

Chapter 7.14

Service–Oriented Architectures for Context–Aware Information Retrieval and Access

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ABSTRACT

Humans are quite successful at conveying ideas to each other and retrieving information from interactions appropriately. This is due to many factors: the richness of the language they share, the common understanding of how the world works, and an implicit understanding of everyday situations (Dey & Abowd, 1999). When humans talk with humans, they are able to use implicit situational information (i.e., context) to enhance the information exchange process. Context (Cool & Spink, 2002) plays a vital part in adaptive and personalized information retrieval and access. Unfortunately, computer communications lacks this ability to provide auxiliary context in addition to the substantial content of information. As computers are becoming more and more ubiquitous and mobile, there is a need and possibility to provide information “personalized, any time, and anywhere” (ITU, 2006). In these scenarios,

large amounts of information circulate in order to create smart and proactive environments that will significantly enhance both the work and leisure experiences of people. Context-awareness plays an important role to enable personalized information retrieval and access according to the current situation with minimal human intervention. Although context-aware information retrieval systems have been researched for a decade (Korkea-aho, 2000), the rise of mobile and ubiquitous computing put new challenges to issue, and therefore we are motivated to come up with new solutions to achieve non-intrusive, personalized information access on the mobile service platforms and heterogeneous wireless environments.

LITERATURE REVIEW

Current research on context-aware information retrieval systems is focused on Web information

systems, search techniques, and digital memory systems (Jones, 2005). The “Stuff I’ve Seen” (SIS) system (Dumais et al, 2003) is a search engineering approach to context-aware information retrieval. SIS stores most information, which people have interacted previously with, along with a context index. It also provides recommendations with heuristic algorithms. Though the approach is straightforward, as search techniques are mature nowadays, the requirement of search-driven will limit the scope of exploration of the system; yet it is not suitable for mobile users as well, since many user inputs are required. Moreover, it is built on the data level, and no service provisioning issues are considered.

CAR is a pioneer attempt to address the challenges of context-aware information in the ubiquitous computing environment (Jones & Brown, 2003). CAR is part of the infrastructure needed by a range of applications that detect and exploit context in mobile devices such as PDAs and mobile phones. CAR uses context-of-interests to personalize the information seeking process and manage that information accordingly. However, no implementation detail was given and the system does not consider any service selection issues in mobile platforms either.

MyLifeBits is a Microsoft Research project to create a “lifetime store of everything” (Bell et al., 2006). It is the fulfillment of the Memex vision (Bush, 1945) including full-text search, text and audio annotations, and hyperlinks. This project has raised many interesting questions relating to the reuse of captured data and context, but research into useful applications exploiting these resources is currently at a very early stage. Like the above previous approaches, this project uses context to personalize data representations and does not touch the service selections which we believe are of importance to mobile users.

OUR APPROACH AND PROPOSAL

Service-oriented architecture (SOA) is an evolution of distributed computing based on the request/reply design paradigm for synchronous and asynchronous applications. An application’s business logic or individual functions are modularized and presented as services for consumer/client applications. What is key to these services is their loosely coupled nature—that is, the service interface is independent of the implementation. Application developers or system integrators can build applications by composing one or more services without knowing the services’ underlying implementations.

Due to the heterogeneity of mobile computing devices and the variety of widespread network communication technologies, nowadays users have more possibilities to access various services. However, having alternative networks and services does not bring ease to users immediately, but often results in increased burdens in terms of repetitive configuration and reconfiguration, though users are only interested in the actual use of the appropriate services.

We propose tackling this problem with SOA in a context-aware manner, aiming to facilitate users’ ability to make use of different services in a smart way, based on adaptive services which exploit their awareness of users’ context. In this chapter, we present the SOA architecture, along with the context-aware action systems that provide a systematic method for managing and processing context information (Back & Sere, 1996). Action systems are intended to be developed in a stepwise manner within an associated refinement calculus (Back & Wright, 1998). Hence, the development and reasoning about the proposed systems can be carried out within this calculus, ensuring the correctness of derived mobile applications (Sere & Walden, 1997).

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