Chapter 6
Supporting Semantically Enhanced Web Service Discovery for Enterprise Application Integration

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ABSTRACT

The availability of sophisticated Web service discovery mechanisms is an essential prerequisite for increasing the levels of efficiency and automation in EAI. In this chapter, we present an approach for developing service registries building on the UDDI standard and offering semantically-enhanced publication and discovery capabilities in order to overcome some of the known limitations of conventional service registries. The approach aspires to promote efficiency in EAI in a number of ways, but primarily by automating the task of evaluating service integrability on the basis of the input and output messages that are defined in the Web service’s interface. The presented solution combines the use of three technology standards to meet its objectives: OWL-DL, for modelling service characteristics and performing fine-grained service matchmaking via DL reasoning, SAWSDL, for creating semantically annotated descriptions of service interfaces, and UDDI, for storing and retrieving syntactic and semantic information about services and service providers.

INTRODUCTION

Service-oriented computing is emerging as the dominant paradigm for enterprise computing and is changing the way business software applications are architected, developed, delivered, and consumed. The model of Service Oriented Architecture (SOA) and its manifestation through Web service technology standards promise to alleviate many of the barriers that stand on the path to Enterprise Ap-
plication Integration (EAI) and become enablers for business agility in the modern enterprise.

In a service-oriented landscape where contemporary technologies are employed, the integration of a set of enterprise applications (such as ERP, CRM, or WMS), is typically performed by composing the reusable Web services that are exposed by the individual applications into service orchestrations which are encoded in the popular WS-BPEL language -Web Services Business Process Execution Language- (Alves, et al., 2007). A BPEL orchestration is essentially an executable program that specifies how a set of services exposed by different applications should be coordinated in order to realise a specific business process, such as order fulfilment or stock replenishment. By deploying the service orchestration on a BPEL execution engine, the fulfilled business process is externalised as a normal Web service on the corporate network, which means that it can be consumed by client applications or re-composed in new Web service orchestrations.

**Web Service Discovery for Enterprise Application Integration**

During the phases of construction and maintenance of a service orchestration, the business process expert needs to search and discover Web services that are suitable for carrying out each of the key activities/functions in the workflow of the envisaged business process. The Web services that will finally be selected and included in the orchestration, among the tens or hundreds of services that may potentially be available on the corporate network, have to match a number of requirements. Depending on the application domain and the type of business process that the orchestration seeks to realise, these requirements may involve functional or non-functional aspects of service operation.

In every occasion, however, an essential requirement that needs to be satisfied is the integrability of the Web service on the basis of the input and output messages that are defined in the service’s interface. The ability of a Web service to be integrated in a service orchestration depends on whether proper data flow and thus proper communication can be established among the two. More specifically, proper data flow can be achieved only if the amount of data which the BPEL orchestration provides as input when it invokes a service are sufficient with regard to the amount of data that the service expects to receive, and at the same time, the amount of data that the service produces as output are sufficient with regard to the amount of data that the orchestration expects to obtain. If this condition holds, integration can be made possible even if the schema definitions of the business objects to be exchanged by the two parties along input and output messages are not identical (the heterogeneity can be overcome by applying some data mediation/transformation process).

Undeniably, in a fully SOA-enabled business application ecosystem with tens or hundreds of deployed Web services, the task of manually searching and identifying services that satisfy the above requirements for integrability can become extremely resource-intensive and error prone. This is why the existence of intelligent automated Web service discovery mechanisms that can address these needs is considered a core challenge for increasing the levels of efficiency and automation in EAI.

**Web Service Discovery with UDDI**

The need for efficient search and discovery of services was the original motivation behind the development of the Universal Description, Discovery and Integration (UDDI) specification as a standardised way to catalogue and discover reusable Web services (Clement, Hately, von Riegen, & Rogers, 2004). The UDDI specification was the result of an industry-driven standardisation effort led by the OASIS consortium, and its scope was not limited to providing support for EAI alone,