Title of Paper:

An automatic service composition algorithm for constructing the global optimal service tree based on QoS

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Abstract

1. Introduction

Recently, more and more researches have been done on the web service composition, which is the key to service-oriented architecture (SOA). Two trends have been formed to solve the problem of web service composition, one is the method based on process model with the workflow on behalf of it, and the other is utilizing semantics of web services described by the OWL-based Web service ontology (OWL-S), which is mainly used in the field of AI planning. The method based on semantics tries to make the service matchmaking and discovery more accurate and adaptive to variety of web services.

In the field of geography, various methods about the composition of Geospatial Web Services (GWS) have come up. However, almost all of them are just based on the matching between inputs and outputs, and the result generated is a service chain. The service chain generated has some obvious disadvantages. First, it hasn't taken the Quality of Service (QoS) into account, so the quality of the service chain is not the best in the service composition even the service chain generated matches well between inputs and outputs. Second, actually a single service chain is not the best way to demonstrate the service composition in some applications.

In this paper we look the service chain as a service tree, the automatic composition of services would be transformed to a issue of optimal combination. We would get a set of service trees by using the methods of optimal combination to collect the services from the service library, and find the optimal service tree via the standard of service quality. In this way, the service tree generated would guarantee global optimal features.

2. Problem solving strategies and algorithm

Given a processing task by a user, which requires an outcome from an input dataset, we need to begin with the outcome, and it could be only obtained from the service after processing the inputs, which are also obtained from other services after processing their inputs. If similar processes go on, at last, we could get a series of services with the shape of a tree, which we called service tree. It represents a service composition to perform specific tasks.

QoS includes many factors, such as response time, reliability, processing accuracy, cost, and so on. Besides these general elements, we add a correlation between services to it, which represents the probability of combing two services in use. The information of QoS will be stored in the semantic library of GWS, which is constructed by the ontology. The weight of a service in a service tree would be the weighted value calculated by the QoS factors mentioned above, so the quality of a service tree would be calculated from weights of all services that compose the service tree.

The algorithm of constructing a service tree is as follow:

1) match the inputs and outputs by the type of spatial data, based on the outcome provided by the user, find the set of services P that satisfy the outcome and take a service P_i as the root of the service tree.

2) find another set of services that satisfy the first input of P_i, take a service within the set as the next node in the service tree. If the service matches well with the input provided by user, the activity will halt. If no other service that matches with the service can be found, the path will be abandoned.

3) iterate the previous process until all leaf nodes of the branch has been searched. No service can repeats in a top-to-bottom path.

4) go on with another branch, at last, it will form a service tree that satisfies the requirements of the user.

5) similarly, there would be other service trees in the set P, calculate the quality of service tree using the standard of QoS, and find a best service tree in quality.

3. Experiments and conclusions

The semantic knowledge of service classification, metadata of spatial data types and QoS are stored in the semantic library of Oracle, while the specific GWS are stored in the Oracle database, attached with extra information correspond to the semantic library. The algorithm is implemented with Java programming language, and we apply it in some complicated geoanalysis, which proves that the algorithm could be applied in service composition of GWS, and the service tree generated by the standard of QoS turns out to be more useful.

References

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