

Analyzing Quality of Service Parameters of Abstract Web Services Using Software Agents for Building Composite Web Services

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Abstract - Composite web service is a combination of multiple abstract web services. To build a composite web service we have to combine multiple abstract web services together may be in sequence or in parallel. On the fly to select the best web service from the multiple abstract web services available for the same purpose is the challenging job and leads to the NP complete problem. So we are proposing an analyzing model of the abstract web services using software agents. Due to seamless integration of web services and mobile agents, agent based framework is a natural choice. We are proposing the analysis part of web services and users with the help of software agents. And decision taken by this analyzing agent will be used to select the best abstract web service which will be the part of composite web service. Analyzing agents use the QOS parameter and Characteristic of web services for selecting best web service.

Keywords - Mobile Agent, Web Service Composition, QOS, SOAP, WSDL, Restful Web Services, Abstract Web Service.

1. Introduction

Aim of building composite web service is to satisfy the customer's complex need. To fulfill the customer's complex need, single abstract webservice will not be sufficient. So single composite web service may require multiple numbers of abstract web services. And for the single basic requirement multiple number of abstract web services are available. So it is challenging to select the best abstract web service out of these. Also building a composite web service is not the straightforward. It is a combination of different abstract web services together. And these abstract web services are combining together in sequence, parallel or in combination. So to build such composite web service we have to construct directed acyclic graph (DAG) to combine different abstract web services in sequence/parallel/ combination.

In directed acyclic graph, each node is related to individual abstract web service which is the part of composite web service. To select individual abstract web service for constructing composite web service on the fly is difficult, because for each individual subtask of composite web service numbers of similar abstract web services are available. So we are taking the advantage of seamless integration of web services and software agents. We are proposing various mobile agents which will analyze individual abstract web services. To analyze abstract web services, we are using the unique features of web services based on its description, type and various quality of service possess by individual abstract web service. These intelligent agents are also using to priorities an users need of quality of service. As per the users expectation coordinating agents select the proper individual abstract web service to take part in composing a composite web service.

2. Related Work

Authors of Ref [01] concentrates on combining optimization and ranking based on non-functional QoS parameters to evaluate its quality. Ref[02] However use innovative idea for selecting best web service using the reliability issue for designing QoS-aware optimal selection scheme for web services with a trusted environment. We can also compare the web services based on the different types of web services, explain in Ref[05]. Author of Ref[06] presents a comparative performance evaluation of two Web service implementations: one is based on SOAP and the other on Representational State Transfer (REST). We utilized response time and throughput metrics to compare the performance of these Web services. They found that, on average, REST has better performance

compared to SOAP, though not all results were statistically conclusive. As an ancillary outcome, they also found that developing Web services using SOAP was easier, due to considerable tool support. However, developing Web services using REST was time consuming and difficult due to the necessity of in-depth knowledge of HTTP and rudimentary tool support. Ref[13,14,21] explains the role of mobile agents for analyzing the web services for their different parameters, because web services cannot be analyzed on the fly. In Ref [16] Schahram Dustdar and Wolfgang Schreiner do a survey on web service composition and role of QOS parameter for web service composition?

SOAP based and Restful Web services are studied and analyzed for the web service composition in Ref[24,25,26] From the above study it is concluded that best web services can be selected using QOS parameters and other features for web service composition using mobile agents.

3. Web Service

Web services are self-contained modular applications that are defined, published and accessed across the Internet using standard protocols in a web communication environment[24].

3.1 Web Services Types

There are basically two types of web services[05] :

1. SOAP Based Web services: SOAP stands for Simple Object Access Protocol. It is a XML-based protocol for accessing web services.

SOAP is a W3C recommendation for communication between two applications. SOAP is XML based protocol. It is platform independent and language independent. By using SOAP, you will be able to interact with other programming language applications.

Advantages of Soap Web Services :

- 1) **WS Security:** SOAP defines its own security known as WS Security.
- 2) **Language and Platform independent:** SOAP web services can be written in any programming language and executed in any platform.

Disadvantages of Soap Web Services :

- 1) **Slow:** SOAP uses XML format that must be parsed to be read. It defines many standards that must be followed while developing the SOAP

applications. So it is slow and consumes more bandwidth and resource.

- 2) **WSDL dependent:** SOAP uses WSDL and doesn't have any other mechanism to discover the service.

2. Restful web services :REST stands for Representational State Transfer. REST is an architectural style not a protocol.

Advantages of RESTful Web Services:

- 1) **Fast:**RESTful Web Services are fast because there is no strict specification like SOAP. It consumes less bandwidth and resource.
- 2) **Language and Platform independent:** RESTful web services can be written in any programming language and executed in any platform.
- 3) **Can use SOAP:**RESTful web services can use SOAP web services as the implementation.
- 4) **Permits different data format:** RESTful web service permits different data format such as Plain Text, HTML, XML and JSON.

3.2 Analysis of Web Services

3.2.1 Analysis base on Types of Web service [24,25]

Table1 :Comparison table for SOAP based and Restful web services

	<i>SOAP</i>	<i>REST</i>
1)	SOAP is a protocol.	REST is an architectural style.
2)	SOAP stands for Simple Object Access Protocol.	REST stands for REpresentational State Transfer.
3)	SOAP can't use REST because it is a protocol.	REST can use SOAP web services because it is a concept and can use any protocol like HTTP, SOAP.
4)	SOAP uses services interfaces to expose the business logic.	REST uses URI to expose business logic.
5)	SOAP defines standards to be strictly followed.	REST does not define too much standards like SOAP.
6)	SOAP requires more bandwidth and resource than REST.	REST requires less bandwidth and resource than SOAP.
7)	SOAP defines its own security.	RESTful web services inherits security measures from the underlying transport.

8)	SOAP permits XML data format only.	REST permits different data format such as Plain text, HTML, XML, JSON etc.
9)	SOAP is less preferred than REST.	REST more preferred than SOAP.

3.2.2 Analysis based on QOS Parameters [01,02,13,14]

Every abstract web service has the following QOS parameters consider for analysis:

- 1) Response Time :Time to get response result
- 2) Throughput:No. Response in a min. period of Time
- 3) No. of time service Available
- 4) Reliability:No. of time service provided.
- 5) Latency :Bandwidth Required

3.3 Web Service Composition

Sometime need of the end user will not be satisfy by the single abstract web service, so we need to combine multiple numbers of abstract web services together.The process of building such composite web service is called as web service composition (Fig,01). While building such composite web services, the combination of various abstract web services together are in sequentially one after the other or they may be combine in parallel or in combination of both.

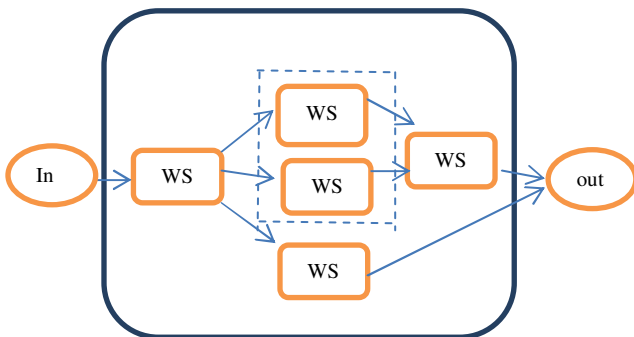


Fig.01 : Composition of Web Service

4. Software Agents[06]

A **Software Agent** is a computer program that acts for a user or other program in a relationship of agency.

4.1 Properties of Software Agents

Software agents possess the following properties:

- 1) Ubiquitous :Agents provide a service anytime and everywhere.
- 2) Communication Behavior:Agents supports communication between another agents.
- 3) Negotiation Ability :Due to inbuilt intelligence negotiation between agents can be made possible.
- 4) Delegation Ability :Delegation means that partial tasks can be passed on to agents. Agents execute these tasks according to the results they can deliver and execution control.
- 5) Learning Adaptability :An agent learns by executing tasks and uses the acquired knowledge during task execution.

4.2. Role of Software Agents for Composition of Web Service

In our framework (Fig.02) we are taking the advantage of the facility of seamless integration of web services and agents together[03,04]. So we are building following software agents for different purposes.

1. Web service Agent: to collect the information of respective from the different web sites and return JASON Object subsequently to web services.
2. Analyzing Agent [05] : To analyze the web services for the selecting to participate in composite web service. Individual web services are analyzed based on Types of web serviceand QOS Parameters (Computation of Availability, reliability, throughput etc....)using following formula.

$$MQ = \frac{\sum Mi Wi}{\sum Wi}$$

Where: MQ = Overall QoS Matching Value

i = Index of the assigned weights ,

Mi =Semantic matching of ithQoS Criterion

W = Weight of the ithQoS Criterion

3. User Agent : To collect the user information based on the Questions and Answers with users . Also set an expectation of users from the web service with respect to QOS parameters.

4. Coordinating Agent : To negotiate between user agent and analyzing agents.

5. Proposed Model

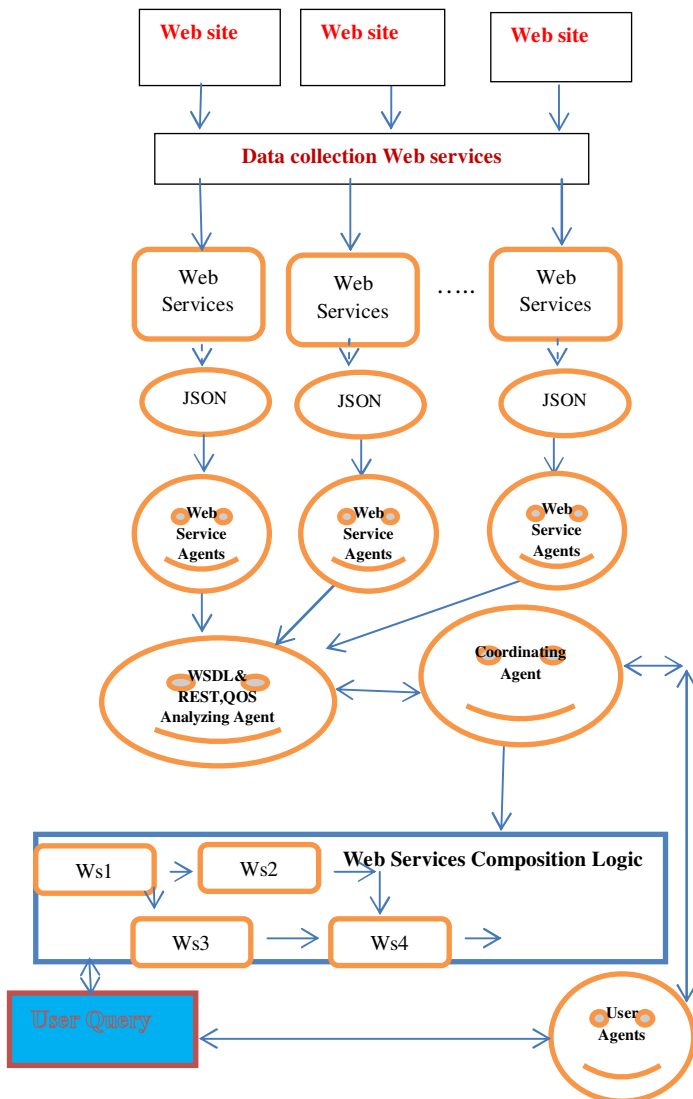


Fig.02 :Proposed Framework

Steps for Proposed Model :

Following steps are followed for building the composite web service based on negotiations on the WSDL, Rest and QOS parameter.

1. WSDL and REST Analysis: The web services are analyzed based on the different basic information like Type, messages, Name, etc.
2. QOS Parameters: Availability, reliability, Latency, Throughput, performance parameters are captured of each web service using agents. Matrix of QOS parameters are build

3. Normalized Matrix: Normalized matrix will built as per the priorities set for WSDL, Semantic and QOS parameters Respectively at Analyzing agent.
4. Negotiation Matrix :Negotiation matrix will built at user agents based on the question and answer between user and their respective agents.
5. Both Normalized matrix and Negotiating matrix supplied to coordinating agents, at coordinating agents based on the negotiation matrix the most suited web service as per the requirement will be selected.
6. Selected web service of step 5 will take part in building the Directed Acyclic graph of composite web service using Ant colony optimization algorithm.
7. Final Directed Acyclic Graph will be our finalized composite web service.

6. Experimental Results

To build a composite web service, Let's assume that 4 abstract web services are required. These 4 web services are provided by single service provider or those are from different service provider. There are two types of overall index are calculated one for analyzing agent and another for the negotiating agent. Out of these four web services first web services will be selected from two tables i.e. Normalized matrix and negotiating matrix.

Table2 :Normalized Matrix for Analyzing web service

Parameters	Ws1	Ws2	Ws3	Ws4	Ws5
SOAP based	2	2	2	2	2
Restful	0	2	2	0	2
Availability	4	4	4	1	3
Reliability	4	4	3	2	3
Throughput	4	4	2	2	2
Latency	4	4	1	3	3
Response Time	4	4	0	4	2
Total Normalized Index	22	24	14	14	17

If Restful web service available then it score 2 marks each in SOAP based and Restful But if SOAP based web service available the only score 2 marks for SOAP Based and 0 for Restful.

Similarly for Each QOS Parameters are graded for their achieving level of characteristic for web services. : Poor =0 ,Average =1, Good=2, Very Good=3, Excellent =4

Table3 : Negotiation Matrix

	Q1	Q2	Q3	Q3	Q4	Q5	User Negotiation INDEX
User1	0	1	2	2	2	4	11
User2	2	3	4	4	4	4	21
User3	1	2	3	4	4	4	18
User4	4	4	4	4	4	4	24
User5	1	4	2	4	3	1	15
User6	2	4	3	1	4	2	16
User7	3	1	4	2	0	3	13

Every user will be asked 5 set of question having the answer and corresponding value

Poor =0 ,Average =1, Good=2, Very Good=3, Excellent =4

So in this example user and web service pair will be as follows.

Table4 : Selection Matrix for abstract web service selection based on Parameters

	User Negotiation Index	Web service (Normalized Index)
User1	11	Ws3 or Ws4 (14)
User2	21	Ws1(22)
User3	18	Ws5(17)
User4	24	Ws2(24)
User5	15	Ws5(17)
User6	16	Ws5(17)
User7	13	Ws3 or Ws4(14)

Similar procedure will be followed for selecting different web services for different sub tasks.

Then selected web services will be a part of directed acyclic graph (like shown in fig 01) for composite web service.

The results are tested for composing the web service as per user need and depend on the number of web services available. (As shown in Graph)

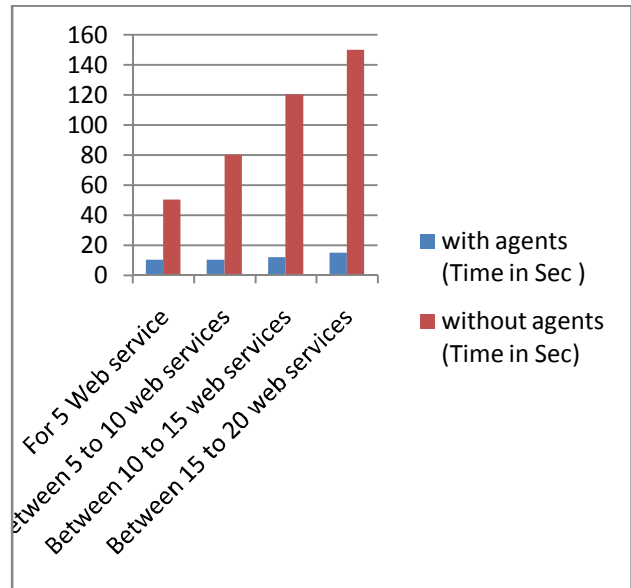


Figure: 03 Graph for Experimental Results

7. Conclusion

Due to the proposed model, all the features of agents are exploited and use to solve the composite web service building process. Different agents helps here to localize the decision, delegation of the decisions, Role and capacity of the agents are defined and finally the agents are used to negotiation as well. Due to the use of agents the composition process will be much faster as compare to if we try to build the composite web services.

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