

## Chapter 8.14

# Matching Dynamic Demands of Mobile Users with Dynamic Service Offers

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### ABSTRACT

This chapter describes the use of ontologies for personalized situation-aware information and service supply of mobile users in different application domains. A modular application ontology, composed of upper-level ontologies such as location and time ontologies and of domain-specific ontologies, acts as a semantic reference model for a compatible description of user demands and service offers in a service-oriented information-logistical platform. The authors point out that the practical deployment of the platform

proved the viability of the conceptual approach and exhibited the need for a more performant implementation of inference engines in mobile multi-user scenarios. Furthermore, the authors hope that understanding the underlying concepts and domain-specific application constraints will help researchers and practitioners building more sophisticated applications not only in the domains tackled in this chapter but also transferring the concepts to other domains.

## INTRODUCTION

Regarding the trend towards ubiquitous computing and ambient intelligence, modern information systems basically have to support mobile users. As a first step towards fulfilling dynamic demands of mobile users, the concept of context-awareness has been introduced to enable filtering of information based on user-specific context information.

To cope with user acceptance, we abstract from context information and use a situation model. Situations are easy to understand for a user and can be derived from a set of context information, including location and time and even user profile information and other sources. They are named cognitive abstractions of context. When such situations are linked with user goals (e.g., get food when hungry), it is evident that different situations imply the need for different information and services to help a user in achieving his goals. User profiles are used for describing personal data, preferences, and interests of individual users, from which user goals can be derived.

Furthermore, we observe a growing demand to cope with dynamic service offers. Service-oriented architectures mainly integrate Web-based services from different providers. One consequence is the need to cope with unavailability of services, for example, due to broken connections or limited scopes of service validity. To enable an automatic replacement of services, that is, service roaming, service profiles are used that provide for a matching with user profiles and context information.

To enable matching of dynamic user demand and service offers on a semantic level, we use semantic technologies. This includes the development of a description model for service semantics and a semantic registry able to cope with such descriptions. The service ontology is modular, based on other ontology modules covering general concepts, situations, and the application domains. As demands from a large number of users are to be matched dynamically with service descriptions

provided by a large number of service providers, the application ontology acts as a semantic reference system.

In the following, we start with the discussion of the conceptual background of our approach, followed by an outline of sample application scenarios. In the main part, we discuss the construction and use of the application ontology as a basis for a semantic matching of demand and offers and give an overview of the system architecture supporting this process. A brief summary of practical experiences gained from the deployment of the system as a mobile tourist guide follows. The chapter closes with a look at future trends.

## BACKGROUND

Following Dey (2001, p. 5), “context is any information useful to characterize the situation of an entity. An entity is a person, place, or object considered relevant to the interaction between a user and an application, including the user and application themselves.” Context-aware applications are able to adapt their functionality based on existing context information towards the user’s environment. This includes filtering and provision of information and services being of interest to the user in his specific context, thus making applications more proactive and reducing the need for explicit user interactions. This property is of value especially for mobile applications due to the restricted interaction capabilities of mobile devices. Mobility always has a location aspect that is an important part of almost any context-aware application. In this way, mobile computing and context-awareness are good supplementations in order to provide users with the right information anywhere and anytime.

Research on context-aware applications started in the beginning of the 1990s. One of the first applications was the Active Badge System (Want, Hopper, Falcao, & Gibbons, 1992) from Olivetti Research Lab. It allowed users to locate people

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