

Chapter 2.4

A Context-Based and Policy-Driven Method to Design and Develop Composite Web Services

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ABSTRACT

Web services are nowadays attracting the attention of both academia and industry. However, a very little has so far been accomplished in terms of design and development methods that assist those who are responsible for specifying and running applications based on Web services. For this purpose, we developed CP4WS that stands for Context and Policy for Web Services. CP4WS is a context-based and policy-driven method for designing and developing composite Web services. Policies manage various aspects related to Web services like participation in composition and adjustment due to changes in the environment, and context provides the necessary information that enables for instance to trigger the appropriate policies and to regulate the interactions between Web services according to the current state of the environment. CP4WS consists of several steps such as user needs identification and Web

services behavior specification. Each step has a specific graphical notation that facilitates the representation, description, and validation of the composition operations of Web services. A running scenario that illustrates the use of CP4WS is presented in the chapter as well.

INTRODUCTION

For the World Wide Web Consortium (W3C), a Web service “*is a software application identified by a URI, whose interfaces and binding are capable of being defined, described, and discovered by XML artifacts and supports direct interactions with other software applications using XML-based messages via Internet-based applications*”. In a short period of time, the development pace of Web services has been spectacular (Dustdar, 2005). On the one hand, several standards related to Web services description, discovery, etc., have

been developed like WSDL, SOAP, and UDDI (Curbera, 2002). On the other hand, several projects related to Web services composition, personalization, etc., have been initiated (Sprick, 2005; Pernici, 2005; Nepal, 2005; Mrissa, 2005; Tolk, 2005). These projects' efforts are mainly put into the development of solutions that address Web services automatic-composition issues. Composition handles the situation of a user's request that cannot be satisfied by any single, available Web service, whereas a composite Web service obtained by combining available Web services may be used.

In addition to composition, other research initiatives on Web services are concerned with the issues of Web services description, discovery, semantic mediation, just to cite a few (Pernici, 2005). In this chapter, we shed the light on another issue that has so far received a little attention from the research community. This issue is the lack of design and development methods. The main objective of such methods is to assist those who are in charge of delivering Web services-based information systems as per end-users' needs and requirements. Nowadays, designers and developers are put on the front line of satisfying the promise of Web services' providers to deliver a new generation of Business-to-Business information systems. Simply put, a method comprises first, a set of steps to perform according to a certain chronology and second, a notation to comply with during graphical modeling. A graphical notation is very important since it facilitates discussions and validation exercises among the members of the design team and with end-users, respectively. In this chapter we propose our design and development method CP4WS, which stands for Context and Policy for Web Services. CP4WS is built upon our previous research on Web services (Maamar, 2006a; Maamar, 2005a; Maamar, 2005b; Maamar, 2006e; Mrissa 2005), and puts forward two major concepts on top of the Web services concept: policy and context. Policies are here to manage various aspects related to Web services like participation in

composition, semantic mediation, and adjustment due to changes in the environment, while context is here to provide the necessary information that enables for instance to trigger the appropriate policies and to regulate the interactions between Web services according to the current state of the environment.

In CP4WS, an extra element namely resource is part of the design and development exercise of Web services-based information systems. A resource identifies a computing means, e.g., software and hardware platform, upon which a Web service operates. Because resources schedule the execution requests of Web services, these latter have to be constantly aware of the capabilities and limitations of these resources. It is stressed that locking resources for long periods of time is by far not acceptable as the number of available Web services continues to grow, so the use of resources will become intensive (Limthanmaphon, 2004).

The rest of this chapter proceeds as follows. The next section defines policy and context concepts, discusses the rationale of adopting both concepts in CP4WS, and continues afterwards with introducing a running scenario that is used for illustration purposes throughout the chapter. Next, a new section is devoted to the different steps that constitute CP4WS. Some steps come along with a graphical notation, which is illustrated using the running scenario as part of the modeling exercise of a composite Web service. This is followed by a presentation of the prototype that implements the design of the running scenario. Related work and concluding remarks are presented and drawn in the last two sections, respectively.

PRELIMINARIES

Definitions

Context "... is not simply the state of a predefined environment with a fixed set of interaction resources. It is part of a process of interacting

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