electronic Rights for the 21st Century Act	Privacy protection for information held on the Net.	HR2644 Personal Data Privacy Act of 1999	Controls data collection by government and business, including "5 day" access rights.
HR237 Consumer Internet Privacy Enhancement Act	Requires prior notification of what information is used for.	HR3221Electronic Privacy Bill of Rights Act of 1999	To stop unfair practices in collection and use of personal data.
HR313 Consumer Internet Privacy Protection Act	Requires consent for the disclosure of personal information.	HR3650 Online Privacy Protection Act of 2000	Web sites have to disclose what they collect and what they do with it.
HR367 Social Security Online Privacy Protection Act	Non–disclosure of social security numbers or other information.	HR5018 Electronic Communications Privacy Act of 2000	What it says.
HR369 Children's Privacy Protection & Parental Empowerment Act of 1999	A general bill to protect children's privacy (including, presumably, their whereabouts).		

Table 4. Selected Bills Pending in US (Source: mbusiness, 3/01).

The Council of Europe Convention (1981)	The EU Data Protection Directive
The EU Directive of the Processing of Personal Data	The EU proposed Directive on the Processing of Personal Data and the Protection of Privacy in the Electronic Communications Sector.

Table 5. Relevant European Legislation.

Settlement

Perhaps operators will give customers a simple choice: have the benefit of LBS (and there are clear customer requirements: Bank of America's ATM Locator 800 number gets 150,000 calls per month [13]) in return for giving up some privacy, or go without LBS and protect privacy. Operators don't want them to go without: Gartner (5/01) estimate that LBS will be adding 20% to ARPU by 2006. Yet if, as seems

likely, location information will eventually been seen as marketing data like any other [14], then protecting privacy may be tough: it needs to be built in to the fabric of LBS, not slapped on as an afterthought.

The questions are tough ones. Will the police be able to check whether my phone got from the M1/M25 to M4/M25 junctions at more than 70 miles per hour? More importantly, how am I going to be able to delegate authority for the school to track my children's whereabouts at certain time during the day but not others? These issues, unlike the technical issues, seem some way from being resolved. Therefore, in the short term, it is highly likely that the major beneficiaries will not be mobile operators or mobile consumers but lawyers [15]. Unless operators and service providers work together to provide a safe and secure environment for LBS, there will be a backlash from consumers that will be to no–one's benefit.

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