On Personalizing
Web Services Using Context

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ABSTRACT

This paper presents a context-based approach for Web services personalization so that user preferences are accommodated. Preferences are of different types, varying from when the execution of a Web service should start to where the outcome of this execution should be delivered according to user location. Besides user preferences, it will be discussed in this paper that the computing resources on which the Web services operate have an impact on their personalization. Indeed, resources schedule the execution requests that originate from multiple Web services. To track the personalization of a Web service from a temporal perspective (i.e., what did happen, what is happening, and what will happen), three types of contexts are devised and referred to as user context, Web service context, and resource context.

Keywords: context; conversation; personalization; policy; Web service

INTRODUCTION AND MOTIVATIONS

With the latest development of information and communication technologies, academia and industries are proposing several concepts that can hide the complexity of developing a new generation of user applications. Among these concepts are Web services (Papazoglou & Georgakopoulos, 2003), which are suitable candidates for achieving the integration of distributed and heterogeneous applications.

A Web service is an accessible application that other applications and humans can discover and trigger to satisfy various needs. It is known that Web services (also called services in the rest of this paper) have the capacity to be composed into high-level business processes known as composite services. Composing services rather than accessing a single service is essential and offers better benefits to users (Casati et al., 2003; Maamar et al., 2004b). Composition addresses the situation of a user’s request that cannot be satisfied by any available service, whereas a composite service obtained by combining a set of available services might be used (Berardi et al., 2003). For example, applying online for a loan requires identifying the Web site of the appropriate financial institution, filling in an application, submitting the application for assessment, and collecting the analysts’ comments for decision-making and appli-
cant notification. In this paper, composition is a kind of collaborative interaction that emerges when each participant has some, but not all, of the information and abilities required to perform an operation.

Because users’ expectations and requirements constantly change, it is important to include their preferences in the composition and provisioning of Web services. Indeed, some users, while on the move, would like to receive answers according to their current locations (Maamar et al., 2004c). This simple example sheds light on personalization and its impact on making applications adjustable. Personalization is of an explicit or implicit type (Muldoon et al., 2003). Explicit personalization calls for a direct participation of users in the adjustment of applications. Users clearly indicate the information that needs to be treated or discarded. Implicit personalization does not call for any user involvement and can be built upon learning strategies that automatically track users’ behaviors. Personalization is motivated by the recognition that a user has needs and that meeting them successfully is likely to lead to a successful relationship with the user (Riecken, 2000).

Personalization depends on the features of the environment in which it is expected to happen. These features can be about users (e.g., stationary user, mobile user), computing resources (e.g., fixed device, handheld device), time of day (e.g., in the afternoon, in the evening), and physical locations (e.g., meeting room, shopping center). Sensing, collecting, assessing, and refining the features of a situation permit the definition of its context. Context is the information that characterizes the interaction between humans, applications, and the surrounding environment (Brézillon, 2003). Prior to integrating context into Web services, various issues need to be addressed (adapted from Satyanarayanan, 2001): how is context structured, how does a Web service bind to context, where is context stored, how frequently does a Web service consult context, how are changes detected and assessed for context update purposes, and what is the overload on a Web service of taking context into account?

Web services composition and provisioning are a very active area of R&D (Papazoglou & Georgakopoulos, 2003). However, very little has been accomplished to date regarding their context-based personalization. Several obstacles still hinder personalization such as (1) current Web services are not active components that can be embedded with context-awareness mechanisms, (2) existing Web services composition languages (e.g., WSFL and BPEL) typically facilitate choreography only, while neglecting context of users, Web services, and computing resources, and (3) there is a lack of support techniques for modeling and specifying the integration of personalization into Web services. In this paper, we present our approach for personalizing Web services using context. The major features of this approach are as follows and will be detailed throughout this paper:

- Three types of contexts are devised and correspond to U-context to denote user context, W-context to denote Web service context, and R-context to denote Resource context.
- Three types of policies are developed for regulating personalization of Web services. These policies guarantee that the Web services still do what they are supposed to do, despite being subject to personalization.
- Web services initiate conversations with appropriate components during their personalization. The flow of exchange and
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