Chapter 4.4
Web Services in Distributed Information Systems:
Availability, Performance and Composition

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ABSTRACT

Distributed information systems are growing rapidly in response to the improvement of computer hardware and software and this is matched by the evolution of the technologies involved. This article focuses mainly on Web Services technology and discusses related technical issues including availability, performance and composition. It also introduces Grid, agents and Semantic Web technologies that can work together with Web Services to serve different business goals.

INTRODUCTION

Distributed information systems are becoming more popular as a result of improvements in computer hardware and software, and there is a commensurate rise in the use of the associated technologies. Because of the increasing desire for business-to-business (B2B) communication and integration, technologies such as Service-Oriented Computing (SOC), Semantic Web, Grid, Agents/ Multi-agents, peer-to-peer, etc., are receiving a high level of interest nowadays.

As a part of distributed information systems, web information systems play an important role in the modern, ubiquitous Internet world and the applicability of Web Services as a particular implementation of SOC has been widely recognized for current B2B integration (e.g. e-commerce, e-government and e-healthcare).

However, building all aspects of Web Services comprehensively needs further improvement, for instance, Quality Of Service (QoS) has yet to be properly addressed. Likewise, the detection of service availability to achieve self-healing in the invocation process, service reuse, how best to define atomic services, and service composition are all issues that urgently require more research.

Meanwhile, it should be noted that Web Services play only a partial role in evolving distributed information systems. With the development of future computer hardware, software and business requirements, many other technologies will probably emerge that will serve particular business goals better. Therefore, much recent research has been focusing not only on individual technologies in distributed systems, but also on the possibility of combining currently available technologies to improve business outcomes.

In this article, we concentrate mainly on Web Services and technical issues associated with current Web Services standards, but we also give a brief overview of three other distributed technologies, namely Grid, agents and Semantic Web, which can work with Web Services. Thus, it concentrates initially on the background of services in distributed information systems, then it introduces Grid, agent and Semantic Web technologies. After that, the article discusses several technical aspects of Web Services in current distributed information systems, in particular, general Web Service availability and performance issues and the possibility of combining agent technology and Web Services to provide improved understanding of service availability. We then introduce JSON (Javascript Object Notation), which may provide an alternative to current approaches that

will deliver better Web Service Performance and discuss service composition, illustrating it with an implementation from the EU Living Human Digital Library (LHDL) project.

WEB SERVICES AND RELATED TECHNOLOGIES IN DISTRIBUTED INFORMATION SYSTEMS

Internet applications are developed and hosted by many different organizations, and customers from all over the world access them via the Internet from their desktops, or possibly from hand-held devices, such as a PDA or mobile phone. Originally, Internet applications referred to activities such as web browsing, FTP, and email. More recently, they have also included more advanced applications that are generally referred to as services. These mirror our real-world business activities in the cyber world.

Let us take a ticket-booking system as an example. The processes may include: the initial search for the right ticket, using criteria such as price, timing, etc; the actual booking, which will include some form of payment process which itself may involve authentication processes such as a credit check by the credit-card company; then various forms of after-sales service, such as notifications a few days before travel, etc. In the real world, all the services may be provided by different specialist companies and achieved by human interaction, using their knowledge and intelligence. In the cyber world, these actions are achieved by so-called software services. To avoid continually having to rebuild services, there has been a trend towards using "atomic" services as building blocks from which to construct more complex services.

In open distributed systems, independent components cooperate with each other in order to achieve a goal. Apart from SOC, Grid technology and agent technology are the most widely used technologies for developing distributed systems. In this article, the authors do not offer a syntactic

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