Chapter XIII

Web Services Hybrid Dynamic Composition Models for Enterprises

Taha Osman
Nottingham Trent University, UK

Dhavalkumar Thakker
Nottingham Trent University, UK

David Al-Dabass
Nottingham Trent University, UK

ABSTRACT

Web services are used in enterprise distributed computing technology including ubiquitous and pervasive computing and communication networks. Composition models of such Web services are an active research area. Classified as static, dynamic, and semiautomatic composition models, these models address different application areas and requirements. Thus far, the most successful practical approach to Web services composition, largely endorsed by industry, borrows from business processes’ workflow management. Unfortunately, standards subscribing to this approach fall under the static composition category, therefore the service selection and flow management are done a priori and manually. The second approach to Web services composition aspires to achieve more dynamic composition by semantically describing the process model of the Web service and thus making it comprehensible to reasoning engines and software agents. In this chapter, we attempt to bridge the gap between the two approaches by introducing semantics to workflow-based composition. We aim to present a composition framework based on a hybrid solution that merges the benefit of practicality of use and adoption popularity of workflow-based composition with the advantage of using semantic descriptions to aid both service developers and composers in the composition process and facilitate the dynamic integration of Web services into it.
INTRODUCTION

The last decade has witnessed an explosion of application services delivered electronically, ranging from e-commerce to information service delivered through the World Wide Web, to services that facilitate trading between business partners, better known as business-to-business (B2B) relationships. Traditionally, these services are facilitated by distributed technologies such as RPC (remote procedure call), CORBA (Common Object Request Broker Architecture), and more recently RMI (remote method invocation). Web services are the latest distributed computing technology. It is a form of remote procedure call like other distributed computing technology, but uses XML (extensible markup language) extensively for messaging, discovery, and description. The use of XML messaging makes Web services platform and language neutral. Web services use SOAP (simple object access protocol; Gudgin, Hadley, Mendelsohn, Moreau, & Nielsen, 2003) for XML messaging, which in turn uses ubiquitous HTTP (hypertext transfer protocol) for the transport mechanism. HTTP is considered a secure protocol, thus it allows Web services to be exposed beyond the firewall. The Web service messages and operations with invocation details are described using a platform-independent language WSDL (Web services description language; Christensen, Curbera, Meredith, & Weerawarana, 2001). Web services can be published and discovered using UDDI (universal description, discovery, and integration protocol). The Web services architecture centered on WSDL, UDDI, and SOAP is called a service-oriented architecture (SOA).

To take advantage of Web services features, network application services have to be developed as Web services or converted into Web services using a wrapping mechanism. Moreover, multiple Web services can be integrated either to provide a new value-added service to the end user, or to facilitate cooperation between various business partners. This integration of Web services is called Web services composition and is feasible to achieve because of the Web services advantages of being platform and language neutral and loosely coupled.

The logic for composition mainly involves two activities: (a) the selection of candidate Web services that fulfill the requirement in accumulation, and (b) the management of flow, which comprises control flow, the order in which Web services operations are invoked; and dataflow, the messages passed between the Web services operations. The level of automation provided in performing these two activities classifies composition into static, semiautomatic, or dynamic categories.

Static composition involves prior hard-coding of the service selection and flow management. Performing selection and flow management on the fly, in machine-readable format, leads to dynamic composition. In semiautomatic composition, the service composer is involved at some stage (Thaker, Osman, & Al-Dabass, 2005).

WEB SERVICES COMPOSITION APPROACHES

Workflow-Based Composition

Work flow-based techniques approach Web services composition as a business process management (BPM) solution. Business processes can be considered as the group of activities that carry out business goals (Leymann, Roller, & Schmidt, 2002). Business applications represent such activities in the business processes; for example, a customer order fulfillment process will include individual applications for the activities of a customer placing an order, checking an account status, verifying an order, and dispatching an order. BPM deals with achieving the integration of these individual applications to achieve a business process view.

The main industrial standards to achieve such composition of Web services are WS-BPEL (Web
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