A Spanning Tree Based Approach to Identifying Web Services

Hemant Jain, University of Wisconsin – Milwaukee, USA
Huimin Zhao, University of Wisconsin – Milwaukee, USA
Nageswara R. Chinta, Tata Consultancy Services, India

ABSTRACT

Web service has been envisioned as an important trend in application development and integration. It allows pre-built applications/application components wrapped as web services to interact with each other through standardized interfaces and form larger application systems. This paper describes a formal approach to web services identification, which is a critical step in designing and developing effective web services. The approach takes an analysis level object model, representing a business domain, as input and generates potential web service designs, in which the classes in the object model are grouped into appropriate web services based on static and dynamic relationships between classes. An initial hierarchical grouping of classes is derived using a maximum spanning tree algorithm. A set of managerial goals for evaluating alternative designs is derived based on business strategy of web service fabricator. Since the managerial goals are conflicting, a multi-objective genetic algorithm has been designed to search for alternative non-dominated solutions, from which a preferred solution can be selected. The approach has been implemented in a web services identification tool and used for designing web services in an auto insurance claims domain. The experts evaluated the utility of the approach.

Keywords: web services; web services identification; graph partitioning; spanning tree; genetic algorithm

INTRODUCTION

Web services are envisioned as the next technological wave. Leading software vendors, including Microsoft (Miller, 2003), Sun (Williams, 2003), and IBM (Kreger, 2003), are investing extensively in the development of protocols and products that facilitate the development, deployment, discovery, and composition of web services. At the same time, a set of web services technologies is being standardized and supported by the industry (Kreger, 2003).

Web services are expected to greatly enhance web application interaction and integration and can...
facilitate assembly of larger business applications from reusable components wrapped as web services. Based upon emerging standards such as HTTP, XML, SOAP, WSDL, UDDI, and BPEL4WS, web services allow loosely coupled web based application systems to be quickly built by assembling application components wrapped and published as web services. In these applications, the individual components that provide focused business functionalities can communicate with each other through standardized interfaces (i.e., XML messaging) to form larger application systems that carry out more complex business processes. Offering a language-neutral, environment-neutral computing model, web services technology is promoting application interaction and integration through the Internet both within and across enterprises (Gottschalk et al., 2002).

The development and integration of web services resemble Component Based Software Development (CBSD), where pre-built parts, known as business components, are assembled into larger-scale applications (Herzum and Sims, 2000; Vitharana et al., 2003). A web service is essentially a business component, which implements an autonomous business concept or business process. Development of web services typically requires the following steps: domain analysis and modeling, web services identification, web service design & implementation, testing, acceptance, and deployment & publication. A critical step among these is web services identification, where related object classes are grouped into web services.

The problem of identifying appropriate web services has not been addressed in the literature. No formal methodology and tools that allow the designer to generate and evaluate alternative designs based on a set of managerial design goals exist. This paper describes a formal approach to web services identification.

The paper is organized as follows. First, the web services identification problem is discussed and approaches being used in identifying reusable assets and in designing business components are briefly reviewed. A formal approach to web services identification is then presented. An implementation of the approach in a tool and its application to identifying web services for an auto insurance claim system are then described. Finally, conclusions and future research directions are given.

WEB SERVICES IDENTIFICATION PROBLEM

Web services need to be developed such that they can be reused within the same domain and may possibly be reused across domains. The challenge is to identify web services that can be developed in a cost-effective manner, are suitable for reuse, easy to assemble into larger applications, easy to maintain, and provide capability to customize end applications by proper selection and assembly of web services.

Identifying reusable artifacts is
Aspect-Oriented Framework for Web Services (AoF4WS): Introduction and Two Example Case Studies
Managing Web Service Quality: Measuring Outcomes and Effectiveness (pp. 245-263).
www.igi-global.com/chapter/aspect-oriented-framework-web-services/26082?camid=4v1a