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Context of qos In Web Service Selection

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Abstract: In the recent year, web service selection is becoming more and more prominent due to the large impact the web service in e-commerce.In selecting best services, several candidate services with similar capabilities are provided by different service providers. The question is, how upon a request over a B2B integration scenario, the system chooses a service among several candidate services offering a capability satisfying its requests? The Quality of service presents the key factor to answer this question. In this paper, we continue our work, we emphasize on the effect of increasing the number of qualities (higher than three), and the effect of increasing the number of services (higher than six) on the process of selection of web services based on both context and the QoS ontology for multi dimensional QoS. Finally, some experiments are run so to demonstrate consistency and effectiveness of the proposed method.

Keywords*: Selection of services, semantic Web service, quality of service, QoS Ontology, context Ontology, matching.*

I. INTRODUCTION

Actually, the Web Service plays an important role in large field for the development of the e-science, e-commerce, and e- education. Still, not all is good. One serious consequence is to delivering relevant service to the user. The web semantic solves these problems, it structures information, adds the logic, it expresses the sense by the ontology, however, there is a certain difficulty concerning semantic heterogeneity and conflicts semantics. Clearly it is not sufficient for the semantic Web to resolve all problems related to the use of ontology. The Pragmatic Web plays an important role to solve these problems especially it describes the semantic of information in their context. The pragmatic Web services are located at the cross roads of two major research areas of the net technology: the pragmatic Web and Web services. The aim of pragmatic Web services is to create a pragmatic Web service whose properties, capabilities, interfaces and effects are unambiguously described and used by machines with introduce pragmatic technologies. Our goal is to find the best provider of e-service that responds to a request for service. To achieve that, the following steps are required:

- Submit the query with terms and values of quality without and within their context.
- Compare the qualities of provider services with the qualities of request.
- Select the best provider service.

In the last step, to select the best provider, we first compute the matching degree of published qualities and required qualities for each service without using the context of quality. Second, we make use of the context of quality and compare the two cases [1] [2]. In our last work, we are showed the importance of context in interpreting the concepts of qualities in selecting processes. In this paper, we present a service selection based on both the context and the QoS ontology where QoS is multi-dimensional. We emphasize on the effect of increasing the number of qualities, and the effect of increasing the number of services on the process of selection of web services. The rest of this paper is organized as follows: Section 2 presents web service selection and related works in the current literature, Section 3 presents some concepts on the context and QoS, Section 4 presents the proposed approach, Section 5 is devoted to experiments and Section 6 concludes this article.

II. WEB SERVICE SELECTION AND RELATED WORKS

From a semiotic point of view, there are two ways to deal for Web services: first, an approach based on Web Socio semantic [3], and second an approach based on the pragmatic web [4].our work focus in the second way. We can group the approaches of selection into several categories:

Selection based on the Matchmaking: Classification of services deals with ranking. This is by determining the degree of similarity between the requested and the provided services. [5][6]

Selection based on Quality of Service (QoS): The classification of services is done by evaluating criteria such as response time, cost, and reputation for delivering such service. Major techniques in the current literature are based on the quality of service, some approach based on one dimension [7] [8] [9] [10] and the others on multi dimensional.

Selection based on context:

Most relevant concepts found in the current literature are summarized as follows: [Gandon F and al 2004]: Stress the need to consider knowledge about user preferences and contextual characteristics to seek information. Their approach is based first on a server context that contains information about preferences, and second, the access rights of a user [11]. [Behr G and al 2004]: propose a framework that operates on four profiles that describe the characteristics of the content or media (type, format, size, location where the media is stored) of the user (preferences), the device (hardware and software capabilities), network and service (media format supported, network connection, bandwidth, latency and performance [12]. [Pashtan and al 2004]: propose to adjust the content delivered by the web service through processing of Extensible Stylesheet Language Transformations (XSLT) [13]. [Keidl M and al 2004]: proposed an integration of the definition of Simple Object Access Protocol (SOAP) in order to find a web service that is able to meet user needs [14].

Selection based on Configurable Web Services

The selection algorithm ranks the offered services and their configurations according to the requester's preferences and thus facilitates personalized selection strategies. In addition, the approach leverages existing Web standards to provide a maximal degree of interoperability between services. Providers and their customers leading to significant efficiency gains. The approach is implemented prototypically and the performance is evaluated by means of a simulation [15].

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Selection based on communities

There are two ways for this category: first, an approach a reputation-based Web services community architecture and define some of the performance metrics that are needed to assess the reputation of a Web service community as perceived by the users and providers [16] and second an approach based on the model of communities whose main objective is to allow client applications to select the services which better meet a set of non-functional properties such as quality of service. The model of communities is formalized by a set of abstract data types. Types provide operations which enable service providers to register services to a community and client applications to select services, either at design time or at run time, and those that meet their needs [17].

Selection based on negotiation between Requester and Provider

In this approach, authors propose an agent negotiation framework towards Pragmatics Web Service. First, they abstract the rule and policy for access control to private information about context, preference towards the Pragmatics Web Service. Second, they have formalized the access control rules, context information and preference policy, and stored them in the service ontology base possessed by service agent [18].

III. QOS AND CONTEXT

Selection of service still is an important challenge, especially, when a set of services fulfilling user's capabilities requirements have been discovered, among these services which one will be eventually invoked by user is very critical, generally depending on a combined evaluation of qualities of services (QoS) [19].Due to the increasing number of Web Services, which provide similar functionality, the non-functional properties are becoming more important during the selection of the best available service. Non-functional properties describe Quality of Service (QoS) as well as context of service execution. Although there are many approaches considering only QoS or context during service discovery and selection, there is a lack of systems taking both non-functional categories into account [20]. In our work, we always associate context to quality. Moreover, this condition justifies the adoption of a use of context; we can define "the context of Quality includes all internal or external elements which is relative to the quality that is necessary to the correct interpretation of the Concept of quality". For raison of simplicity, we choose an approach for modeling of context proposed by [21] .this approach consists to store the context using a set of couples (attribute, value), mainly because of the diversity of the contexts in a multi dimensional QoS. Furthermore, we may say that a formal and practical model of the context is not available, big efforts are provided to define how to capture the context to the system. Our goal is to give an answer of how to combine the QoS with the context. This is where this paper is supposed to give contribution.

IV. THE PROPOSED SOLUTION

Our work is based on the use of the notion of context to facilitate the process of selection between services. We already have proposed an architecture which uses different qualities of services, and gives the appropriate interpretation for these qualities in their respective context. But remember we introduce some relevant related basic concepts.

4.1 Similarity measures

Measure based on the interpretation of concepts

In [22] the authors proposed a similarity measure of the concepts described in logic, and defined as follows:

$$s(C, D) = \frac{|C \cap D|^I}{|C|^I + |D|^I - |C \cap D|^I} \times \max\left(\frac{|C \cap D|^I}{|C|^I}, \frac{|C \cap D|^I}{|D|^I}\right) \quad (\mathbf{1})$$

Where $(\,.\,)^I$ is a function of interpretation and $|\,.\,|$ is the cardinal of a set. This measure is interesting because it verifies the semantic properties such as the similarity between two equivalent concepts ($C \equiv D$) is equal to 1.

4.2 The proposed architecture

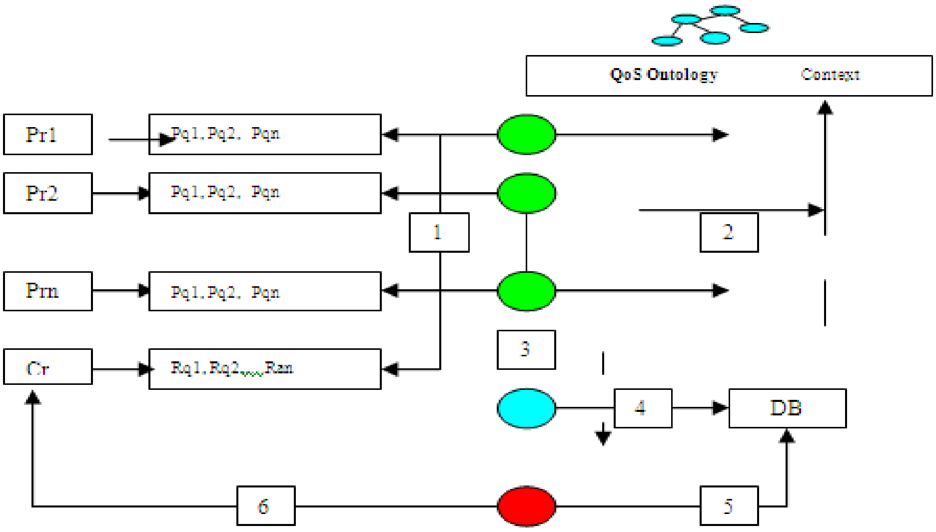
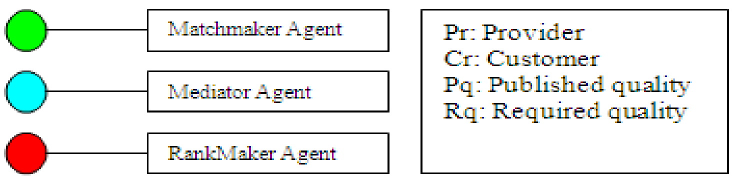


Figure 1: The proposed architecture



Our architecture consists of a set of agents: Matchmaker Agents, Mediator Agent, and a Rankmaker Agent. The process of selection is described as follows:

1- Matchmaker Agent consults the required qualities and the published qualities.
2- Matchmaker Agent uses QoS ontology to match the required qualities and the published qualities.
3- This Agent sends the result by a message to the mediator agent.
4- Mediator Agent receives the message that contains the result and stocks it in a Database. This agent connectswith Database by using the pilot jdbc: odbc.
5- Rankmaker Agent consults this Database and makes the ranking by using Algorithm [23] in two stages without using context and using it.
6- Finally, RankMaker sends the result to the consumer.

The primary task of this architecture is ranking through using the proposed algorithm in [23] in two stages without using context and with context. This is resumed as below:

The 1st stage [without using context]

We assume that $Q_R = \{r_1, r_2, \ldots\ldots\ldots r_k\}$ expresses the profile of a user's quality requirements, which includes k quality metrics. Similarly, the quality profile of m candidate services in set S is denoted as $Q_S = \{Q_{A1}, Q_{A2}, \ldots\ldots\}$ Where $Q_{Ai} = \{q_{i1}, q_{i2}, \ldots\ldots q_{ij}\}$ i, j $\in$ N .Therefore, the matrix of QoS for service matchmaking $M_Q = \{Q_R, Q_{A1}, \ldots\ldots Q_{Am}\}$ with the quality requirements Q_R in the first row, and the quality information of candidates services in the other rows. For uniformity, matrix M_Q has to be normalized [23], i.e., the elements of the matrix are real numbers in the range [0, 1] , the result matrix is $M_{Q'}$. Finally, we compute the evaluation result for each quality metrics by summing the values of each row. These abstract values are taken as a relative evaluation of each service's QoS.

$$M_{Q''} = M_{Q'} \times W = \sum_{I=1}^{M} (q_{ij} \times w_j) \quad (2)$$

$W = \{w_1, w_2, \ldots\ldots\ldots\ldots, w_n\}$, Where w represents the weighted value for each quality metrics.

The 2nd stage [use of context]

We use the semantic distance (equation 1) because this distance may introduce the required interpretation in this method.

We assume C_j The Context of Quality r_j for customer

We assume C'_{ij} The Context of Quality q_{ij} for service

The interpretation of required quality in context is: C_j^I

The interpretation of published quality in context is: $C_{ij}^{\prime I}$

We apply equation (1)

$$S(C_j, C'_{ij}) = \frac{|C_j \cap C'_{ij}|^I}{|C_j|^I + |C'_{ij}|^I - |C_j \cap C'_{ij}|^I} \times \max\left(\frac{|C_j \cap C'_{ij}|^I}{|C_j|^I}, \frac{|C_j \cap C'_{ij}|^I}{|C'_{ij}|^I}\right) \quad (1)$$

The degree of match with context for q_{ij} present by the average between the normalize value of q_{ij} and semantic distance $S(C_j, C'_{ij})$, after we compute the evaluation result for each quality metrics with context by summing the values of each row (equation 2) .These abstract values are taken as a relative evaluation of each service's QoS with context. In our case the context presents additional information, therefore we compute the degree of matching without use QoS ontology, then we take the average match degree that specifies the relation existing between the context and the quality of service.

V. EXPERIMENTAL RESULTS

In the last paper [2] , we showed the performance of selecting web services using three quality services is similar to the one using up to seven quality services, and we proved the selection of web services using three qualities (price, ComRat, Repu) is well adapted up to six services. This paper emphasize on the effect of increasing the number of qualities (higher than three), at beginning we take four qualities (price, ComRat, PenRat, Repu).

Table1: experiment data with five qualities.

	Pri	CompRat	PenRat	Execu	Repu
s1	25	0,7	0,3	100	2,0
s2	25	0,8	0,1	40	2,3
s3	40	0,2	0,8	200	2,5
s4	55	0,6	0,5	104	4,0

Table2: Normalization

Pri	CompRat	PenRat	Execu	Repu	
1,000	0,799	0,287	0,625	0,000	6,510
0,998	1,000	0,000	1,000	0,167	7,324
0,497	0,000	1,000	0,000	0,235	3,458
0,000	0,735	0,601	0,597	1,000	4,668

Table3: result of selection with 5 qualities

s2	7,324
s1	6,510
s4	4,668
s3	3,458

We repeat with four qualities (price, ComRat, PenRat, Reput)

Table4: experiment data with four qualities

Pri	CompRat	PenRat	Repu	
1,000	0,799	0,287	0,000	5,885
0,998	1,000	0,000	0,167	6,324
0,497	0,000	1,000	0,235	3,458
0,000	0,735	0,601	1,000	4,071

The result of ranking is:

Table5: experiment data with four qualities

s2	6,324
s1	5,885
s4	4,071
s3	3,458

In table 3 we can find the results of ranking procedure with 5 qualities, and in table 4 we can find The results of normalization and QoS with four qualities (price, ComRat,PenRat,Reput),and table5 shows results of ranking procedure with four qualities. Through this example, we observe that for these four services, the result with four qualities is the same as with five. To check this hypothesis, we apply the Kolmogorov-Smirnov test:

Table6: Kolmogorov-Smirnov test for 4 services

1,00	0,50	0,33	0,25	0,20	
0,0417	0,001736	7,2E-05	3,01E-06	1,25587E-07	
0,9583	0,498264	0,33326	0,249997	0,199999874	0,958333333

In table 6 we repeated this experiment five times with random values generated by function "runif" of language R as mentioned before. For entries n=4 and α=0.05, the value of doorstep according the statistics table Kolmogorov-Smirnov is 0.6239. In our experiment D= max $|F_n(x) - F(x)|$ =0, 958333333; that is higher than 0.6239. This shows that the result for five qualities is the same as for with four qualities. We repeated this experiment for 5, 6, 7, 8 services.

Table 7: Kolmogorov-Smirnov test for 5,6,7,8 services

N=number of services	D
5	0,999999421
6	0,998611111
7	0,999801587
8	2,48016E-05

The table 7 resumes the results. Through those experiments, it is shown that when the number of services is higher than seven, the value of D is smaller than 0.6239, therefore we may say that the hypothesis is accepted up to seven services, that is the selection of web services using four qualities (price, ComRat, PenRat,Repu) is well adapted up to seven services. Finally, to illustrate this approach, we propose a purchasing scenario so to demonstrate consistency and effectiveness of the proposed method. In table 14, there are six providers S1 to S6, all of them providing the same services. The evaluation of quality of services is made by multi-dimensional QoS. The second, third, and fourth columns represent respectively price, Compensation Rate, and Reputation. The fifth, sixth, and seventh columns represent the normalization of quality; the eighth column is the current values of each QoS. Following the proposed method in section 4.2, we first start with identifying the effect of the context on the selection of services based on QoS. In the first time, the context is not used; the results obtained after calculating QoS are illustrated in the figure2 Following this step, we rely on the context to select the best service for a particular request. The results obtained are illustrated in the figure3.In Figure 2, the best service is S3 and in Figure 3 it is S2. Through this example, we notice that the context affects the process of selection. Furthermore, we repeat this experiment thirty one times. We try to check the dependencies existing between the two major variables: QoS modality with context and QoS modality without context. In all those experiments, we observed that the ranking procedure without context is different that with context. We make use of the $\chi 2$ test. In this experiment, the observed frequency is 31, the theoretical frequency Is this means that we can accept the hypothesis of dependencies. We may assert that the QoS depends on the context. Future work will emphasize on extending the proposed method by increasing the number of services in the selection process. We implemented computer simulation of several scenarios using jade [http://jade.tilab.com] for implementing agents and Jena [http://jena.sourceforge.net] for interaction with ontology, and finally R language for generating random values.

VI. CONCLUSION

This paper continued our work of selection of web services based on both context and the QoS ontology. This is done by proposing an architecture that makes an automatic selection of best service provider that is based on mixed context and QoS ontology for a given set of parameters of QoS. We first showed that the performance of selecting web services using four quality services is similar to the one using up to seven quality services. Moreover, other experiments demonstrate that the QoS is strongly dependent of the context. Furthermore, future work may emphasize on the effect of increasing the number of qualities, and the effect of increasing the number of services on the process of selection of web services based on both context and the QoS ontology.

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