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Chapter IX

A Scalable QoS-Aware Web Services Management Architecture (QoSMA)

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Abstract

As Web services are growing rapidly and as their adoption by a large number of business organizations is increasing, scalability and performance management of Web services environments are of paramount importance. This chapter proposes a scalable QoS-aware architecture, called QoSMA, for the management of QoS-aware Web services. The aim of this architecture is to provide QoS management support for both Web services' providers and consumers. The proposed architecture is based on the commonly-used notion of QoS brokerage service. The QoS broker mediates between service requestors and service providers. Its responsibilities include performance monitoring of Web services, supporting users in Web services selection based on their QoS requirements, and the negotiation of QoS issues between requestors and providers. The QoSMA architecture provides the following benefits: First, it allows the automation of QoS management and QoS monitoring for both provid-

ers and clients. Second, the scalability of the architecture allows for better handling of the increasing demand while maintaining the pre-agreed-on QoS between service requestors and providers.

Introduction

Web services are increasingly used as a new technology for providing and/or consuming services artifacts via the Internet. Web services approach presents fundamental changes in the way systems are required, designed, developed, deployed and managed. Due to this rapid growth, quality of service (QoS) is becoming a key feature in Web services competition. End-to-end quality management of Web services is a critical issue that is highly related to the changing and dynamic environment of Web services. In fact, the QoS delivered to a client is highly affected by factors such as the performance of the Web service itself, the hosting platform, and the underlying network.

Web services paradigm is a recent concept of emerging Web applications. It connects a set of technologies, protocols, and languages to allow automatic communication between Web applications through the Internet. A Web Service is an application that exposes its functionality through an interface description and makes it publicly available for use by other programs. Web services can be accessed using different protocols, different component models, running on different operating systems. Web services make use of eXtensible Markup Language (XML)-based messaging as a fundamental means of data communication, and often use the standard Hypertext Transfer Protocol (HTTP) to exchange messages between service consumers (clients) and service providers (services).

As Web services are a new emerging technology, most existing work focuses more on their development and their interfacing practices. Research on Web services has focused more on functional and interfacing issues, that is, Simple Object Protocol (SOAP), Web services Description Language (WSDL), and Universal Description, Discovery, and Integration (UDDI). QoS support in Web services is still at the earlier stages of maturity as a research area where most of the efforts are focused on the enumeration of QoS requirements and mechanisms for QoS management. Also, considerable research efforts have been conducted to address the issues of QoS, manageability, and security in service-oriented architectures (SOA) in general.

Our aim, in this chapter, is to provide QoS management support for both service provider and consumers. Web services providers need support to publish and guarantee (enforce) the QoS of their Web services, while users need support to be able to express service-specific requirements while selecting Web services. The quality of service management process is automatically conducted through a set of phases ranging from specification of QoS parameters, selection of QoS-aware Web services, contract negotiation between providers and users, QoS monitoring, and guarantee.

The success of QoS support for Web services depends largely on the scalability of the proposed mechanisms as the number of clients and servers is expected to be very high in a SOA. This issue was not considered in SOA standard, and until very recently the issue was only highlighted without any real solution to tackle the problem. The need for performance and