Chapter 2
Location-Based Services:
A Taxonomy on Theory and Practice

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ABSTRACT

The provisioning of Location-Based Services (LBS) follows the chain of determination of a position, mapping this information onto a natural language-based description of this position and performing the service itself. The evolution of technologies regarding applications and infrastructure, standards and contents has brought up various streams that have influenced the development of this chain over the past years (Zeimpekis et al., 2003). On the one hand, emerging theoretical concepts have been showing the way for many commercial and non-commercial services. On the other hand, the conceptual evolution has been accompanied by significant investments of mobile technology companies and service providers to the further development of practical solutions (Gessler and Jesse, 2001).

INTRODUCTION

A wide field for technological innovation, the conceptual discussion of LBS has widely remained a technology issue dominated by the development of positioning techniques, infrastructure and data transmission concepts. This chapter re-emphasizes the term service, including information and functionality, which is offered by LBS applications and consumed by customers. It sheds light on the ubiquitous information management approach as important foundation for advanced mobile data services (Acharya et al., 2004).

Furthermore, the chapter provides an overview of the essential service concepts and relevant implications, challenges, and opportunities that can be derived from the application context of LBS. Finally, a taxonomy on theory and practice is presented that draws the link from the technology to the service.

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UBIQUITOUS INFORMATION MANAGEMENT

Along with the sophistication and increasing performance of communication devices, such as Personal Digital Assistants (PDAs), mobile phones as well as wireless communication networks, the environment and the world increasingly adopts a mobile character. In this respect, a very important driver is constituted by a ubiquitous information management concept, which is free from temporal and, in general, also from spatial constraints. In such mobile computing, ubiquitous computing or pervasive computing environments, mobile databases and the data dissemination infrastructure are two integral components especially in the context of LBS. Data dissemination can follow push-based or pull-based information flows depending on where location and application data is processed. This can be done either on the server side or on the device, i.e., client side (Acharya et al., 2004).

In *push*-based systems, data is pushed into a wireless channel and a user tunes in and downloads the required data. This approach can process read-only transactions and may include popular data like the stock quotes, news, weather information, traffic information. On the other side, in *pull*-based wireless services, a user induces the server to process specific transactions and send the result to the user through a back channel. These transactions can be simple queries or update transactions.

The two-tier concept of information management to disseminate, process and further store data can be collectively termed *information layer*.

LOCATION-ADAPTED SERVICES

LBS provide users of mobile devices personalized services tailored to their current location. These central information services fall into three broad categories that also emphasize the added value for consumers: *positioning* and location identification, *contextual* and environmental location information as well as *navigation* between different locations.

There exists a vast body of literature on positioning technologies reaching from the early Active Badge indoor locating solutions to the Global Positioning System (GPS) and the more recent Wireless Local Area Network (WLAN) and Bluetooth concepts (King et al., 2006).

The diversity of the underlying technological basis as well as the opportunities and limitations among these approaches in design and characteristic means of data networks correspond to the increasing need for adapted LBS infrastructures. These are tailored to the specific requirements of different types of locations, different modes of mobility and distance (Zeimpekis et al., 2003).

The precision of location information and the distance of a mobile device to a Location Service Provider (LSP) are two factors that play a key role in this context. They present the overall framework in which the *service layer* of key features of applications and infrastructure technology is embedded.

Physical and Symbolic Location

A LSP can provide two kinds of location information: physical and symbolic. Physical positions are determined by longitude, latitude and altitude. In contrast, symbolic location encompasses abstract ideas of where something is: in a certain room, in a certain town or next to a certain object (Gessler and Jesse, 2001).

A system providing a physical position can usually be augmented to provide the corresponding symbolic location information with additional information, infrastructure, or both. For example, a PDA equipped with a GPS receiver may access a separate database that contains the positions and geometric service regions of other objects to provide applications with symbolic information (Brumitt et al., 2000). Linking real-time train positions to the reservation and ticketing database

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