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A Trusted Composition Evaluation Model to Support Web Services Coordination in Multi Domains

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Abstract: With the widespread development of web services application in multi-domains, more and more researchers have focused on the quality of web services composition. However, the research on the evaluation method for web services composition is still little nowadays. Therefore, a QoS-driven Trusted Composition Evaluation Model (TCEM) is proposed in this study, it can judge the business stream effectively and comprehensively by choosing an appropriate and trusted evaluation method for the generated services composition chains. Furthermore, on the basis of Case-Based Reasoning (CBR) and the retrieval mechanism oriented to web services coordination, the TCEM-based execution engine and algorithm is implemented to evaluate the quality of service composition. The proposed algorithm has the satisfied result compared with the traditional method, and it shows more efficient and trustworthy where web services composition is widely used in multi domains.

Key words: Algorithm, cased-based reasoning, composition evaluation, coordination, service model

INTRODUCTION

With the increasingly application of web service composition, the attention mostly in need is the trusted evaluation for web service composition. Research on the service composition evaluation is relatively little in these years. Meanwhile, there is no unified and standardized evaluation mechanism to be established. The most important step of the evaluation process is to make a general judgment by using a global index to show the objective level for the evaluated objects. So the QoS-driven web service composition evaluation and selection at runtime has become an important research topic (Arpinar *et al*., 2005). The QoS properties include reliability, efficiency and credibility, which can be previously set based on the users personalized request. As we know, lots of comprehensive evaluation methods has been studied in the past years (Chen *et al.*, 2008; Sun *et al*., 2008), such as AHP, fuzzy evaluation method, data envelopment analysis, artificial neural network evaluation, gray comprehensive evaluation etc. A new computing architecture - Computing Power Services (CPS) - has been applied to utilize web services and business process execution language for overcoming the issues about flexibility, compatibility and workflow management (Tsai and Wang, 2008). A web service relevancy ranking algorithm based on QoS parameters has been presented for the purpose of finding the best available web service (Guo *et al.*, 2008). Wavelet neural networks is applied to predict the QoS of Web Service and the functions of the MATLAB toolbox are adopted to create a network model for QoS prediction (Zhang, 2010). All these methods need to be further studied and applied to the practical applications to fulfill the service coordination in multi domains.

Based on the related studies on web service composition, the QoS-driven service composition evaluation can improve the accuracy and consistency in some traditional applications, but now the evaluation methods for web service composition tend to focus on the trusted evaluation mechanism with an established method. Consequently, it needs to do our further research on how to identify and measure the advantages and disadvantages of these different methods, thus the objective accuracy of the results will be got successfully. In this paper, the establishment of a Trusted Composition Evaluation Model (TCEM) is not only to make the decision for composition methods and evaluation methods, but also to make the quality of evaluation process more efficient and trustworthy.

THE ESTABLISHMENT OF TRUSTED COMPOSITION EVALUATION MODEL (TCEM) AND THE CASE-BASED CONTROL MECHANISM

The trusted composition evaluation model for service coordination: In some practical domains, the multi-agents is just like the web service applications, it is needed to achieve coherence between each service application in order to satisfy users' requirements for web service composition. Based on the main idea of Case-Based Reasoning (CBR) module, the trusted composition evaluation model can be implemented, where the case-

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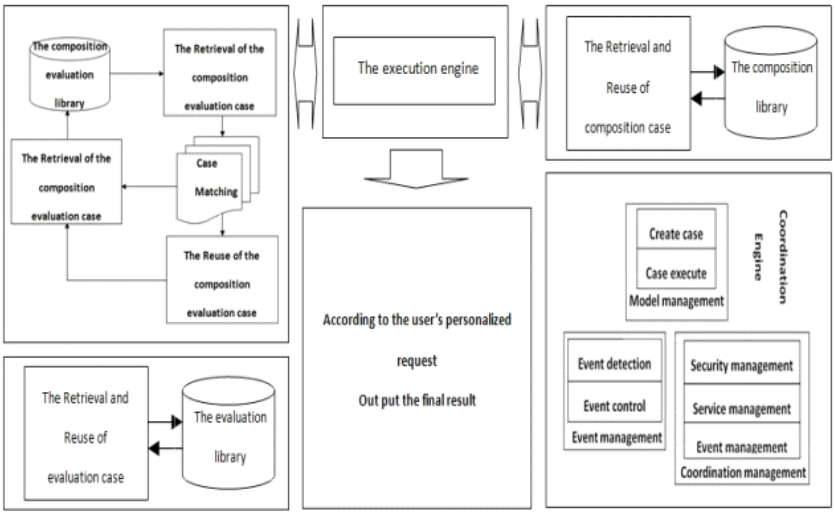

Fig. 1: The structure of the trusted composition evaluation model

base for service composition evaluation is created for the matching process. The basic TCEM structure is shown in Fig. 1. The working mechanism ofthis modelcan be summarized asfollows:

- Discovering the problem and the conversion of date. The proposed problem by users is primarily treated that undergoes the basic processing of the original problem..
- Setting the global index. The date contains the integration andprocessing of the evaluation library in order to set theindex as indicators.
- Selecting the appropriate service composition method. The appropriate and satisfied method is determined, thus the various services will be coordinated in multi domains.
- Searching the case-base of web service composition method. The results ofa successfulmatch may be returned, otherwise, thecase-base will be modified
- Evaluating the final solution. On the basis of the selected composition method, the corresponding evaluation methods will be selected to evaluate the returned solution.

The retrieval of the case-base for service composition evaluation: The case-base to support the aboveTCEM structurecan be divided into 2 categories, which named case-based reasoningmodule and expertanalysis module separately. Based on theprinciple of TCEM,there are some definitions listed as follows. Definition [*] triple {S, T, ID}, S represents the evaluation solutions, T represents composition methods to be evaluated, ID represents each case serial number. In the same case-base for web service composition, the serial number of each case is unique. Accordingto the definition and thecorresponding weight been set for service composition evaluation, the appropriate Case-Based Reasoninglibrary (CBRL) can be got.

For example,when aweb service compositionto beevaluated, T (Petrinets),can beselected and evaluatedto determinethe appropriatesolutionS (AHP). And eachcasehas itsown ID, such as A-1. It is just the sameforT (graph-basedplanning) that can beselected and evaluatedto determinethe SolutionS (ANN),and thecaseID is defined as A-8. Using the discussed structure, if there is suitable case for service composition in CBRL, the CBR process can then reuse the case.

THE IMPLEMENTATION OF THE EXECUTION ENGINE AND THETCEM-BASED ALGORITHM

The basicexecution process ofcomposition evaluation execution engine: As shown in Fig. 1, the execution engine contains three main parts, which are named as input part, processing part and output part separately. Each of the parts has its own working mechanism in the execution control process. According to the TCEM discussed above, the input part undertakes the monitor of control for requirement description, translator, original problem description and global index setting etc. The processing part does the control task for service composition selection module, coordination module and evaluation selection module. Then, the output part does the control work for the final date output. The process of the execution engine is listed as follows:

- The execution engine calls web service parser to analysis the business process definition files, and

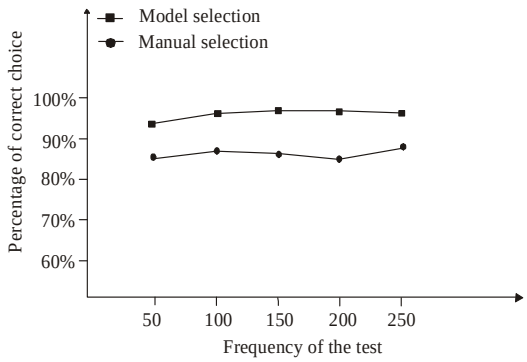

Fig. 2: The experimental result of TCEM-based algorithm

produces the corresponding process instance objects

- At run-time, web services will be called back and transmit the activity execution parameters, checking the result after termination conditions. If the execution process is completed, the TCEM manager will output the intermediate results
- It will check the condition according to the execution environment, in order to judge whether the execution process is achieved

The implementation of the TCEM-based algorithm: The selection of the evaluation methods is based on different choices of composition methods; That is to say, each web service composition will be specified with the corresponding evaluation indicators and parameters before the evaluation process begins. In this process, these following factors will become the basis of the selection strategy for service evaluation methods, which includes the number of evaluation factors, the extent of user involvement and the complexity of the problem. Two definitions for the evaluation methods are given as follows:

Definition (Singh, 2003), For certain service composition methods in multi domains, just to define aN-tuple Q = <a1, a2, an>, an represents the characteristics of the service composition method, an = 0, 1, 2, 3, 4, 5. When the value increases, the higher degree membership of this property will be expressed for this service composition method.

Definition (Wan-Cheng *et al*., 2008), According to the characteristics of the evaluation method, to define a M-tuple S = <b1, b2, bm>, bm indicates the characteristics of the evaluation method for service composition, and bm takes discrete value, bm = 0, 1, 2, 3, 4, 5. The greater the returned value is, the better performance of the evaluation method on the characteristics.

The TCEM-based algorithm is designed as follows Algorithm (Singh, 2003):

- Requirement description ->Translator ->The original problem.
- Service matching in the service library
  For (I = 1, i≤[library] , i++){Select the suitable service in the library. Give each selected service a lab}
- Call for Agents->The retrieval of the composition method library-> Coordination Engine.
- The retrieval of the composition evaluation library
  If there is the corresponding composition evaluation case in the library . Reuse of the case
  Else Algorithm (Wan-Cheng *et al*., 2008), the proposed evaluation algorithm for service and composition selecting. According to the experts, it is necessary to set the number of the value and the definition of the value for service composition method.

◦ For (I = 1, i≤n, i++)
Step1,compareeach parameter in N-tuple: a_1, a_2, … a_n, a_n with the corresponding one in M-tuple: b_1, b_2, …, b_m (n = m).
Step 2, get the difference in value and set the value as c
Step 3, calculate the accumulation of the parameter value:

$$c=\left[\sum_{i=1}^{n}\left(a_i-b_i\right)^p\right]^{1/p}$$

◦ To make sort of each value:

$$c=\left[\sum_{i=1}^{n}\left(a_i-b_i\right)^p\right]^{1/p}$$

the smaller the value of:

$$c=\left[\sum_{i=1}^{n}\left(a_i-b_i\right)^p\right]^{1/p}$$

the higher the matching degree is.

◦ For the generated composition evaluation methods to be selected, according to the needs of users, to select one with the smaller value of:

$$c=\left[\sum_{i=1}^{n}\left(a_i-b_i\right)^p\right]^{1/p}$$

as the result.

◦ Assign the case with the ID value ID *,Create the triple against the ID, S = (ID, Type, Scheme)
S. ID = I D*; S. Type = Type*; Scheme = Scheme*;
Add the case into the case base, and update the operations of the case base.

The TCEM'S comparative test of the evaluation method selection: In order to make the experimental test, the model is applied to a travel planning application, the multiple comparison tests are made in this case. In order to get the more satisfied result of the experiment, different times of the tests are executed, and the test results are shown in Fig. 2.

CONCLUSION

It firstly compares several popular evaluation methods for web service composition in multi applications, meanwhile the characteristics of service coordination is also considered in this paper, Then, a trusted composition evaluation model called TCEM is proposed to promote the service quality in multi-domains. Furthermore according to the QoS-based evaluation method for service composition, the controlling module of the above model is reliable and trustworthy in the method of selection process. Finally, the TCEM-based algorithm is designed by determining the composition method and evaluation method. The algorithm is implemented just on the basis of the definition of N-tuple and M-tuple of the service composition and service evaluation method. On comparing the operation of characteristics, the satisfied result will be got in the travel planning application. It is also helpful to promote the efficiency of evaluation process for web service composition.

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REFERENCES

Arpinar, B., R. Zhang, B. Aleman-Meza and M. Angela, 2005. Ontology-driven web services composition platform. Inf. Syst. E-Business Manage., 3(2): 175-199.

Chen, W., L. Xiong andL. Jiyao, 2008. The analysis of cooperative strategies based on multi-agent system. Chinese Control and Decision Conference, CCDC, pp: 4511-4516.

Guo, L.I., H.P. Chen, G. Yang and R.Y. Fei, 2008. A QOS Evaluation Algorithm for Web Service Ranking Based on Artificial Neural Network. International Conference on Computer Science and Software Engineering, Wuhan, China, pp: 381-384.

Singh, M.P., 2003. Trustworthy service composition: challenges and research questions. Lecture Notes in Computer Sci. Springer-Verlag, 26(31): 39-52.

Sun Z, H. Jun and D. Dong, 2008. Five Perspectives on Case Based Reasoning. 4th International Conference on Intelligent Computing, ICIC, September 15, 2008-September 18, pp: 410-419.

Tsai, M.J. and C.S. Wang, 2008. A computing coordination based fuzzy group decision-making (CC-FGDM) for web service oriented architecture. Expert Syst. Appl., 34(4): 2921-2936.

Wan-Cheng, N.I., L.I.U. Lian-Chen and W.U. Cheng, 2008. Survey on Web Services composition methods. Comput. Eng., 34(4): 79-81.

Zhang, J.H., 2010. A Short-Term Prediction for QOS of Web Service Based on Wavelet Neural Networks. International Conference on Computational Intelligence and Communication, Bhopal, India, pp: 254-258.