

Chapter 41

Developing Map-Based and Location-Aware Collaborative Applications for Mobile Users

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ABSTRACT

Map-based and location-aware collaborative applications allow geographically distributed and mobile users to communicate and share different kinds of location-based data among themselves, such as geo-referenced annotations or other user's position. Although many of such applications share a good amount of common functionality, most of them are developed from scratch, or are tailored to a specific mobile platform using proprietary libraries, which limit their applicability. The use of middleware platforms and application frameworks is a means for achieving platform-independence and software reuse, and hence support efficient application development and service provisioning. The main goals of the chapter are to discuss the challenges and requirements related to development of such applications and to present prototypes of a middleware and application framework addressing these requirements. The system described in this chapter is based on Google's Android platform and has been designed to support flexible configuration, dynamic adaptation, and deployment of modular map-based collaboration services, so as to simplify the development of customized applications out of reusable components.

DOI: 10.4018/978-1-61520-655-1.ch041

1. INTRODUCTION

The confluence of several recent advancements in design of portable devices, cloud computing, sensor technologies and mobile network technologies, as well as the emergence of new forms of mobile user interactions are leveraging new forms of collaboration between users. These include presence- and location-sharing, map-based, geo-tagging, and proximity services, multimedia interaction and mobile social networking. In a near future, users will use their portable devices and smart phones for almost any of their daily communication and coordination tasks, both for business and leisure.

Following this trend, several new collaborative mobile applications for portables are being developed which take advantage of enhanced computing facilities, wireless interfaces, and several kinds of sensors built into these devices, such as GPS and accelerometer. These applications allow geographically distributed users to instantly communicate and share different kind of data among themselves. For example, users are able to share geo-referenced annotations, presence information, music and live video streams, etc. or visualize other user's location on maps displayed on their mobile device in real-time.

Although many of such applications share a good amount of common functionality, most of them are developed from scratch, or are tailored to a specific mobile platform using proprietary libraries, which limit their applicability. The use of middleware platforms and application frameworks is a means for achieving platform-independence and software reuse, and hence support efficient application development and service provisioning. Major considerations driving the development of middleware platforms for mobile collaboration are built-in support for flexible composition and reuse of services, context-awareness, cross-layer and distributed resource management, as well as run-time configurability and adaptation.

In the scope of the Mobilis Project¹, we have proposed a component-based middleware architecture that supports the development of mobile collaborative applications that feature real-time sharing of context information, specifically the user's location, and for obvious reasons use maps as their predominant user interface. Hence, we call these sort of applications MLCAs (Map-based and Location-aware Collaborative Applications). Typically, a MLCA is a mobile application (a.k.a. client) which uses specific communication and data sharing services that execute on remote servers of the wired network, i.e. cloud services, instead of establishing direct, *ad hoc* wireless connections among the user's mobile devices.

In order to illustrate the potentials of a MLCA, and highlight some application-specific requirements, we will adopt the following use case as the reference scenario throughout this chapter.

Using a MLCA, a group of tourists visiting a city can share and search for points of interest (POI) on the city map, e.g. nearby restaurants, museums, beaches, landmarks, etc., which they visualize through their GPS-enabled smart phones. In addition, each user's location is also shared among all group members, and can be visualized on their digital maps in real-time. Moreover, members can create new POIs, attach different sorts of data to them such as textual keywords (tags), descriptions, pictures, videos, and share the newly created POI with the group in real-time. Such application allows the group to split into sub-groups for visiting different touristic attractions but still remain constantly aware of the other group member's activities. Furthermore, POIs can be persisted in a content network and be made available to other tourist groups.

Our middleware architecture has been designed to support flexible configuration, dynamic adaptation and modular deployment of map-based collaboration services, so as to simplify the development of customized MLCAs out of reusable

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