A Service-Oriented User Interface for the Next Generation Web

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ABSTRACT

The Web enters a new era where contents are to take the back seat and services will take the driver seat to form a service-oriented Web. This paper presents a service-oriented user interface design for the next generation Web. The design leverages the advances of semantic Web and service composition technologies to provide an intelligent and generic user interface to query, compose and execute Web services for a variety of user tasks. First, a simple cost model is developed for estimating the development and learning overheads of Web service interfaces for service-oriented applications as the motivation of this work. Then, the authors present the design of the service-oriented browser and discuss the enabling technologies. A prototype system is developed using existing technologies and standards as a proof of concept.

Keywords: Semantic Web, Service Oriented Architecture, Service Query, User Interface, Web Service Management System

INTRODUCTION

The success of the Web has significantly changed the way we do things in our life. There are more than 1.7 billion internet users (about 25.6% of the total population) all over the world as the latest statistics from Internet World Stats (2011). Many of them use the Internet regularly to obtain information (e.g., news, emails, articles, etc.), conduct business (e.g., online banking, online shopping and eBay), solve specific problems (e.g., scientific research) and participate in virtual communities (e.g., Flickr, Facebook, Twitter, etc.).

While Google and other search engines have done a great job in helping people to find right contents and services on the Internet, sometimes the processes are not straightforward. With the current Web technologies (e.g., browsers, search engines, etc.), a common way for users to find a particular content or service is as follows: (a) the user provides a few related keywords to a search engine; (b) the search engine returns a list of Website URLs, which may (or may not) meet users’ requirements. Nevertheless, the user has to identify which Website contains what they want by manually

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iterating the list one by one. This can be a tedious process and heavily depends on individual’s knowledge, skills and patience. Furthermore, it provides no guarantee in terms of the quality of the services and contents.

A significant amount of research has been conducted in improving people’s abilities to explore the Web’s full capacity. One of the technical trends is Semantic Web (Berners-Lee, Hendler, & Lassila, 2001). Semantic Web aims at defining the meaning of the Web contents, services and their relations at a semantic level. With semantic Web, people can precisely specify what they want and the Web is likely to deliver the right contents and services. Another technical trend is the Service Oriented Architecture (SOA), which has been widely adopted by industries as a new paradigm to deliver services across the Web. As a result, a variety of new concepts have been proposed to align existing IT infrastructures and applications with this new paradigm such as Data as a Service (DaaS), Software as a Service (SaaS) and Infrastructure as a Service (IaaS). These concepts support the development and deployment of a large amount of (Web) services across the Internet. These services can be further ‘mashed-up’ to build new services/applications. This is paving the way to the next generation Web - an open, collaborative and service-oriented Web (Murugesan, 2009). As the new Web platform is approaching us, how users are interfaced to the new Web remains an interesting and challenging problem.

In this paper, we address this problem by presenting a service-oriented user interface for service-oriented Web. Our key contributions are as follows: (a) we develop a simple cost model to estimate the interface complexity that has to be handled to develop Web service based applications; (b) we provide an architecture design of an intelligent user interface that is service-oriented and generic enough to automatically handle a variety of user queries; (c) we identify the key components and research issues enabling the service-oriented browser; (d) we prototype the service-oriented user interface and demonstrate its concept with two service composition scenarios.

RELATED WORK

There has been considerable work from different research communities on improving people’s ability to access a variety of resources (e.g., information and services) on the Web. In the following, we only describe some of them closely related to this paper.

Semantic Web approach is to define the contents, services and their relations on the Web with standardized concepts/notations and logics (usually within a given domain). As a result, people can unambiguously specify their requirements, which are completely understandable by computers. Driven by this promise, RDF (W3C, 2004) and OWL (W3C, 2009) were proposed to facilitate semantic Web resources modelling. OWL is further extended to OWL-S (Martin et al., 2004), which is dedicated for semantic Web service modelling with its counterpart WSMO (Bruijn et al., 2005). Semantic Web is a foundation of our work. While our generic UI is semantic-aware for a given domain, the back-end software systems will use domain ontology in any semantic Web service language to interpret and resolve a user query by binding with the appropriate Web services.

Some work has already adapted semantic Web approach to improving interface to the Web. For example, Dzbor, Motta, and Domingue (2007) present a tool that can help to interpret the Web resources for user by adding an ontology-derived semantic layer to Web browsers. This semantic layer allows users to plug-in different semantic services to conduct semantic annotations, ontology updating and content interpretation. Quan and Karger (2004) demonstrated how to make a semantic Web browser with a prototype called Haystack. Like classical Web browser, Haystack allows users to ‘view’ a RDF and navigate from one resource to another in the RDF. As a result, the users have a chance to ‘preview’ a Web page before making a decision to pull the contents. While our work is similar to Dzbor, Motta, and Domingue (2007) and Quan and Karger (2004) in principle (e.g., all have a semantic model for underlying Web resources), our work focuses
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