Chapter XI
Geographic Information Systems & Location-Based Services

INTRODUCTION

This chapter is about geographic information systems (GIS) and its relevance to the location-based services industry. One might initially ask how relevant GIS is to a book that is predominantly about automatic identification and its future trajectory. The answer becomes apparent quickly as the reader is introduced to the importance of geocoding information, i.e., geographically linking data such as personal details using a unique ID number. In the past data matching programs have received a great deal of attention from privacy advocates, especially those used for the administration of government procedures. Till now, automatic identification has facilitated electronic services (e-services), allowing an individual to be matched to a fixed address, usually their place of residence. But it is one thing to tag and another to track. Today, we are moving towards a model of tracking and monitoring people as they go about their daily business, in real time. We are no longer satisfied with knowing where an individual lives but we want to know their every move- so that we can estimate traffic congestion on a busy road, design 3G mobile networks that have enough capacity during busy hours, and to ensure someone's safety when adequate supervision is not available.

GEOGRAPHIC INFORMATION SYSTEMS

Geographic information systems (GIS) are playing a crucial role in the success of location-based services (LBS). GIS is defined by Burroughs (1986) as a "set of tools for collecting, storing, retrieving at will, transforming, and displaying spatial data from the real world for a particular set of purposes" (Taylor & Blewitt, 2006, p. 9). Dransch (2005, p. 32) classifies LBS as a subset of mobile geoservices. A location-based service is the ability for an information system to denote the position of a user, based on a device they are carrying or their position in a given context (Gartner & Uhlirz, 2005, p. 159). LBSs have the ability to provide specific, relevant information according to a given "spatial location associated with

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a physical point or region relative to the surface of the earth (Dawson et al., 2006, p. xv). While a great deal is written about the network technologies that allow for the tracking and monitoring of objects and subjects, GIS is usually considered the add-on feature. However, without GIS, most location-based services would not be plausible as commercial offerings. According to Lopez (2004, p. 171) "LBS consist[s] of a broad range of services that incorporate location information with contextual data to provide a value-added experience to users on the Web or wireless device." It then follows that GIS is integral to the success of LBS (Brimicombe & Li, 2007). Motivations for using GIS in LBS include: cost-effectiveness, service provisioning, system performance, competitive advantage, and database creation, access, and use (Shiode et al., 2004, p. 363).

What is the Difference between GIS and LBS?

Lopez (2004) is extensive in his book chapter on the differences between GIS and LBS. He stipulates that GIS is about mapping, spatial indexing, spatial operators, geocoding and routing technology. LBS on the other hand, is different to GIS because it makes use of information technology and wireless technology. GIS is about maps, people, places, buildings, points of interest, while LBS is about using that basic knowledge to provide some kind of meaningful application such as "find the nearest Automatic Teller Machine" or "help me, I'm lost". Performance, scalability and interoperability are three other differentiators of LBS and GIS. LBS requires numerous components to work together to provide an end-to-end solution while GIS is quite localized in that it manages and stores information using proprietary data structures and models. Consider the location service for WAP phone users in shopping centers, such as the Colombo Centre located in the Iberian Peninsula (Câmara & Dia, 2004). GIS provides the spatial background usually in the form of a map form with georeferenced points of interest while the LBS provides the awareness, the reality of the user's position in a given context.

The Importance of Geocontent to LBS

In his classic text, *Location-Based Services: fundamentals and operation*, Axel Küpper (2005, p. 35) stipulates that while spatial databases and geographic information systems cover a broad range of applications such as surveying and transportation, it is in the context of LBS that "they are important for indicating the positions of one or several targets with respect to geographical content like borders of cities and countries, road networks, or buildings. They are used for mapping spatial location onto meaningful descriptive location information and vice versa, which is referred to as *geocoding* or *reverse geocoding* respectively, as well as for creating digital maps and routing information, or for finding nearby points of interest." Here Küpper is referring to geocontent. Jensen (2004, p. 117) has written that geocontent is *essential* to LBS, citing the metaphor that "[u]sers think of the real content as being located in a transportation infrastructure and access the content via the infrastructure." Jensen uses the example of a point of interest (POI) location which is typically given in terms of a civic address (i.e. containing a street name), and the routing directions for how to reach that destination are given in terms of the transportation infrastructure. However, it is important to note that while LBS uses *location* as a "context parameter to which the presented information is referred", it is about "the complete situation in which a user acts and requires spatial information" that is becoming increasingly important (Dransch, 2005, p. 32). It is not only about *where they are* or *where it is*, but in the context of the time, the temperature, the lighting, the humidity, the precipitation level, the elevation, the sugar level in the bloodstream, the

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