Chapter V

Engineering Location-Based Services in the Web

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Abstract

In this chapter, we will present a modular approach for building evolvable location-based services in the context of Web applications. We first motivate our research by discussing the state of the art of location-based services; next we analyze which design problems we face while building this kind of application, stressing those problems related with the application's evolution. We present an object-oriented design approach for engineering location-based applications that effectively supports the evolution of these applications rather than their revolution and give a few examples of its use. We finally discuss some further research issues not explicitly addressed in this chapter.

Introduction

As communication and hardware technology are rapidly evolving, there is a growing interest in the development of mobile Web applications. The most important feature of these applications is their ability to react in different ways according to the user's context. Research issues related with mobile computing range from hardware (small memory devices, interface appliances) and communication networks (trustable connections, security, etc.) to software and data management aspects such as new interface metaphors, data models for mobile applications, continuous queries and transactions, adaptive applications, and information exchange between disparate applications. In this chapter, we focus on a particular kind of mobile application: those that adapt their behaviors to the user's location, the so-called Location-Based Services emphasizing which design issues are critical due to their evolution patterns.

Location-based services are a specific case of ubiquitous applications which "evolve organically. Even though they begin with a motivating application, it is often not clear up front the best way for the application to serve its intended user community" (Abowd, 1999). The main consequence of this fact is that the design structure of a location-based application should be thought to deal with evolution easily.

In this chapter, we analyze some design challenges that we face while building location-based services and discuss some micro-architectures that help solve these problems.

The structure of the chapter is as follows: we first present an example scenario to motivate the following discussion. We then survey the state of the art of location-based software, analyzing their evolution from monolithic GIS applications to lighter Internet services. Following the survey, we discuss the design challenges we have to face when applications evolve. Next, we outline our solution by presenting a set of design micro-architectures for building modular and adaptive location based services. We then present a simple example for integrating the mentioned architectures into the Web. Finally, we present some further work and concluding remarks.

An Example Scenario

Suppose, for example, a simple application to provide a foreign student with information when he moves in different places of his new place of residence. When he is traveling, he can be prompted with information about best routes to go somewhere and informed about tourist spots and services (such as gas stations). When he is in the city, he can find places of residence near the university, restaurants according his preferences, or shops. In our first application's release, we assume that we can obtain the user's location in terms of locators such as geographic coordinates or present address by using a cartography service such as NTV (2003) to inform him of what he needs. Existing state of the art technologies (Kraak, 2001) make these alternatives absolutely feasible.

Afterwards, and assuming that the first prototype was successful, we want to integrate it with a new component that helps the student move inside the campus and get

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