

Chapter 87

Case Based Web Services

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INTRODUCTION

Web services are Internet-based application components published using standard interface description languages and universally available via uniform communication protocols (Singh & Huhns, 2005). Web services can be also considered the provision of services over electronic networks such as the Internet and wireless networks (Rust & Kannan, 2003). Web services is a new computing paradigm that has drawn increasing attention in information technology (Deitel, et al, 2004, p.13), information systems, and is playing a pivotal role in service computing and service intelligence (Singh & Huhns, 2005). Web services is a new business paradigm that is playing an important role in e-business, e-

commerce and business intelligence (Wang, et al, 2006). The key motive for the rapid development of web services is the ability to discover services that fulfil users' demands, negotiate service contracts and have the services delivered where and when the users request them (Tang, et al, 2007). The current research trend is to add intelligent techniques to web services to facilitate discovery, invocation, composition, and recommendation of web services (Wang, et al, 2006).

Case-based reasoning (CBR) is an artificial intelligence technique that solves problems by reasoning from a case base of previously solved cases, either by finding an exact solution to a previously solved problem or by adapting one or more past solutions (Kolodner, 1994). The most similar set of cases to the current problem will be extracted from

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the case base (Sun & Finnie, 2004). CBR as an intelligent technique has found many successful applications in e-business (Sun & Finnie, 2004) and web services (Lu, et al, 2007), especially in service retrieval, discovery, brokering, composition and recommendation of web services (Yao, 2006). For example, Ladner et al (2008) use a case-based classifier for web services discovery. However, what is the relationship between CBR and web services? How can CBR be applied to the main activities of a web service lifecycle? These problems still remain open. This article will address the above mentioned problems by proposing a unified CBR approach for the main activities of the web service lifecycle. To this end, the remainder of this article is organized as follows: It first looks at web service lifecycle from a requester's demand perspective. Then it proposes CWSR: a case-based web service reasoner. It examines the correspondence relationship between web services and CBR and provides a unified treatment for case-based web service discovery, composition and recommendation. It also looks at some future research directions. The final section ends the article with some concluding remarks and future work.

WEB SERVICE LIFECYCLE: A WEB SERVICE REQUESTER'S PERSPECTIVE

From the perspective of computer science (Pressman, 2001), the software development lifecycle (SDLC) describes the life of a software product from its conception, to its implementation, delivery, use, and maintenance (Pfleeger & Atlee, 2006). A traditional SDLC mainly consists of seven stages: planning, requirements analysis, systems design, coding, testing, delivery and maintenance. Based on this, a web service lifecycle (WSLC) consists of the start of a web service (WS) request

(He, et al, 2004) and the end of the WS transaction as well as its evolutionary stages that transform a web service from the start of the request to the end of the transaction.

There have been many attempts to address the WSLC in the web service community. For example, Sheth (2003) proposes a semantic web process lifecycle that consists of web description, discovery, composition and execution or orchestration. Zhang and Jeckle (2003) propose a WSLC that consists of WS modelling, development, publishing, discovery, composition, collaboration, monitoring and analytical control from a perspective of developers. Kwon (2003) proposes a WSLC consisting of four fundamental steps: WS identification, creation, use and maintenance. Narendra and Orriens (2006) consider the WSLC consisting of WS composition, execution, mid-stream adaptation, and re-execution. Tsalgaidou and Pilioura (2002) propose a WSLC consisting of two different layers: a basic layer and a value-added layer. The former contains WS creation, description, publishing, discovery, invocation and unpublishing. The latter contains the value-added activities of composition, security, brokering, reliability, billing, monitoring, transaction handling and contracting. They acknowledge that some of these activities take place at the WS requester's site, whereas others take place at the WS broker's or provider's site. However, they have not classified the proposed activities based on the WS requester, provider, and broker in detail.

Demand is an important factor for market and economy development (Jackson & McIver, 2004). The demand of WS requesters or customers is the significant force for promoting the research and development of web services. In what follows, we will examine a WSLC from a WS requester's demand perspective.

As a WS requester, he (for brevity, we use he to represent she or he) usually searches, matches web services to meet his demands. For example, if he

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