Chapter 9
Insurance-Based Business Web Services Composition

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ABSTRACT

As more web services that implement core functions of business are delivered to customers with service charges, an open and competitive business web services market must be established. However, the qualities of these business web services are unknown without real experiences and users are unable to make decisions on service selection. To address this problem, the authors adopt insurance into business web services composition. In this paper, the authors propose three insurance models for business web services. Based on the insurance models, the authors propose an approach to compute the expected profit of composite business web services, which can be used as a criterion for business web services composition. The insurance of business web services and the criterion for business web services composition will help service competition and boost the development of more business web services and the software industry.

INTRODUCTION

As the latest distributed computing technology and the most suitable technology for realization of service-oriented-architecture (SOA), web services have gained a lot of attention in the past few years. A web service is actually a kind of software that can be described, discovered, and accessed by some XML-based specifications that include Web Service Description Language (WSDL), Universal Description, Discovery, and Integration (UDDI), and Simple Object Access Protocol (SOAP) (Curbera et al., 2002). Web services fulfill user requests in an on-demand manner and therefore can be used to realize software-as-a-service (SaaS) which is a model of software deployment whereby

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a provider licenses an application to customers for use as a service on demand. Gartner (2009) says that the market of SaaS will reach $9.6 billion in 2009, a 21.9 percent increase from 2008 revenue of $6.6 billion, and will show consistent growth through 2013 when worldwide SaaS revenue will total $16 billion for the enterprise application markets. Meanwhile, more and more web services that implement core functions of business will be delivered to customers with service charge and we refer to this kind of web services as business web services. For example, Amazon Simple Storage Service (Amazon S3) charges customers in United States $0.01 per 10,000 GET requests (Amazon, 2009). In the remaining parts of this paper, we also mean "business web services" when we talk about "web services", if it is not clearly specified.

It can be expected that, with the facilities of advanced web services technologies, more and more web services of various functions will be developed, deployed, published on the web and users will have more opportunities to choose among these services. The factors that may affect a user's decision on service selection include service price and quality (or quality of service, QoS). QoS is a broad concept that includes a number of non-functional properties (Sullivan et al., 2002; Menasce, 2002; Ran, 2003; Maximilien & Singh, 2004). In terms of web services, QoS may include response time, reliability, security, etc. Just like other kind of services, people have to make tradeoffs between price and quality. Some services with the same functions or qualities may ask for different prices, which may not be worthy of (or matching) their qualities. It is quite hard for a user to choose a service provider and its service from available ones (of the same or similar kinds). Actually, users may require different levels of QoS for different purposes of businesses and different QoS should deserve different prices. For those critical businesses, users usually are willing to pay a higher price for a more reliable service, and for non-critical businesses, a moderate quality with a lower price is more preferable.

To fulfill SOA promise, basic services need to be composed into new larger services which could be further composed until the composite services can accomplish the whole business requirements. From the outside world, a composite service looks like any other basic service. From the inside perspective, a composite service is a collection of tasks, each of which is carried out by a service that is either basic or composite. Generally, a number of services can be used to perform the same task, but they may have different QoS. Therefore, one important objective of service composition is to maximize (or minimize) a user-defined utility function while satisfying all QoS constraints. This actually is an NP-hard problem (Bonatti & Festa, 2005) and quite a few algorithms have been proposed to solve it (Zeng et al., 2004; Canfora et al., 2005; Berbner et al., 2006; Ardagna & Pernici, 2007; Yu et al., 2007; Alrifai & Risse, 2009).

In terms of business web services, the objective of service composition becomes more straightforward: to maximize the profit of composite services while satisfying all QoS constraints (Cheng et al., 2007). Ideally, this problem can be solved using the aforementioned service selection algorithms by assigning appropriate weights to different QoS attributes in the utility function. This is however problematic in practice due to the following reasons. First, these algorithms assume that the advertised QoS is trusty. Unfortunately, this is not the case. In fact, users are usually unable to know the qualities of services in detail before really using them. They usually get to know these services and their qualities from their providers' own reports or advertisements. No objective, third-party, independent report is currently available. Secondly, these algorithms neglect the economic losses caused by QoS degradation or buggy services. Sometimes, QoS is more critical in the success of a business since potential loss due to QoS is risky (Kokash & D'Andrea, 2007). Losses caused by services can be huge, depending on the role of services in the entire business. Similar to hardware

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