ELSEVIER

On coordinating personalized composite web services

Zakaria Maamar

Software Agents Research Group@zu, College of Information Systems, Zayed University, P.O. Box 19282, Dubai, UAE

Abstract

This paper presents a research project on the coordination of personalized composite web services. By coordination, it is meant the mechanisms that specify the orchestration of the component web services of a composite web service. The orchestration is about the execution chronology of the component web services, the data that the component web services exchange, the states that the component web services take, and the actions that the component web services perform. By personalization, it is meant the integration of user preferences into the specification that orchestrates the component web services. These preferences concern when the component web services are to be executed. In this research project, the operations of coordination and personalization are entrusted to software agents, which, for instance, monitor the context surrounding users and trigger as a result the appropriate component web services. In addition, software agents engage in conversations with their peers when it comes to tracking the personalized component web services.
© 2005 Elsevier B.V. All rights reserved.

1. Introduction

Web services offer new opportunities for implementing business-to-business scenarios [12,21]. Web services composition is the object of intense investigation. Composition sheds the light on the complex nature of user demands and the inability of a single web service to achieve these demands by itself [10]. Hence, a collection of interacting web services is deemed appropriate to accomplish user demands. Currently multiple standards back the widespread use of web services including WSDL, UDDI, and SOAP [14,19].

Composing web services (also called services in the rest of this paper) is essential and offers better benefits to users. Discovering and selecting the component services according to user requirements, inserting the selected component services into a composite service, triggering the composite service for execution, and finally monitoring the execution of the composite service are among the operations that are assigned to users. Most of these operations are complex, although repetitive with a large segment suitable for

—————
E-mail address: zakaria.maamar@zu.ac.ae

computer support. Software agents are suitable for assisting users in similar operations [7].

It is reported that until, now, research on web services has mainly concentrated on three aspects [6]: description and modeling, discovery, and composition. An element of the composition aspect that is looked into in this paper is the coordination of personalized composite web services. On the one hand, by coordination we mean the mechanisms that specify the orchestration of the component services of a composite service. The orchestration is concerned among other things about the execution chronology of the component services, the data that the component services exchange, the states that the component services take according to this exchange, and the actions that the component services perform. On the other hand, by personalization it is meant the integration of user preferences into the specification of the orchestration of the component services. Personalization aims at characterizing the way a user wants to interact with the available services. In this paper, we identify user preferences with time (i.e. when a service has to be executed, and when the outcome of performing a service has to be returned). Through appropriate mechanisms, users are given the opportunity of adjusting the specification that coordinates the component services according first, to their personal preferences and second, to the features of and constraints

over the environment in which they will probably be (e.g. is there any network coverage, is there any printer in the area?). Keeping track of the progress of the user-adjusted specification requires some awareness mechanisms for detecting the changes in the execution environment of this specification. These mechanisms are installed on top of a structure that we refer to as context. Context is the information that characterizes the interaction between humans, applications, and the surrounding environment [9].

Further to the agents of users, performing the coordination of personalized composite services calls for additional agents. The extra agents are deployed on top of the component services, each component being associated with a service chart diagram [15]. A service chart diagram is a means for describing a service as an independent component and as a member of a composite service. Using a service chart diagram, the description of a service occurs from various perspectives among them business, performance, and data [15]. Because of user preferences, it will be shown in this paper that a time perspective is anchored to a service chart diagram. The semantics of time perspective is based on Allen's work [2].

Coordination of composite services cannot be efficient without implementing interactions between the component services. In addition, because web services are currently bound to the rigid trigger-response interaction pattern that frames the exchanges of web services with the external environment of users and peers [16], we will show the way these interactions are leveraged to the level of conversations. A conversation is a consistent exchange of messages between participants involved in joint operations and thus, have common interests. Acting on behalf of services and running on top of their respective service chart diagrams, the software agents engage in conversations with their peers when it comes to searching for the component services, checking the availability of the component services, triggering the component services, and coordinating the actions of the component services for free-of-conflict situations.

In this paper, we report on our approach for the coordination of personalized composite web services. Section 2 motivates the rationale of web services composition, coordination, and personalization. Sections 3 presents some fundamental details associated with context, coordination, and web services, and reviews as well some related work. The approach for coordinating personalized composite web services is discussed in Section 4. Prior to overviewing the prototype and concluding the paper in Sections 6 and 7, respectively, the integration of conversations into the coordination approach is presented in Section 5.

2. Motivating scenario

Our running scenario concerns Melissa, a tourist who is visiting Dubai. Following her checking-in at the hotel,

Melissa browses some of the web sites that Dubai authorities recommend in their brochures. The top-ranked web site offers different web services that can be composed according to different patterns.

Melissa binds to this web site and picks sightseeing and shopping web services. Melissa's plans are to visit outdoor places in the morning and go shopping in the afternoon. The first part of the plan is subject to weather forecasts; outdoor activities are cancelled in case of hot weather. Initially Melissa is prompted to select some outdoor places, and indicate the pickup/drop-off times for sightseeing and shopping.

With regard to the first activity of Melissa's plan, sightseeing web service checks with weather web service the forecasts for the five coming days. If there is no warning of hot weather, the scheduling of the places to visit begins by ensuring that these places are open for public on these days, and transportation and guide are arranged. The logistics of Melissa's rides is entrusted to transportation web service, which identifies for instance the type of vehicle, and the possibility that Melissa commutes with other tourists heading towards the same places. In case of hot-weather warning, sightseeing web service might suggest other places (e.g. museums) where indoor activities take place. The same description applies to the shopping activity, which consists of checking out the running promotions in the malls that Melissa has selected. Transportation web service coordinates shopping's beginning time with sightseeing's finishing time.

The chronology of the web services that participate in Melissa scenario yields insight into the multiple challenges that coordinating personalized web services, faces including: how does the personalization affect the chronology of web services, to what extent can a web service be personalization without affecting its consistency, how to track the deployment of personalized web services, and last but not least how is the coordination of personalized web services achieved?

3. Background

3.1. Definitions

A software agent is an autonomous entity that acts to perform tasks on behalf of user [7]. The design of many software agents is based on the approach that users only need to specify high-level goals instead of issuing explicit instructions, which leaves the how and when decisions to the agent.

Context is any information that is relevant to the interactions between a user and an environment [11]. This information can be about the circumstances, objects, or conditions by which the user is surrounded.

A conversation is a sequence of messages that involves two or more participants who intend achieving a particular