A Collaborative QoS-Aware Service Evaluation Method Among Multi-Users for a Shared Service

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ABSTRACT

In service selection, an end user often has his or her personal preferences imposing on a candidate service’s non-functional properties. For a service selection process promoted by a group of users, candidate services are often evaluated by a group of end users who may have different preferences or priorities. In this situation, it is often a challenging effort to make a tradeoff among various preferences or priorities of the users. In view of this challenge, a multi-criteria decision-making method, named AHP (Analytic Hierarchy Process), is introduced to transform both qualitative personal preferences and users’ priorities into numeric weights. Furthermore, a QoS-aware service evaluation method is presented for a shared service’s co-selection taking advantage of AHP theory. At last, a case study is presented to demonstrate the feasibility of the method.

Keywords: Analytic Hierarchy Process (AHP), Quality of Service (QoS), Service Evaluation, Service Selection, Web Service

INTRODUCTION

Current Status of Related Research

Nowadays, to gain and retain competitive advantages in a competitive business arena, collaborative business transactions among multiple enterprises are causing more and more attention in Business-to-Business (B2B) environment (Ye, Cheung, & Chan, 2006). With this tendency, Web service techniques have created unprecedented opportunities for an organization to establish more agile and versatile collaborations with other organizations (Ye et al., 2006). Technically, a Web service is an autonomous software system identified by a certain URI, which is often published online via some service
registers. It is often identified and invoked through certain internet protocols initiated by a group of XML-based standards (e.g., SOAP, WSDL, and UDDI) (Curbera, Duftler, Khalaf, Nagy, Mukhi, & Weerawarana, 2002; Austin, Barbir, Ferris, & Garg, 2004). With these XML-based standards, a Web service can be advertised, located, and accessed through a group of encoded messages.

As Web services often encapsulate application functionality and information resources that are intended to be used by other applications, Web services need to be described and understood both in terms of functional capabilities and Quality of Service (QoS) properties (i.e., non-functional properties) (Jeong, Cho, & Lee, 2009; Rao, Kiingas, & Matskin, 2006; Agarwai, Lamparter, & Studer, 2009; Wang, 2009). With ever-increasing number of service providers, there are more and more services with identical or overlapped functionality. Users often discriminate these alternatives according to their QoS information for selecting an ideal Web service (Zeng, Benatallah, Hgu, Dumas, Klagnanam, & Chang, 2004).

Aiming at selecting a qualified Web service for certain application, efforts have been exerted in QoS-aware service selection and service composition (Jeong et al., 2009; Wang, 2009; Zeng et al., 2004; Rosario, Benveniste et al., 2008; Cardoso, Sheth, Millerb, Arnold, & Kochtub, 2004; Sun, He, & Leu, 2007). For example, Zeng et al. (2004) and Zeng, Benatallah, Ngu, and Nguyen (2001) explored quality-driven services composition based on an AgFlow-based middleware platform. Their approach focuses on optimizing service selection at a composite service level and handles various types of QoS criteria. Xu and Nahrstedt (2002) provided a global planning algorithm for dynamic QoS-aware service composition. Cardoso et al. (2004) developed a model to analyze and estimate the overall QoS for new functionality in the context of Web processes. Sun et al. (2007) extended the Web service Registrars to meet the end-users’ quality requirements. In Sun et al. (2007), the qualified services would be syndicated together, which will be provided as a package to an end-user.

Roughly speaking, the service selection methods presented in these referred works are often promoted by definite QoS information. Technically, QoS is a broad concept that encompasses a number of non-functional properties such as price, duration, availability, reliability, reputation (Zeng et al., 2004; O’Sullivan, Edmond, & Hofstede, 2002). It is worth noting that these QoS properties may be discriminated from two perspectives. For some QoS properties (e.g., price), they are associated with a standalone service naturally determined by its provider. As services are usually distributed across the Internet, some of their QoS properties (e.g., availability and successful execution rate) are affected by the communication link, and should be measured from the perspective of the requestor rather than the provider (Zeng et al., 2004). For enterprises, QoS information plays a very important part for effectively promoting online B2B collaboration through dynamically creating value-added coordination by composition of existing Web services (Zeng et al., 2004).

**Motivation**

Here, a motivating example is presented, firstly, for highlighting the motivation of our research.

A real estate buyer wants to buy a house property from a real estate company. The buyer would ask Bank for a loan. In requesting a loan service from Bank, the buyer expects his or her loan requirement could be satisfied as soon as possible. For Bank, it often spends some time to seriously verify a buyer’s paying ability before offering a customer’s final loan contract. Here, suppose that it would spend eight workdays for Bank to satisfy a customer’s loaning requirement. For the real estate company, it always receives its customers’ payment through its accounting opening bank, and it also expects the payment is fulfilled as soon as possible. Suppose that the real estate company’s accounting opening bank is Bank. Here, suppose that it would spend two workdays for Bank to
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