Discovery of Web Service Flow based on Service Context

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ABSTRACT

The growing number of services faces the need to combine them to create complex services and meet users’ requirements. Discovery based on the similarity evaluation only focuses on those services with similar functions. Techniques based on the conventional semantic Web offer many relations to connect services, but considerable time is spent on reasoning. This paper proposes an approach to discover associated service flows for the purpose of combination. The authors firstly obtain the text descriptions with rich semantics about the service functions from the Web to build the service contexts. They then create E-FCM representation for services based on the contexts to describe the functions of services because it can keep the semantic information and be automatically created. Furthermore, instead of reasoning, the association relations among services can be quickly found based on computation. Associated web service flows are generated from the association relations to recommend services with related functions to users. Thus, discovery effectiveness can be improved and facilitate the utilization of services.

Keywords: E-FCM, Service Combination, Service Flow, Service Relation, Web

1. INTRODUCTION

The rapid adoption of SOA (service-oriented architecture) and Web service technique has brought a large number of services, which makes it convenient for the users to reuse services and combine them into complex services to satisfy the complicated applications. To build complex service firstly requires the rapid discovery of services with associated functions which are suitable to be composed together.

Key-word based discovery methods mainly requires that all the results contain keywords which the retrieval algorithms are based on. When there is no such service or mashup (i.e., service combinations), they have low precision rate because of the neglect of relations among services.

Discovery of services based on the similarity evaluation (Stroulia, 2005; Gomadam, 2006)
Researchers (Mecella, 2001; Kazhamiakin, 2006) utilize the formal methods and aim to verify the feasibility of the composition of selected services by checking whether the types of the parameters of input/output messages are compatible or whether the external behaviors of services conform to the desired goal. These approaches have assumed the presence of discovered services.

Although semantic service discovery techniques based on the ontology languages, like OWL (McGuinness & van Harmelen, 2004), WSMO (Brujin, 2005) and other light weight ontology languages (Paolucci, 2002; Küster, 2007), provide many kinds of relations between services and improve the precision rate, they have low discovery efficiency because the ontology creation is not automatically and considerable time has to be consumed on creating ontology and reasoning about different relations among services.

We draw our inspiration from the association between topics or themes and propose the discovering of service flows. The idea is simple and intuitive: the user selects some initial services that are indicative of their requirement and our approach recommends possible services to complete or further expand their requirement by the discovered service flows.

The characteristics of web services introduce two main challenges to the problem of discovering service flows. The first concerns the description of services. Developers usually provide WSDL description of services. Intuitively, WSDL should give detailed description about the function of a service. While in most cases the names of the main components of WSDL, i.e., input/output messages, portTypes and operations, are the concatenation of a few terms. It’s not easy to mine out the relations of services just relying on these terms. Another option is firstly evaluating the similarity of terms by ontology such as Wordnet (Plebani, 2009), then finding out the similarity degree of services. But this option is for similarities and not proper to link services with the associated functions.

The second important challenge is the building of the relations which can connect associated services and reflects users’ preferences. Many kinds of relations exist between services. They can be mined from user’s behaviors (Qu, 2008) or calculated from the representation of services. However users may utilize thousands of services to create mashups and users’ behaviors vary with time and are affected by many factors, such as the popularity of service, browsing through all to identify the common manner or patterns is time-consuming.

To address the above issues, in this paper we focus on the text descriptions of services and calculate the association relations between services depending on the semantics from the texts. Service flows are produced upon the associated relations to recommend services closely related to users’ initial selections. The experiments on users’ behaviors show the efficiency and effectiveness of our approach.

More detailed, firstly we obtain the text descriptions of services depending on the search results from the Web search engine because the descriptions provided by service developers usually contain little information about the functions of services. By leveraging the search results, the great context for services can be determined to resolve the absence of terms which can express their functions.

Secondly, based on our previous work (Liu, 2008), we utilize simplified E-FCM (Element Fuzzy Cognitive Map) (Luo & Fang, 2008; Zhuge, 2006) to represent web services for the reason that E-FCM keeps the semantic information as far as possible and E-FCMs are constructed automatically. Furthermore, unlike the relations of service described using ontology language which are based on reasoning, the relations among E-FCMs are based on computation. That makes the association relation among services can be discovered quickly.

Finally, with the calculated association relations, a semantic layer upon the individual and
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