Dynamic Approach for Web Services Selection

Abhishek Pandey, S.K.Jena

Abstract— **Web Service is a software component invoked over the Web via an XML[1] message that follows the Simple Object Access Protocol (SOAP[2]), which is a simple XML based protocol to let applications exchange information over HTTP and to transport the messages using open protocols standard. Web Services are based on distributed technology and provide standard means of interoperating between different software applications across and within organizational boundaries with the use of XML. The purpose of web service selection is to select optimal web service for a particular task. When dynamic discovery is used in Web Services, it is common that the result of the discovery contains more than one provider. The purpose of this work is to develop an approach for secured, dynamic and transparent service selection and to evaluate the proposed architecture in terms of what selection techniques should be applied.**

***Index Terms*— QoS, Security, SOAP, Web Services.**

I. Introduction

The basic Web Service platform is combination of HTTP and XML. The HTTP protocol is the commonly used internet protocol. XML provides a language which can be used between different platforms and programming languages. Web services use XML to code and to decode data, and SOAP for establishing sessions to exchange information. Web Services are web applications whose interfaces are exposed over protocols like HTML and XML [3] .Web Services are described by Web Service Definition Language (WSDL) in XML format. WSDL [4] is a major language that provides a model and an XML format to describe the syntax about Web services. It acts as a vocabulary, associated with UDDI[5].

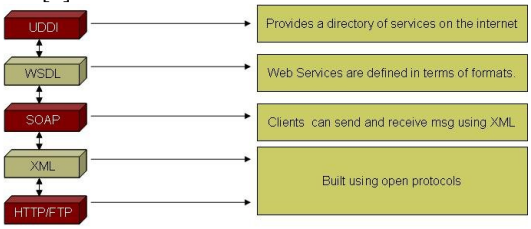

Fig1. Web Services Structure

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Web Services can encapsulate a specific task or can be designed as a composition of other services, representing a complex aggregation. Service providers describe their Web Services and advertise them in a universal registry called UDDI[5]. This enables service requestors to search the registry and find services. UDDI allows for the creation of registries that are accessible over the web.

Once the list of services, offering the same functionality, is available and the criteria are specified, a set of steps (instructions, rules) for Web Service selection should be followed during the decision making process, in order to determine the component to handle the client's request. Various sets of instructions represent different selection techniques.

II. Motivation

Researchers have proposed various approaches for dynamic web service selection. Maximilien and Singh [6] proposed a multi-agent based architecture to select the best service according to the consumers' preferences. Maximilien and Singh describe a system in which proxy agents gather information on services, and also interact with other proxy agents to maximize their information and the conceptual model they use to interact with the services is detailed elsewhere [7]. The proxy agents lie between the service consumer and the service providers. The agents contact a service broker, which contains information about all known services, as well as ratings about its observed QoS. From there, the information is combined with its own historical usage, and the combined knowledge is used to select a service, though the authors do not detail how. The agencies contain data about the interactions between the clients and the services which is used during the Web Services selection process

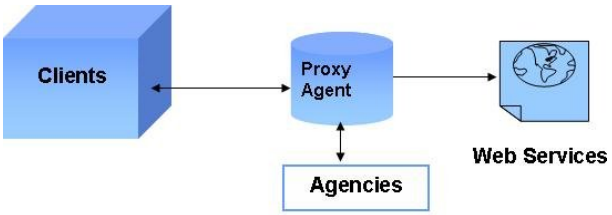

Fig2.1. Model proposed by Maximilien and Singh [6]

In his work, trust and reputation are taken into account during the decision process. Their approach divides the QoS attributes into objective and subjective. The former include QoS features such as availability, reliability, and response

time. Their approach is shown in figure 2.1. Liu, Ngu, and Zeng [8] consider these features in their proposed approach as well but their major selection criteria is based on the QoS based service selection. They have considered three quality criteria namely execution time, execution duration and reputation for the selection. In addition, execution price, duration, transactions support, compensation and penalty rate are the other criteria. The authors of [8] suggest an open, fair, and dynamic framework that evaluates the QoS of the available Web Services by using clients' feedback and monitoring.

The reasoning mechanism is responsible for the selection of a Web Service at a particular moment of time. In order to distinguish one service from another using the specified criteria, this unit requires a set of instructions that help evaluate each component and choose the most appropriate one respectively. A set of instructions can be seen as a selection technique. The major components of a reasoning mechanism are criteria, model, and selection technique. The model collects information about the participants of the client-server interaction as well as represents it as aggregated measures. Different selection techniques can implement various business logics in order to make a decision.

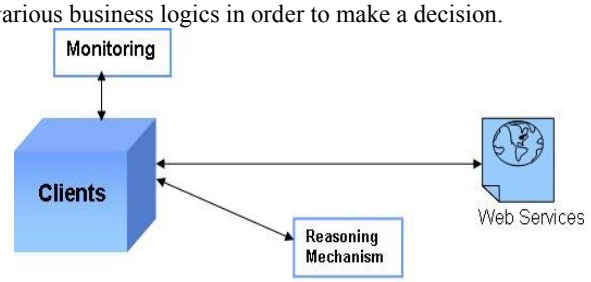

Fig2.2. Model proposed by Liu, Ngu, and Zeng[8]

The reasoning mechanism in the approach proposed by Liu, Ngu, and Zeng[8] computes the QoS of the Web Services, ranks them, and selects the most appropriate one. To perform the selection, the QoS registry in their system takes in data collected from the clients, stores it in a matrix of web service data in which each row represents a web service and each column a QoS parameter, and then performs a number of computations on the data, such as normalization. Clients can then access the registry, and are given a service based on the parameters that the client prefers. The bottleneck of the approach is the dependency on the consumers to give regular feedback about their past experience with the Web Services. An overview of their approach is shown in figure 2.2 .The Success of this model is based on the clients or the end users and their will to provide the necessary feedback on QoS.

When dealing with dynamic components like Web Services, it is hard to observe all of their possible features. The researchers focus mostly on some generic criteria, since they can be applied to any service. Availability, reliability, and response time are the most popular ones, as they provide an overview of the services and at the same time they can be evaluated relatively easily. A summary of the reviewed literature that uses criteria for dynamic service selection is shown in the table 2.1.

	Run-Time Selection	Reasoning Mechanism	Transparency during selection	Clients Involved in Web Service Selection	Clients Feedback
Maximilien and Singh	Yes	Agents	Yes	No	No
Liu, Ngu, and Zeng	Yes	QoS Computation QoS Ranking	No	No	Yes

Table2.1: Comparison of various Web Services

III. PROBLEM DEFINITION

Web Service Selection: The purpose of web service (WS) selection is to select optimal web service for a particular task. When dynamic discovery is used in Web Services, it is common that the result of the discovery contains more than one provider. Even for a composite Web Service consisting of many atomic Web Services, the selection issue still needs to be addressed when there are multiple providers available for an atomic service. In order to make a distinction between the services which provide the same functionality, selection criteria should be used. They help evaluate the Web Services within a group and choose the component that matches the needs and the preferences of the consumers, while taking into account the abilities of the providers. Web Services can be ranked by the Quality of Service (QoS) they offer. QoS is a means to enable selection and filter out unqualified providers. QoS can be seen as an aggregated measure of generic criteria such as availability, reliability [10, 11], failure rate, trust and reputation, response time, price, and network load and domain specific features [8].The reasoning mechanism is responsible for the selection of a Web Service at a particular moment of time. The previous works as already discussed in section II and as compared in table 2.1, reflects that the clients are not involved in the selection process.

The purpose of this work is to develop an approach for dynamic and transparent service selection and to evaluate the proposed architecture in terms of what selection techniques should be applied. In this proposed model the clients are also involved in the selection process but the systems complexity is kept hidden from them to enhance the security.

IV. WEB SERVICES SELECTION MODEL

We propose a technique for dynamic selection of Web Services which will also handle the problem of redundant Web Services. In this work, we introduce a model with a Web Service repository, as shown in figure 4.1 will act as an independent unit possessing a definite functionality. This repository will be used to redirect the client's request. This will also provide a level of security since it will not be allowed

to invoke directly by the clients. This technique will prevent unauthorized access to the real services. This provision will also help to hide the systems complexity from the clients.

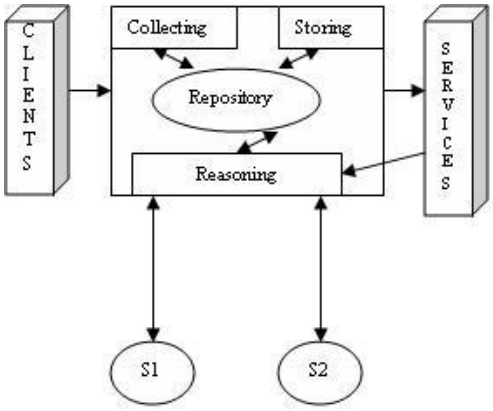

Fig4.1. Repository based Web Service Selection

The repository will perform three functions namely, storing, collecting and reasoning. In storing operation a QoS feedback report is generated by the client and is saved in the repository. The QoS feedback report provides a historical reference for the consumer to assess the provider. Each provider only keeps the feedback information relevant to it. The collecting operation retrieves all necessary data from providers for the reasoning operation. The reasoning operation manages to select the best service provider for the consumer according to the collected data. Consider an example where clients needs a service(S1,S2) as in fig.4.1, it sends a request .The collecting, storing and reasoning mechanism interacts with the web services to find the most appropriate of the services and the results are stored in the repository for future reference. Web Services here interacts with the reasoning mechanism to find out the appropriate services. Once the service is selected, the request is forwarded to it. Finally, when the result is generated, it is passed to the repository which sends it back to the client.

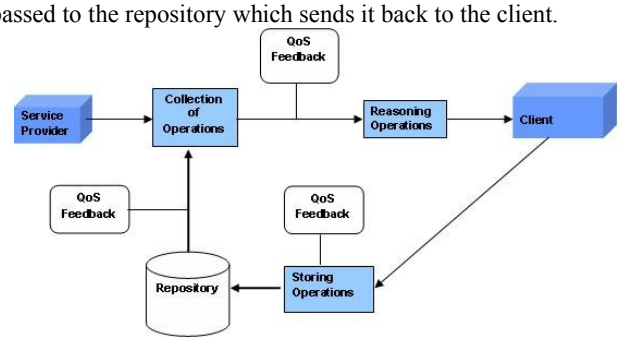

Fig4.2. Web Service Selection Process

Algorithm for Web Services Selection: This algorithm shows the necessary steps to choose a service and get the maximum quality results.

1. For finding a service for a specified task, perform a search on service descriptions.
2. Arrange all discovered services by their signature parameter and discard all other services.
3. Get the desired Service Parameters.
4. Collect the services result and order by their utility.
5. If no results are found, let the client reconsider the constraints, go to step 2.

This algorithm provides an approach for selecting a specified service. Services, not matching the profile are discarded on the fly .It also helps in taking an alternative services.

V. Conclusion

We propose an approach for dynamic service selection and, which has the following advantages in comparison with previous approaches:

• It hides the system's complexity from the clients.

• It provides a transparent service selection from the client's point of view.

• It assures a level of security, since the clients do not have direct access to the Web Services.

In future, other technology that can be applied in the Repository based system is Semantic Web technology. By describing the data in a machine-understandable manner and creating semantics of QoS criteria, the decision-making process would be based on more features as well as their relationships would be represented in a better and more flexible way. The experimentation will be conducted in a reference system, which is a working implementation of the architecture and consists of prototype clients and Service Providers running on multiple machines. The scalability of the reference system is limited to the available hardware resources.

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