Chapter 2.2
Business Process and Workflow Modeling in Web Services

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INTRODUCTION

In large organizations, typical systems portfolios consist of a mix of legacy systems, proprietary applications, databases, off-the-shelf packages, and client-server systems. Software systems integration is always an important issue and yet a very complex and difficult area in practice. Consider the software integration between two organizations on a supply chain; the level of complexity and difficulty multiply quickly. How to make heterogeneous systems work with each other within an enterprise or across the Internet is of paramount interest to businesses and industry.

Web services technologies are being developed as the foundation of a new generation of business-to-business (B2B) and enterprise application integration (EAI) architectures, and important parts of components as grid (*www.grid.org*), wireless, and automatic computing (Kreger, 2003). Early technologies in achieving software application integration use standards such as the common object request broker architecture (CORBA) of the Object Management Group (*www.omg.org),*

the distributed component object model (DCOM) of Microsoft, and Java/RMI, the remote method invocation mechanism. CORBA and DCOM are tightly coupled technologies, while Web services are not. Thus, CORBA and DCOM are more difficult to learn and implement than Web services. It is not surprising that the success of these standards is marginal (Chung, Lin, & Mathieu, 2003).

The development and deployment of Web services requires no specific underlying technology platform. This is one of the attractive features of Web services. Other favorable views on the benefits of Web services include: a simple, low-cost EAI supporting the cross-platform sharing of functions and data; and an enabler of reducing integration complexity and time (Miller, 2003). To reach these benefits, however, Web services should meet many technology requirements and capabilities. Some of the requirements include (Zimmermann, Tomlinson & Peuser, 2003):

- *Automation Through Application Clients:* It is required that arbitrary software applications running in different organizations have to directly communicate with each other.

- *Connectivity for Heterogeneous Worlds:* Should be able to connect many different computing platforms.
- *Information and Process Sharing:* Should be able to export and share both data and business processes between companies or business units.
- *Reuse and Flexibility:* Existing application components can be easily integrated regardless of implementation details.
- *Dynamic Discovery of Services, Interfaces, and Implementations:* It should be possible to let application clients dynamically, i.e., at runtime, look for and download service address, service binding, and service interface information.
- *Business Process Orchestration Without Programming:* Allows orchestration of business activities into business processes, and executes such aggregated process automatically.

The first five requirements are technology oriented. A solution to these requirements is XML-based Web services, or simply Web services. It employs Web standards of HTTP, URLs, and XML as the lingua franca for information and data encoding for platform independence; therefore it is far more flexible and adaptable than earlier approaches.

The last requirement relates to the concept of business workflow and workflow management systems. In supply chain management for example, there is a purchase order process at the buyer's side and a product fulfillment process at the supplier's side. Each process represents a business workflow or a Web service if it is automated. These two Web services can be combined into one Web service that represents a new business process. The ability to compose new Web services from existing Web services is a powerful feature of Web services; however, it requires standards to support the composition process. This article will provide a simplified exposition of the un-

derlying basic technologies, key standards, the role of business workflows and processes, and critical issues.

WHAT ARE "WEB SERVICES"?

The phrase "Web services" has been defined in many different ways (Castro-Leon, 2002; Ambrosio, 2002). In the working draft of Web Services Architecture (W3C, 2003), it is defined as:

…a software system designed to support interoperable machine-to-machine interaction over a network. It has an interface described in a machine-processable format (specifically WSDL). Other systems interact with the Web service in a manner prescribed by its description using SOAP-messages, typically conveyed using HTTP with an XML serialization in conjunction with other Web-related standards.

A simplified Web service architecture based on this definition is conceptually depicted in Figure 1.

Main features of Web services are that services (Burner, 2003):

1. Expose programmable application logic.
2. Are accessed using standard Internet protocol.
3. Communicate by passing messages.
4. Package messages according to the SOAP specification.
5. Describe themselves using WSDL.
6. Support the discovery of Web services with UDDI.
7. Are loosely coupled.

WEB SERVICES TECHNOLOGIES

Three XML-based protocols—one for communication, one for service description, and one for

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