Chapter 36
Multicast over Location-Based Services

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ABSTRACT

This chapter details the potential found in combining to different technologies. The two basically different technologies, LBSs in mobile communication and the well-elaborated multicast technology are merged in the multicast via LBS solutions. As this chapter demonstrates, this emerging new area has a lot of possibilities, which have not been completely utilized.

INTRODUCTION

Currently, an important area of mobile communication is *ad-hoc computer networks*, where mobile devices need base stations however they form an overlay without any Internet-related infrastructure, which is a virtual computer network among them. In this case, the selective, location-related communication has not been solved completely.

Traditional Location-Based Services (LBSs) determine the current location of a given person or a given group of people in order to process location-dependent information. This use does not cover the full range that is conceivable for these services. This article introduces so-called Zone Services as a new sub-category of LBSs. In contrast to traditional LBSs, *Zone Services* collect information about persons currently located in a given geographic area. For these services, new considerations regarding data collection, privacy, and efficiency have to be made. Hence, it has to be determined what techniques or mechanisms common in traditional LBSs or in other areas like

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databases or mobile communication systems can be reused and what concepts have to be developed.

One of the various communication models among software entities is the one-to-many data dissemination, called *multicast*. The multicast communication over mobile ad-hoc networks has increasing importance (Hosszú, 2005). The article described the fundamental concepts and solutions on the area of LBSs and the possible multicasting over the LBS systems. This kind of communication is in fact a special case of the multicast communication model, called *geocast*, where the sender disseminates data to a subset of the multicast group members that are in a specific geographical area. This chapter shows that this special kind of multicast utilizes the advantages of LBSs, since multicast is based on location-aware information that is available in location-based solutions.

The two basically different technologies, LBSs in mobile communication and the well-elaborated multicast technology are merged in the multicast via LBS solutions. As the chapter demonstrates, this emerging new area has a lot of possibilities, which has not been completely utilized.

BACKGROUND

The positioning technologies in the LBS solutions are based on the various distances of the communication mobile from the different base stations. With advances in automatic position sensing and wireless connectivity, the application range of mobile LBSs is rapidly developing, particularly in the area of geographic, tourist and local travel information systems (Ibach et al., 2005). Such systems can offer maps and other area-related information. The LBS solutions give the capability to deliver location-aware content to subscribers on the basis of the positioning capability of the wireless infrastructure. The LBS solutions can push location-dependent data to mobile users according to their interest or the user can pull the required information by sending a request to a server that provides location-dependent information.

LBSs process information with respect to the location of one or several persons, also referred to as *targets* before presenting it to the *user*. In recent years, LBSs have become increasingly important and have helped accelerate the development towards ubiquitous computing environments. Traditional LBSs map targets to locations (e.g., Where is person X located?), i.e., they find the position of a specific person or group of people. This type of LBS is denoted as *Tracking Services*.

There are a lot of location positioning methods and technologies, such as the satellite-based *Global Positioning System* (GPS) that is widely applied (Hofmann-Wellenhof et al., 1997). The location determination methods that do not use the GPS can be classified into three categories: *Proximity*, *Triangulation* (lateration), and *Scene analysis* or *pattern recognition* (Hightower & Borriello, 2001). Signal strength is frequently applied to determine proximity. As a proximity measurement, if a signal is received at several known locations, it is possible to intersect the coverage areas of that signal to calculate a location area. If one knows the angle of bearing (relative to a sphere) and distance from a known point to the target device, then the target location can be accurately calculated. Similarly, if somebody knows the range from three known positions to a target, then the location of the target object can be determined. A GPS receiver uses range measurements to multiple satellites to calculate its position. The location determination methods can be ***server-based*** or ***client-based*** according to the place of computation (Hightower & Borriello, 2001).

LBSs utilize their ability of location-awareness to simplify user interactions. With advances in wireless connectivity, the application range of mobile LBSs is rapidly developing, particularly in the field of tourist information systems - telematic, geographic, and logistic information systems. However, current LBS solutions are incompat-