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Web services Discovery Approaches

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ABSTRACT

Web services are the basic construct that aims to facilitate building of business application in a more flexible and interoperable manner for the enterprise collaboration. Now a days web service is getting more and more popular because of its characteristics like loosely coupled, reusable, platform independent etc.. Due to this popularity web services are developed with similar functionality. With the increase of published Web services, it has become a great challenge to recommend consumers the best services with regard to the quality of services (QoS). Service oriented computing and web services have created great potential opportunities for the users to build their own applications. In this paper, we give an overview of different approaches for web service discovery process and the challenges faced by web services.

Keywords: QoS, Web Service, Web Service Selection.

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I. INTRODUCTION

In recent years, a growing number of Web Services have emerged as the Internet develops at a fast rate. Individual Web services usually cannot satisfy some customers' requirements. So we always need to integrate existing services to create new value-added composed services. A composite Web service is a series of tasks that are tied together for accomplishing some specific works. Services able to provide the required functionalities are then associated with the individual tasks of the composite services and invoked during each execution of the composite services. Web Services can encapsulate a specific task or can be designed as a composition of other services, representing a complex aggregation. The amount of data that is processed by users has exponentially increased since the development of the communication technique and the internet. An increase in data presents difficulties in searching information within a user's desired time frame, which currently exceeds the limitation of data processing time for an individual user. Since there are lot of Web services to perform same functionality, we need to select a proper Web Service based on QoS requirements. The Web services composition is gaining a considerable area of an approach to the effective integration of heterogeneous, autonomous and distributed applications to build more sophisticated and Value Added Services (VAS).QoS (Quality of Service) is one of the important criterions to select the best service out of available service for the tasks of composition. The main objective of selecting an algorithm is to maximize the QoS of the composition.

Various other approaches for discovering web services are also available. Some of the discovery approaches are syntax based while other are semantic based. Having system for service discovery which can work automatically is also the concern of service discovery approaches. As these approaches are different, one solution may be better than another depending on requirements. Selecting a specific service discovery system is a hard task. Web services are application components which are based on XML [2]. Web services can be used by any application irrespective of platform in which it is developed. Web service description is provided in WSDL document. It can be accessed from internet using SOAP protocol. In industry, many applications are built by calling different web services available on internet. These applications are highly dependent on discovering correct and efficient web service. The discovered web service must match with the input, output, preconditions and effects specified by the user. Even after functional matching, QoS parameters also need to be matched to have best web service from available web services. Web services developed by different vendors are published on internet using UDDI

[1]. UDDI is the mechanism for registering and discovering web services. It is platform independent registry as it is based on extensible markup language. It allows businesses to give list of services and describe how they interact with each other.

To determine right web service for the customer search engine or Universal Description, Discovery and Integration (UDDI) service provider has to match not only the functionalities of web services, but also their Quality of Services(QoS). QoS of web service depend upon non-functional attributes (e.g. response time, availability etc.). These attributes may have impact on the quality of service provided by Web Services [3][4][5]. Quality of service depends upon numbers of attributes. Every attribute of the QoS has its own effect on overall quality of service, which will change every time based on the services and and user requirements.

The paper is organized as follows: Section 2 gives a brief overview of web services discovery process approaches. Section 3 describes main challenges involved in a service selection processfollowed by the Conclusion part.

II. WEB SERVICE DISCOVERY APPROACHES

A web service discovery process is carried out in three major steps. First step is advertisement of web service by developers. Providers advertise web services in public repositories by registering their web services using web service description file written in WSDL [6]. Second step is web service request by user. User sends web service request specifying the requirement in predefined format to web service repository. Web service matcher which is core part of web service discovery model, matches user request with available web services and finds a set of web service candidates. Final step is selection and invocation of one of the retrieved web services. Discovery of correct web service depends on how mature web service matching process is. i.e.; how actual requirements of user are represented in formalized way and how they are matched with available services.

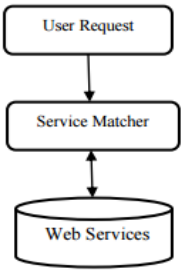

Fig. 1 Web service discovery

Following is the brief overview of different approaches for web service discovery.

2.1 Context aware web service discovery

As format for sending web service request is fixed, some information in user's request is lost during transforming user's request to formalized one. To overcome this limitation, context aware web service discovery approach is suggested by WengeRong and Kecheng Liu [7]. Context aware discovery is useful for request optimization, result optimization and personalization. As concept of context is very complex, they suggest with an example that context should be domain oriented or problem oriented. The context in web service discovery is formally defined as any information that explicitly and implicitly affects the user's web service request generation. They divide context in two categories as Explicit and implicit. Explicit context is directly provided by the user during matchmaking process such as Q&A information. Implicit context is collected in automatic or semi-automatic manner. Implicit context is more applicable to web service discovery as user is not directly involved. Context awareness is again divided in four categories depending on how context is collected. The categories are Personal profile oriented context, Usage history oriented context, Process oriented context and other context.In case where single web service is not sufficient to complete user request, composition of multiple web services is carried out. In this case, context should be built considering composite web service discovery process.

2.2 Publish subscribe model

FalakNawz, KamramQadir and H. Farooq Ahmad[8] propose push model for web service discovery where service requesters are provided with service notification prior to discovery. They use semantic based web service matching where service descriptions are matched using OWL-S [9], an ontology language for web service description. They also rank published web services depending on the scores assigned using concept matching. They divide the system in two phases as subscription phase, which starts when a subscriber registers himself onto registry for notification of required services and notification phase, which starts when a new service is published on registry.

2.3 Service request expansion

One more approach for enhancing web service discovery is sending modifying user requests as suggested by A. Paliwal, N. Adam and C. Bornhovd [10]. They expand service requests by combining ontologies and latent semantic indexing. They build the service request vector according to the domain ontology, build the training set of the LSI classifier by extracting features from selected WSDL files, and then project the description vectors and the request vector.

2.4 Keyword clustering

Web service discovery based on Keyword clustering and concept expansion is suggested by J. Zhou, T. Zhang, H. Meng, L. Xiao, G. Chen and D. Li[11]. They calculate similarity matrix of words in domain ontology based on Pareto principal and use that for semantic reasoning to find matching service.

2.5 BPEL processes ranking using graph matching

When user requests for web service in available web services repository, if exact matching web service does not exist, then approximate matching web service can be suggested by service matcher. To achieve this goal, behavioral matching is required. D. Grigori, J. Carlos Corrales, M. Bouzeghoub and A. Gate [12] developed matching technique which works on BPEL [13] behaviour model. User requirements are expressed as a service behaviour model.

2.6 Layer based semantic web service discovery

Finding a matching web service in whole service repository is time consuming process. Guo Wen-yue, QuHai-cheng and Chen Hong [14] have divided search in three layers by applying filters at each layer and thus minimizing search area.

2.7 Service discovery in heterogeneous networks

F. Johnsen, T. Hafsoe, A. Eggen, C. Griwodz and P. Halvorsen[15] suggest the web service discovery solution which can fulfill the requirements in military networks. As same protocol cannot be used in heterogeneous networks, they suggest using of service discovery gateways, so that each network domain can employ the most suitable protocol. Interoperability is ensured by using service discovery gateways.

2.8 Web service indexing

To enable fast discovery of web services, available web services can be indexed using one of the indexing mechanisms such as inverted indexing and latent semantic indexing. B. Zhou, T. Huan, J. Liu and MeizhouShen [16] describe how inverted indexing can be used for quick, accurate and efficient web service discovery.

III. SERVICE SELECTION CHALLENGES

In this section, we discuss the main challenges involved in the service selection problem. These challenges are: 1) the NP-hardness of this problem for a composite service and the resulting scalability concern, 2) the need to distinguish the abstract business process from its possible set of execution paths, 3) defining the aggregation functions for the QoS attributes to measure the end-to-end quality of the composite service, and 4) elicitation of the service user's preferences about different QoS attributes that is required for the trade-off analysis of the candidate web services.

3.1 NP-hardness and Scalability

Service selection for a composite service can be modeled as a Multi-dimension Multi-choice Knapsack Problem (MMKP), which is known to be an NP-hard problem in the strong sense. This means that for large problems, it is unlikely that an optimal solution can be found given a reasonable amount of computational effort. Hence, there is a need for heuristic approaches when the problem size is too large to be solved by optimal solution procedures. Some researchers have proposed a Genetic Algorithm approach to solve the scalability problem. An alternative proposal to reduce the computational time of the service selection search algorithm is to shrink the search space.

3.2 From Business Process to Execution Path

The assumption in workflow-based service composition approaches is that the required composite service is described at an abstract level as a high-level business process. The business process is a collection of generic service tasks with defined control-flow and data-flow dependencies among them. Different languages and models have been used for describing the composite service, or more precisely its equivalent business process, such as UML activity diagram, state-chart , extended BPEL or YAWL.In service selection, it is essential to distinguish the abstract BP and its possible set of execution paths. Researchers have used different techniques to translate a BP to its corresponding execution paths, such as loop peeling or loop unfolding to treat loop structures.

3.3 Aggregation Functions

A critical challenge in service selection is how to measure the end-to-end quality of the composite service. The aggregated value of a QoS attribute should take into account. The QoS attribute value of the individual services participating in the composite service, and the business process structure. For example, the overall price of a composite service can be defined as the sum of the prices of all the participating services. However, for execution time, we need a more complex aggregation function, e.g. one that returns the maximum execution time among the parallel services, adds up the execution times of sequential services, and combines these two values if there are both parallel and sequential structures in the BP.

3.4 Defining the Weights of QoS Attributes

There is a general assumption that the service requester has a clear idea of the importance of a QoS attribute which let her assign a scalar weight to each QoS criterion. But this may not be realistic, especially as the number of QoS attributes involved in the selection criteria increases. Some researchers have challenged this assumption.

IV. CONCLUSION

Success of published web services depends on how it is getting discovered. Efficiency, accuracy and security factors must be considered while providing discovery mechanism. We have given overview of different web service discovery approaches with their advantages and disadvantages. Many approaches differ in the way web service matching is carried out. Some approaches are considering concept of semantic web, while some other focus on information retrieval methods. Some approaches suggest enhancement in web service request based on metadata about web services generated by feedback of other users. Some approaches suggest additional tools in traditional framework of web service discovery. Minimizing total search area using clustering techniques is also suggested. Survey shows that considering QoS parameters while selecting is important because, number of available web services providing same kind of functionality is very large. As web service discovery

requiring manual interference may take more time, solutions for automatic discovery are drawing more attention.

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