

An Enhancement of Services Selection in Web Services

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웹 서비스에서 서비스의 선택의 개선

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Abstract

Web services provide the possibility of dynamically integrating distributed service components scattered over the Internet to fulfill sophisticated business demands. However due to today's wide variety of services offered to perform a specific task, it's essential that users are supported in the eventual selection of appropriate services. An example of web services for which selection of appropriate services will be crucial is Auto Repair Services. Selecting proper service from a variety of Auto Part Shops would be result of delivering high-quality service and minimizing Auto Repair Service customer's waiting time. Therefore, in this research to assist selecting proper service, we present Functional-Level Mediator and illustrate its usage in matching customer's and web service's goals. Five matching cases have been analyzed and results from experiment have been shown. Also, taking advantage of implementing multithreaded web services which reflects concurrent activity in the real world more naturally, we have significantly minimized customer's waiting time at Auto Repair Service.

1. Introduction

Web services technology is becoming a highly acceptance in all field. If this trend continues, an increasing number of mission-critical systems will start to be deployed in the next few years. However, to be effectively used in real world applications current web services technologies has to be ensured that users are supported in the eventual selection of appropriate services. An example of web services for which selection of appropriate services will be crucial is Auto Repair Services. Selecting proper service from a variety of Auto Part Shop would be result of providing high-quality service and minimizing Auto Repair Service customer's waiting time.

According to current scenario in Auto Repair Service, many customers are untimely coming to repair their cars. Usually, Auto Repair Service doesn't have needed auto part. So after checking the car, service sends a sequence SOAP messages to Auto Part Shop systems in order to request needed part. However, when working with web services the problems could be arisen due to heterogeneity existing in representing data, in the multitude of choices in representing the requested and the provided functionalities which make Auto Repair Service customer dissatisfied from service [1,2].

In this research to assist selecting proper service while resolving possible mismatches between Auto Repair Service's customer and Auto Part Shop arise due to heterogeneity problems, we present Functional-Level Mediator and illustrate its usage in matching customer's and

web service's goals. Five matching cases have been analyzed and results from experiment have been shown. Also, we present multithreaded implementation of web services. Due to more naturally reflection of concurrent activity in the real world, we believe that implementing of multithreaded approach can significantly minimize customer's waiting time at Auto Repair Shop

The rest of paper is organized as follows: in the 2nd chapter we will discuss related studies. Then we will focus on system design and show general scenario for proposed method. Implementation will be illustrated in the 5th chapter. Paper will be concluded with conclusion.

2. Related Studies

This research introduces a comprehensive approach to enhance service selection using Functional-level mediator. As far as we know the mediation in functional-level in Web services has not been directly addressed in any work yet. However similar classification and functional relationships were explored in various discovery working groups [3,4] as prerequisites for the discovery engines.

In the other hand, our approach looks for certain types of logical relationships between the capabilities descriptions of web services and requests. If such a relationship holds, a web service is considered to be usable for resolving the client's goal. On the basis [5], there are five matching notions for functional discovery such exact match, plug-in match, subsumption match, intersection match and non match. In this research, we are going to implement these matching notions in real-life example. Example is considered to be Auto Repair Business.

[1] tries to enhance service selection by emphasizing the role of Functional-Level Mediator in web services architecture, demonstrating how the Functional-Level Mediator can enable web services usages in matching customer's and web service's goal. The only disadvantage of this approach is that it only deals with reducing heterogeneity problems arisen between Auto Repair Service and Auto Part Shop. However, only with enhancing service selection it's hard to deliver high quality service to customer to whom time is critical.

In [2], along with enhancing service selection and resolving possible mismatching between Auto Repair Service and Auto Part Shop arise due to heterogeneity problems, research proposes approach with development of time efficient web service in order to improve timeliness of communication between Repair Service and Auto Part Shop. The main point of this research was to establish communication through alternative web services. In other words, Auto Repair Service system sends request to Auto Part Shops system located in same area as Auto Repair Services in some predefined time. If there is no response from nearest shops, system had to redirect messages to next nearest area so that Auto Repair Service. However, this research is not considering network-related problems. For example, when switching to alternative web service system could fail or messages could be lost or switching time could be increased.

3. System Design

A selection of appropriate web service is necessary while exchanging messages in a business-to-business scenario where important transactions are conducted over the web [6]. In this section, the interaction scenario will be described along with proposed system design to address this scenario by illustrating case in Auto Repair Service.

According to the this basic scenario between customer, Auto Repair Service and Auto Part Shop, after checking damaged part of vehicle Auto Repair Service system should request it from multiple Auto Part Shop system. Web service based system design is shown in Figure 1.

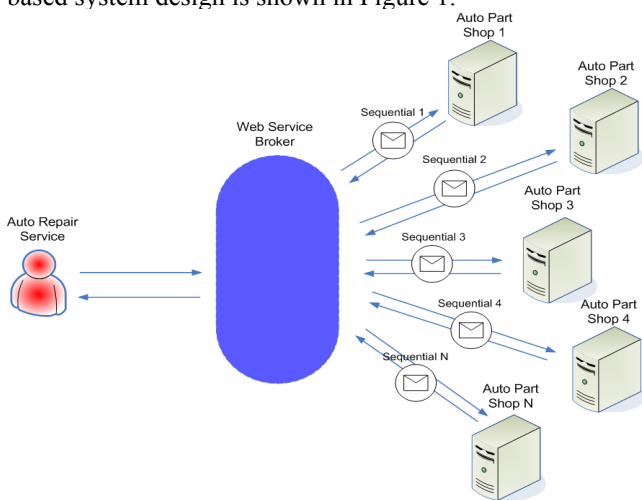


Figure 1. Current web services based system at Auto Repair Service

Working cycle of the following system is as following: customer requests Auto Repair Service to fix problem of his/her vehicle. After identifying what is the problem and which part is needed to solve the problem of vehicle, Auto Repair Service system sends sequential SOAP messages to

Auto Repair Shop system. After processing request Auto Part Shop system will send detailed result of request to Auto Repair Service. Meanwhile, if Auto Repair Service system wants to communicate with another Auto Repair should wait until accepting response from firstly requested Auto Part Shop.

Also, when working with web services there is a great risk that a service is not responding due to several reasons, for instance, the hardware and software faults in web services can failure of the client. There are also many network-related problems such as latency of response, loss of messages, corrupted messages, traffic congestion and etc. In these cases, multithreaded implementation of web services comes in action.

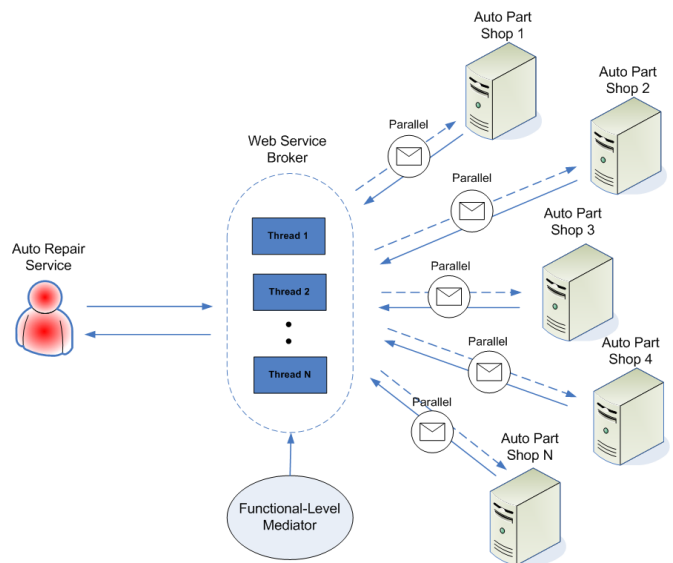


Figure 2. Multithreaded web services based Overall System Architecture

In the figure 2 multithreaded web services based system design is shown where after identify what is the problem Auto Repair Service system sends parallel SOAP messages to Auto Part Shop system Due to concurrent nature of multithreaded web services, Auto Repair Service doesn't have to wait response from failed services since it gets response from other parallel requested services.

Also, there could be situation where Web services should deal with heterogeneity problems. Usually, heterogeneities on the functional level arise when the functionality provided by a Web service does not precisely match with the one requested by a client. In this study we introduce Functional-level Mediator which could handle heterogeneity existing in representing data. Figure 3 shows working cycle of Functional-Level Mediator.

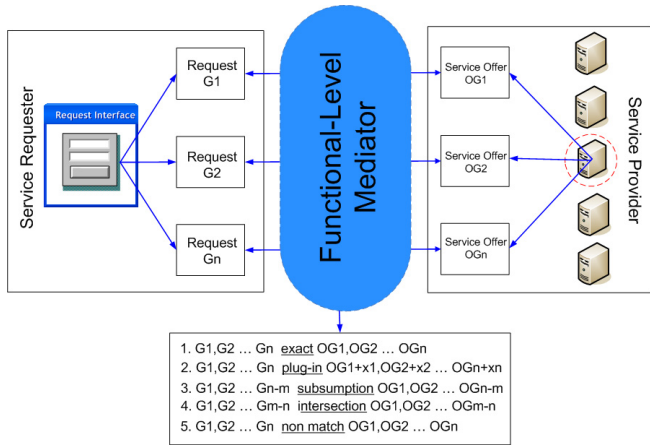


Figure 3. Working cycle of Functional-Level Mediator

In [1], applicability of Functional-level Mediator in Auto Repair Service was shown. Using advantage of this research we will shortly describe usage scenario of matching customer's and Web Services goal.

Case in Exact Match. Within our scenario, ARS defines three goals G1, G2 and G3 of purchasing customer's damaged part as follows: specific amount of money, user's predefined delivery type and condition of needed part itself. If only Web Service WS1 provides exactly what the G1, G2 and G3 goals require then we assume that exact match of goals and Web Service have done in given location. Thus, ARS can present result of request along with detailed information about needed part and user's predefined time.

Case in Plug-in Match. In this case, same goals are defined by customer. After sending request to Web Services, ARS will realize that the status of customer's goals could be even improved due to Web services abundance in given location which can propose better condition to existing goals. So that, if customer requested to purchase P auto part along with his/her goals of G1, G2 and G3, the Web service WS1 with exact match of customer's goals will become usable or customer can choose the better service due to more functionality offered by alternative Web service

Case in Subsumption Match. The subsumption match holds if the Web Service provides part of what the Goal requires. Within our scenario, customer with his/her three goals of purchasing P auto part will make request however part of the goals will not be fulfilled by Web service. For instance, customer desired amount of money M and delivery type D for purchasing P part in given location are not fulfilled by Web service WS1. However, another alternative Web Services WS2 and WS3 in given location can offer M+x and D+y options in order to meet customer's needs. Thus, customer can decide whether choose alternative Web service or cancel request.

Case in Intersection Match. Intersection Match could be applicable if part of the functionality offered by the Web Services matches part of the functionality required by the goals. According to our scenario, customer who wants to purchase P auto part with his/her G1, G2 and G3 goals requests Web service. WS1 can partially fulfill the customer's desire. For example, ARS defines three goals G1, G2 and G3 of purchasing customer's damaged part as follows: specific amount of money, user's predefined

delivery type and state of damaged part itself. WS1 seems to be usable, but all purchasable parts cost significantly more than customer's desire. However, WS2 with different delivery type and state of damaged part are available. Thus, we can propose to adjust the goals. Either weaken it by omitting the price constraint so that WS1 becomes usable, or change the desired delivery type and state of damaged part so that WS2 becomes usable

Case in Non Match. If there are no any possibilities to adjust the customer's defined goals with Web Service, then Non Match will be occurred and request automatically will be redirected to next nearest location.

4. Construction and Test

Our main goal in this study was to determine the general level of performance available from commercial usage of Functional-Level Mediator and multithreaded implementation of web services. We designed a set of test cases of network-related problems and messages lost that reflected typical commercial usage in Auto Repair Service. All of these test scenarios were designed to resemble real life commercial transactions while avoiding any unnecessary server-side processing overhead which may affect to measure performance.

Multithreaded web service test driver written in Netbeans IDE using Java is shown in Figure 4 with the case in local Auto Repair Service. It shows case in exact match where customer's order is fully satisfied by Web Service according customer's preference

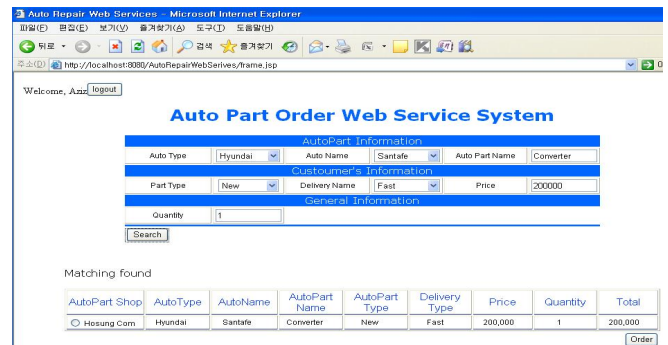


Figure 4. Case in Exact Match

Figure 5 shows case in Plug-in Match where due to Web services abundance. So customer can have choice whether he/she choose service with better functionality or keep current order up.

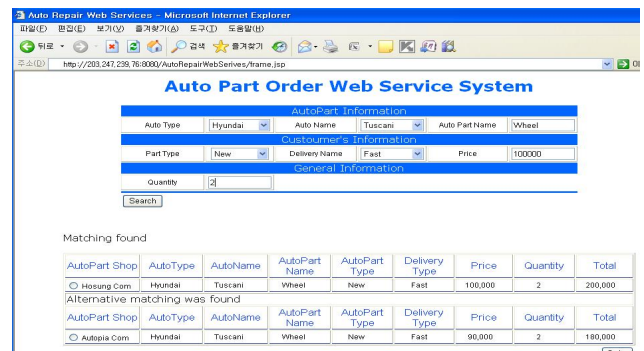


Figure 5. Case in Plug-in Match

Figure 6 shows case in subsumption match where after checking Auto Part Ontology no matching was found. In that case, system provides alternative Web services to meet customer's needs. In this case, the user's goal of part type is failed.

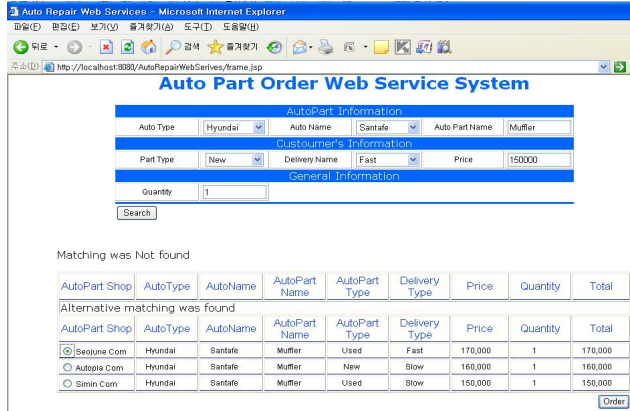


Figure 6. Case in Subsumption Match

Figure 7 shows case in intersection match where part functionality offered by the Web Services matches part of the functionality required by the goals. Functional-level Mediator can adjust goals so user is provided with additional alternative Web services where he/she can choose whether to purchase part or cancel request

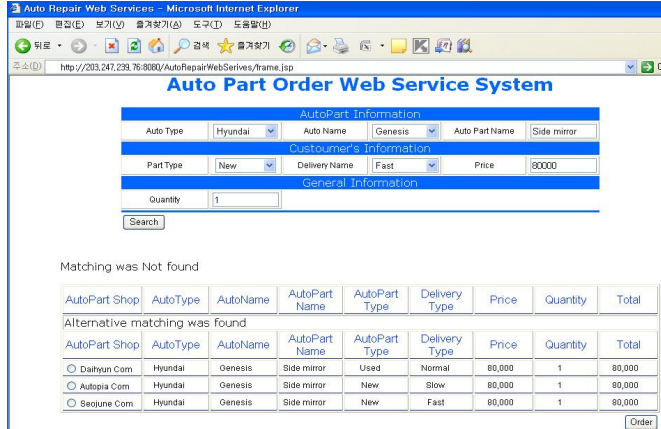


Figure 7. Case in Intersection Match

Figure 8 shows that no matching was found in any case

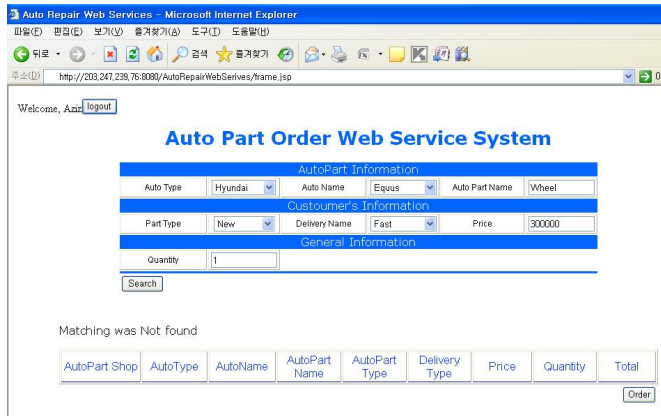


Figure 8. Case in No Match (in next given location)

5. Conclusion

In this research, we have successfully undertaken usage of multithreaded web services and Functional-Level Mediator in order to reflect a range of typical commercial activities. We believe that implementation of this method enhance selection of services in web services and minimize customer's waiting time at Auto Repair Service. We have compared our implemented method with previous methods in order to demonstrate the steps of improvement and successfulness of our current research. Our results has shown that implementation of this method was able to deliver reasonably good performance in order to achieve our goals listed in previous chapters.

The improvement steps have been motivating us throughout our researches and as a logical continuation of improvement is considered to be a delivering overall efficiency of system by presenting Orchestrated web services method.

6. Acknowledgement

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