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Application Discovery of Semantic Web Service Based on Qos Ontology

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Abstract: Taking into account the huge information on Web, by analyzing the several main expressions of Web service, the semantic function ontology and the description of QoS ontology, this study takes the next steps to consider the discovery of Semantic Web service and its relevant problems: Firstly, it builds the QoS models of Web service, then puts forward a framework of Web discovery based on Semantic Web Service and QoS model, finally, establishes a semantic and QoS ontology with a instance.

Key words: QoS ontology, QoS model, Semantic Web, Web service discovery, OWL-Q

INTRODUCTION

Semantic Web service is adding semantic elements in Web services and specified semantic information to the relating Web services, the service providers and the service demanders take next action according to the automatic Web service discovery of these semantic information, composition and execution (McIlraith *et al*., 2007). It implements some functions and satisfies certain need, it is a software component based on Web. In a distributed system, the Web service demanders and providers are loosely coupled relationship, that means the demanders of Web service and providers don't need to be implemented on the same platform (Alonso *et al*., 2004; Yu and Han, 2006). The idea of augmenting the semantic representation of a document beyond a set of plain words is in fact present in earlier works to those decades, such as Jones (2004). Because of the semantic Web service discovery analyzes and matches the user's demand in the semantic level, so it can acquire high accuracy. However, simply rely on the semantic function of Web service discovery may not necessarily satisfy the demand of service. For example, even if the Web service can meet in function, but it is not satisfied with the quality of the performance requirement about some parameters. Therefore, in order to find the optimal Web service for the demanders, there needs to consider the problem from the two aspects of function and quality of Web service (Liu *et al*., 2004).Usually semantic Web service and QoS are separately researched. Liu *et al*. (2011) introduced semantic information into hybrid motion for improving motion graph. This study takes a combination of the two for Web services discovery researches and puts forward a Web service discovery framework. It divides the process into two steps in the framework: the first step is to match from the function and then find the most satisfied QoS requirements of Web services through QoS matching. The study also the analyzes the Web service discovery method, semantic Web service discovery method and QoS ontology description method, it studies on QoS semantic Web service discovery and related problems and finally establishes semantic function of ontology and QoS ontology through examples.

SEMANTIC WEB SERVICE AND ITS DEVELOPMENT

QoS ontology: There are three main applications can be distinguished in the literature based on the type and use of semantic knowledge representation: One is statistical approaches, like LSA (Deerwester *et al*., 1990), use statistical models to identify groups of words that commonly appear together and therefore may jointly describe a particular reality; the other is linguistic conceptualization approaches (Giunchiglia *et al*., 2009; Madala *et al*., 2008; Castells *et al*., 2007) which based on light conceptualizations, usually considering few types of relations between concepts and low information specificity levels; and the third is ontology-based proposals consider a much more detailed and densely populated conceptual space in the form of ontology-based KBs (Guha *et al*., 2003; Popov *et al*., 2004). The main work of semantic Web service is to create domain ontology which represents the relationship of concepts in the field, it is also provide knowledge basis for the operation agent at the semantic level. The Qos of Semantic Web service should be also added a semantic element and established a ontology body. The establishment of QoS ontology needs to expand the above ontology building tools. P. Castells *et al*.

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developed a general framework to leverage ontologies in the frame of traditional vector space (Stephen *et al.,* 2006). The existing methods of establishing the ontology include OWL-Q, QoS ontology language and onQoS etc. OWL-Q is extended from OWL-S and it can describe top ontology QoS, it is used in service of requesters and providers (Tran and Tsuji, 2008). The main ontology body established by OWL-Q is divided into several different representing aspects, each of them is able to expanded describes one of parameters of Web service QoS. Connecting Facet supports the connection of OWL-Q and OWL-S, it offers concepts and vocabularies to define QoS requirements. In this respect, the QoS property can include all elements of services such as input, effects and conditions. Each of the QoS property can be static or dynamic and measured staticly or dynamicly in units. Basic Facet includes the concepts of QoS, such as security, transmission protocol, overhead and the effective date. QoS Metric Facet describes and defines the nature of QoS metrics, it contains various QoS metrics, the QoS attributes, providing the sides of measurement, the field of measurement, the type and the other metrics. Measurement Directive is used to simple measurement unit while Function and Schedule Facets are used for dynamic calculation and measure for the complex unit of measurement. Unit Facet dexcribes Metric unit of QoS, it also contains a unit of measurement for the same and different unit conversion concept. QoSValueType Facet describes the types of values, such as strings, numbers, range, list and the boolean type etc. OWL-Q provides a detailed description of QoS information model, especially regarding the measurement unit, unit, value type and relationship of the nature of QoS. The method of standard components makes the ontology body flexibly add necessary elements such as time body etc.

Semantic web service: The semantic Web service describes the ability, characteristics and attributes of service through which to explain the purpose of Web service. It adds the semantic elements to the concept of Web service and uses specific rules to explain the meanings of the concepts. The semantic Web service can implement automatic service discovery, automatic service execution, automatic service composition and automatic service monitoring (Alonso *et al.*, 2004). In other word, the semantic Web service technology can make use of the semantic information of the service description to achieve automatic Web service operation. Through the automatic Web discovery, service execution, service composition and service monitoring, semantic Web service improves the automatic level of Web service. Now a lot of technologies can be used for the development of semantic Web service framework, for example the technologies of OWL-S (Ontology Web Language for Service), IRS-II (Internet Reasoning Service) and WSMF (WEB Service Modeling Framework). OWL-S is a service ontology which describes the semantic Web service based on intelligence. OWL-S is the most widely used semantic Web service description ontology which issued by W3C as standard in 2004. It consists of the service profile, service model and service point. The service profile is mainly used for description of Web service discovery, it includes the following information: service provider information; service functions and other properties; other information describing the service characteristics, such as transmission speed and reliability of service (Zou, 2009).

Semantic web service discovery: Semantic Web service discovery is the implementation of Web service search in semantic level, it is a kind of Web service discover based on ontology (Yang *et al.*, 2008). The ontology annotates the Web service using expression of knowledge, then it can acquire the semantic meaning of Web service. It finds the Web service through matching Web service requester to Web service register in the semantic level (Gonzalo *et al.*, 2008). Web service discovery technology includes the Web service search technology based on keywords, the Web service search technology based on framework and discovery technology based on semantic Web service. The Web service search technology based on keywords is very similar to the widely used search engine, this technique is a simple text matching, so the accuracy of the search is not high. The Web service search technology based on framework is to use the logic to describe Web service and service attribute, it has a high accuracy rate of searching, but with a very high computational complexity of the service logic representation and deduction which makes the method not applicable to practice.

THE QOS MODEL

The QoS is usually different according to the different application fields. Its model describes the parameter attributes of QoS, it is used to measure the quality of Web service. QoS is also different with the request's emphasis, for example, some request's emphasis on the Web service price and the requester chooses the Web service according to its price, other's emphasis on the reaction time and the requester selects Web service according to its reaction time. In order to describe a generic QoS model, we summarized the works of others, proposed some general QoS attribute parameters which are shown as follows:

- **Reaction time:** Typical attributes describing a WEB service performance, it can be calculated as: Response time (R) = Execution time (R)+Waiting time (R). The execution time is the duration of WEB service, the waiting time is the delay time caused by any event, for example, the transfer time from the service provider to the service requesters
- **Throughput rate:** For service requester, it is important to know that the number of working can be completed within a certain time limit for a Web service, for example the request number within a second. The throughput rate can be calculated as: Throughput (S) = No. of requests/per unit-of-time
- **Reliability:** Reliability is one of the most concerned attributes of QoS, it represents the ability of Web service to complete its function. It can be measured by the probability for Web service to successfully complete its function
- **Availability:** The extent of the Web service can be used determines its availability, it can use the Web service time to calculate availability: Availability(S)=Uptime(S)/(Uptime(S)+Downtime(S)). The uptime and downtime can be separately measure by the mean time of failure and the mean time of recovery

FRAME OF SEMANTIC WEB SERVICE DISCOVERY BASED ON QOS

In order to meet the requirements of Web service with QoS or the selection of better QoS with the same function of Web service, the QoS attributes judgment is added in framework of semantic Web service discovery, this is shown as Fig. 1. The user can query Web service by personal agent at registration center; the query service agent receives message from the personal agent, uses Web service ontology to tag the query message, forms the special format of querying service. For example, a query message may an OWL-S format one according to the semantic Web service ontology., thus the request Web service data has the same format as the ontology Web service.

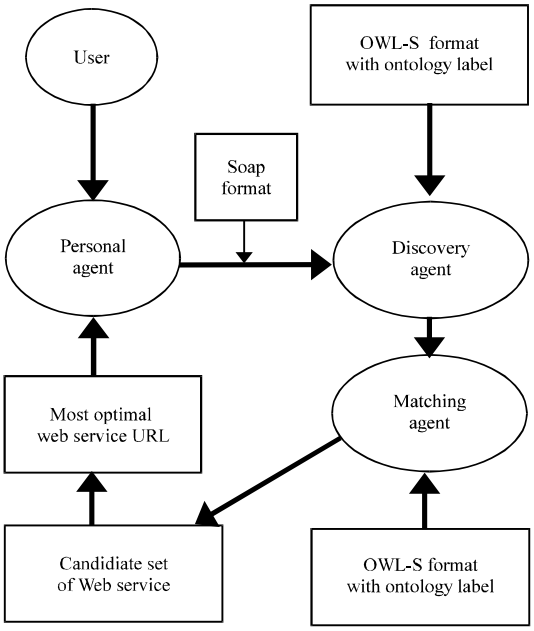

Fig. 1: Frame based on semantic Web service discovery

INSTANCE

Following is an online learning system through which users can achieve the purpose of learning. The system is a distributed software system and users need to take a series of learning activities in order to achieve a learning goal. The system includes two parts: One is a series of activities to achieve the purpose of learning , the other is the learning resources, which includes data and documents and defined as Web service. For the online learning system, it can be supposed that the ontology has the following several training course including Chinese, English, computer, electronics and mathematics.

For this online learning Web service, OWL-S can be used to describe the semantic Web information. The service profile for Web service ontology is described as follows:

```
<profileHierarchy: E learning rdf:ID=
"Profile_Online_ElearningAgent ">
<service:presentedBy rdf:resource=" "/>
<profile:has_proecss rdf:resource=" "/>
<profile:serviceName>
 </profile:serviceName>
<profile:textDescription>
This service provides computer courses for college students whose major is
in computing.
</profile:textDescription>
<profile:hasPrecondition rdf:resource=" "/>
<profile:hasResult rdf:resource=" "/>
<profile:hasResult rdf:resource=" "/>
<profile:hasOutput rdf:resource=" "/>
```

CONCLUSION

This study introduced QoS with the corresponding semantic Web service and analysis of the description of QoS Ontology. It established a general QoS model through practice. And then put forward the framework of semantic Web service discovery based on QoS. Finally, the semantic function ontology and QoS ontology was established through the example. Future work is to improve the QoS model, especially how to choose the values of QoS parameter attributes.

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