Context-Aware Support for Mobile Information Systems

Malte Hülder

Abstract

The widespread presence of wireless networks and the availability of diverse terminal devices has enabled the development of mobile computing applications that take us a step closer to accomplishing the vision of ubiquitous computing. In fact, the former vision increasingly turns into the demand of users to be able to work with applications on any device, anywhere, anytime.

Still, distributed mobile applications suffer from a number of problems that are inherent in mobility. The volatility of network communication, the movement of mobile devices, the availability of resources, and the accessibility of program code and data form a highly dynamic environment, which may change at any moment. The execution of mobile business processes in such an environment often suffers from this instability.

To ameliorate this situation, in this thesis, a number of problems are addressed that developers of mobile information systems typically have to cope with, and an integrated set of solutions is proposed in form of a mobile middleware. Our work focuses on mobile information systems with distinct client-server characteristics that can be described by mobile business processes.

We first discuss the typical problems that are caused by mobility and from which mobile information systems suffer, and we deduce the requirements that have to be met by a mobile middleware in order to address these problems in a general way. Based on the requirements, we propose the design of such a mobile middleware. The design is divided into the fields of execution environment, mobile data store, context-aware dynamic reconfiguration, and the information that can be gained from mobile business process models. Based on these building blocks, the middleware enables preparation for offline operation and allows recovery from sudden network breakdowns.

The proposed design for a mobile middleware has been implemented in combination with a mobile information system as part of the *MobCo* project. This way, the feasibility of the stated approach can be shown and useful insights about its applicability are gained. In addition to the mobile information system taken from the telecommunications domain, other systems developed in student projects are outlined briefly.

We also propose a method to model mobile business processes in a way that allows the identification of process transitions between locations, users, and devices. Knowledge about these transitions enables a designer to foresee situations in which precautions have to be taken to ensure the seamless continuation of a mobile business process. Additionally, the mobile business process model features the assignment of components to mobile business process activities, and it allows extracting relevant information to be used at runtime.

Through the contributions in this thesis, we aim to provide an integrated set of solutions for some of the most common challenges in development, maintenance, and operation of mobile information systems. As a result, we see potential for reducing the development effort of mobile information systems by eliminating the need for multiple implementations for different mobile and stationary devices, by providing generic context monitoring and standard reconfigurations, and by offering means to effortless develop context-aware applications.