

Chapter III

Location Services in Cellular Networks

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ABSTRACT

This chapter presents the main features entailed in providing location services in cellular networks. It begins by describing some of the most important location-based services and the main location techniques that have been developed in order to allow these services to be provided. These techniques involve several constraints that reduce their applicability in certain environments. Several of these restrictions are explained in this chapter, as well as the solutions proposed in order to overcome them. Regulator bodies have included some of these techniques in their official recommendations. This chapter also reviews the location architectures standardized for use in the main cellular networks and presents the concept of location middleware as a natural addition to these architectures.

INTRODUCTION

Location Services That Make Use of Customer Position

Mobility is a key factor in the provision of services in cellular networks. Although most of

the technical limitations (error rate, bit rate, etc.) of 2G and 2.5G networks were overcome in 3G networks, services seem not to have taken off. Most experts agree that in order to revitalize the services market, new wireless services that represent a real addition of value must be developed. And this does not mean

merely translating services from the wired to the wireless context, but developing new value-added services for this particular environment. One example of this set of new services is the location-based service (LBS). LBSs are services that adapt to a user's location and situation—that is, applications that are dependent on a certain location. Goodchild (2001) states: “LBSs exploit the ability of technology to know where the user is and to modify the presented information accordingly.” All definitions agree that LBSs are services that in some way make use of the knowledge of a user's position. Currently, many LBSs have already been designed and are ready to be implemented for commercial exploitation. A selection of the more relevant ones is described as follows.

- **Information Services:** These provide the location of the nearest entity that the user is interested in. Requesting the address of the nearest gas station or the cinema that is closer to our location would be examples of these kinds of services.
- **Navigation:** These services guide the user to a certain destination. A typical example of this service is the navigation system included in the highline cars which leads us to a certain destination.
- **Workforce Management:** This includes any service that can be used to manage a workforce, such as assigning tasks in real time according to the position of the workers and the location of the task. For instance, a company focused on support and maintenance may assign the issues according to the position of their workers, thus reducing the delivery costs.
- **Demand-Responsive Transport:** These services are transport services that have been upgraded with position information, which allow transport companies to provide their services according to customer

location or destination. One example of this kind of service is the management of a taxi fleet, where the position of the customer helps to select the taxi that has to take the order.

- **Lone Worker Applications:** These services aim to assist workers that may be involved in dangerous situations, such as firemen and policemen.
- **Children Tracking:** These services provide the position of children in real time or alert the customer when a person being tracked ventures beyond certain boundaries.
- **Medical Alert:** These kinds of services are aimed at people who are frequently ill. For example, the elderly can alert the nearest medical center in the case of illness and thus provide information about their situation.

Features and Classification of Location-Based Services

LBSs may be classified in several ways. From a business point of view, location services can be sorted according to three criteria (see Table 1):

1. **Service Purpose:** According to its value for the customer, such as what kind of utility it offers. This group includes several types of LBSs, such as tracking and monitoring, assistance, and location-based information.
2. **Customer Participation:** As customers may adopt an active or a passive role during the execution of the location service, there are accordingly two different types of LBSs: push and pull services. The user actively runs push services. Pull services, however, are not initiated by an explicit customer command; instead, they

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