Category: Concepts, Trends, and Challenges

Location-Based Services in the Mobile Communications Industry

Christopher Ververidis
Athens University of Economics and Business, Greece

George C. Polyzos
Athens University of Economics and Business, Greece

INTRODUCTION

Advances in wireless communications and information technology have made the mobile Web a reality. The mobile Web is the response to the need for anytime, anywhere access to information and services. Many wireless applications have already been deployed and are available to customers via their mobile phones and wirelessly connected PDAs (personal digital assistants). However, developing the "killer" wireless application is still a goal for the industry rather than a reality. One direction for developing such applications points to location-based services (LBSs). LBSs are services that are enhanced with and depend on information about a mobile station's position. Location information by itself is not the ultimate service, but if location information is combined with content, useful services may be developed. These services offer the capability to users and machines to locate persons, vehicles, machines, and resources, as well as the possibility for users to track their own locations (GSM Association, 2003). The focus of this article is the analysis of the most critical success factors and challenges for LBS.

BACKGROUND

In order to show the domains on which LBS may have an impact, a list with the LBS categories, as defined by the Third-Generation Partnership Project (3GPPP, 2004), is presented in Table 1. Also, based on the information-delivery method, we identify three types of LBS: pull, push, and tracking services (GSM Association, 2003). In the case of a pull service, the user issues a request in order

Table 1. Standardized LBS types and corresponding application domains

Application Domain	Standardized LBS Types
Public Safety Services	Emergency Services Emergency Alert Services
Tracking Services	Person Tracking Fleet Management. Asset Management
Traffic Monitoring	Traffic Congestion Reporting
Enhanced Call Routing	Roadside Assistance Routing to Nearest Commercial Enterprise
Location Based Information Services	Traffic and public transportation information City Sightseeing Localized Advertising Mobile Yellow Pages Weather Asset and Service Finding
Entertainment and Community Services	Gaming Find Your Friend Dating Chatting Route Finding Where-am-I
Location Sensitive Charging Service Provider Specific Services	

to be automatically positioned and to access the LBS he or she wants. A use-case scenario demonstrating a pull service used broadly in the LBS literature (Poslad, Laamanen, Malaka, Nick, Buckle, & Zipf, 2001; Zipf, 2002) is the following. A tourist roams in a foreign city and wants to receive information about the nearest restaurants to his or her current location. Using a mobile device, the tourist issues an appropriate request (e.g., via SMS [short messaging service] or WAP [wireless application protocol]), and the network locates his or her current position and responds with a list of restaurants located near it. On the contrary, in the case of a push service, the request is issued by the service provider and not the user. A representative example of push services is location-based advertising, which informs users about products of their interest located at nearby stores. In this service, users submit their shopping-preference profiles to the service provider and allow the provider to locate and contact them with advertisements, discounts, and/or e-coupons for products of interest at nearby stores. So, in this case, the service provider is the one who pushes information to the user. Finally, in a tracking service, the basic idea is that someone (user or service) issues a request to locate other mobile stations (users, vehicles, fleets, etc.).

From a technological point of view, LBSs are split into two major categories depending on the positioning approach they use to locate mobile stations. There is the handset-based approach and the network-based approach. The former approach requires the mobile device to actively participate in the determination of its position, while the latter relies solely on the positioning capabilities of elements belonging to the mobile network. For both of these approaches, several positioning techniques have been developed or are under development. What distinguish them from one another are the accuracy they provide and the cost of their implementation. The most popular network-based positioning techniques are cell-global-identity (CGI) methods, timing advance (TA), uplink time of arrival (TOA), and angle of arrival (AOA), while the most popular handset-based positioning techniques are observed time difference of arrival (OTDOA), enhanced observed time difference (E-OTD), and assisted Global Positioning System (A-GPS; Drane, Macnaughtan, & Scott, 1998; Swedberg, 1999). The accuracy provided by some of these techniques in different coverage areas of the mobile network is presented in Table 2.

In order to understand the emergence of LBS, one has to identify the major forces that brought to the surface the need for this kind of services. There exist four major forces, namely, market forces, competition forces, technology forces, and regulatory forces. Each of them is briefly discussed in the following paragraphs.

Market Forces

Market research around the globe has documented the willingness of mobile subscribers to pay for LBS. The LBS subscriber base is forecast to reach 680 million customers globally by 2006. Predictions are that LBS will generate over $32 billion in Europe only by 2005. Numerous firms have already emerged to tap into this growing opportunity (Rao & Minakakis, 2003).

Competition Forces

Having established large customer bases, cellular-service providers will seek new ways to ensure customer loyalty by offering new types of services. Location-based services are the most promising type of these services (called value-added services). Some of the advantages for the cellular-service provider who offers location-based services are the following.

Table 2. Positioning accuracies

	CGI	**E-OTD**
Rural Area	1km – 35km	100m – 300m
Suburban Area	1km – 10km	50m – 150m
Urban Area	100m – 1km	50m – 150m
Dense Urban Area	100m – 1km	50m – 150m
	CGI-TA	**A-GPS**
Rural Area	550m	50m – 100m
Suburban Area	550m	30m – 100m
Urban Area	100m – 550m	10m – 20m
Dense Urban Area	100m – 550m	10m – 20m
	E-CGI	**TOA**
Rural Area	250m – 8km	85m - 100m
Suburban Area	250m – 2.5km	30m - 75m
Urban Area	50m – 550m	25m - 70m
Indoor Urban Area	50m – 550m	25m - 70m