International Journal of Applied Engineering Research ISSN 0973-4562 Volume 10, Number 17 (2015) pp 37396-37402

Performance Enhancement of Composite Web Service Based on QoS Aware Trust Score

F.Ezhil Mary Arasi[1],
Asst.Prof, Department of MCA, SRM University, Kattankulathur, Chennai
ezhilmary.f@ktr.srmuniv.ac.in

Dr.S.Govindarajan[2]
Professor & Head, Department of MCA, SRM University, Chennai
govindaraja.n@ktr.srmuniv.ac.in

J.Antony Judi[3]
Senior Systems Analyst, Accenture Private Limited, Chennai
antony.judi@accenture.com

Abstract
In Service-Oriented Computing, a service is an autonomous and platform-independent computational entity, which can be described, published, discovered and dynamically assembled for developing massively distributed systems. In SOC environments, QoS refers to various non functional characteristics. These specified characteristics should be measurable and constitute a description of what a service can offer. The influence of the candidate service on the Web service composition performance is generally fatal in the Internet, so the problems of services selection for CWS cannot be completely solved by the perspective of performance. In this paper the TWSSCWS model has been proposed for the web service user which helps them to make an optimal selection from the set of candidate web services based on QoS values and Trust. Experimental results show that the method proposed in the paper is more superior comparing to the traditional services selection methods and which in turn reduce the overall response time of composite web service and enhance the performance.

Keywords: Composite web service, Web Service Composition, Quality of Service, Trust, Candidate Service

1 Introduction

In recent years, with the development of information technologies and distributed systems, Service-Oriented Computing (SOC) has emerged as an increasingly important research area, attracting much attention from both the research and industry communities [17].Conceptually, SOC is a computing paradigm that utilizes services as basic constructs to support the development of rapid and low-cost composition of distributed applications, even in heterogeneous environments [16, 18].

A web service framework has evolved to become a promising technology for the integration of disparate software components using Internet protocols. Web Services Description Language (WSDL), Universal Description, Discovery, and Integration (UDDI), and Simple Object Access Protocol (SOAP) are three core standards for web service description, registration, and binding, respectively [19]. Web service providers register web services through an UDDI registry. The web service that they intend to offer is defined by WSDL. Then, web service users/requestors discover the needed web services and send the requests via invocation interfaces. After the response from a web service provider, they invoke those services under SOAP. A web service is defined as a web-accessible function that is well-defined, self-contained, and does not depend on the context of state of other web services. When any single web service fails to accomplish service requestor's multiple function requirements, multiple web services need to be dynamically configured together to form a web service composition to satisfy both the functional and nonfunctional requirements such as quality-of-service (QoS).

The composite web service is composed of several abstract services, and each abstract can be achieved by a set of functionally equivalent concrete services [26]. The goal of QoS aware trust based service selection is to select candidate services from each set of concrete services to satisfy end-to-end QoS and trust requirements to optimize composite web service.

In our daily life, there are many occasions when we have to trust others to behave as they promised or as we expect them to do. For example, we trust a bus driver can take us to our destination on time; we trust a doctor to conduct a physical examination and check whether we have an illness; we trust a motor mechanic to find out whether there is a problem in our car and then repair it; we trust a bank and deposit our money. Each time we trust we have to put something at risk: our lives, our assets, our properties, and so on. On these occasions, we may use a variety of clues and past experiences to believe these individuals good intentions towards us and decide on the extent to which we can trust them. This is the general procedure of trust evaluation in daily occasions.

[25]Web services have become an important media for online business services. The client of a web service and the service provider often share no prior relationship and no common security domain. The lack of effective trust establishment mechanisms for web services impedes the deployment of trust models for online services. Trust establishment is the mechanism by which one entity relies upon a second entity to execute a set of actions or to make a set of assertions. As with

all social relationships, it is difficult to quantify trust and its properties are fuzzy.

Unlike P2P information-sharing networks or the eBay reputation management system where a binary rating system is used [24], in SOC environments a trust rating is usually a value in the range of [0, 1] given by a service client [20, 22, 23], representing the subjective belief of the service client on their satisfaction with a service or a service provider. The trust value of a service or a service provider can be calculated by a trust management authority based on the collected trust ratings representing the reputation of the service or the service provider. Effective and efficient trust evaluation is highly desirable and critical for service clients to identify potential risks, providing objective trust results and preventing huge monetary loss [21].

2 Related Research Work

In this paper, Buvanesvari et al presented an overview which focus on developing fuzzy-based approach for Web service discovery. This paper also describes the web service challenges on fuzzy mechanism that summarized and analyzed in order to assess their benefits and limitations [1].

Fumiko Satoh et al [2] propose a security policy composition mechanism that uses the existing policies of the external services. They define the process-independent policy composition rules and providing a method for semi automatically creating a security policy of the composite service. Their method supports two approaches of policy composition: top down and bottom-up.

Lei Li et al [3] in their paper interpret the trust dependency caused by a direct invocation as a conditional probability, which is evaluated based on the subjective trust estimation with discrete subjective ratings of service components. Then, they specify a subjective probability of each service component based on all its preceding trust dependency to evaluate the composition of trust dependency, which is caused by an indirect invocation. Furthermore, on the basis of trust dependency, a subjective probability based deductive approach has been proposed to evaluate the subjective global trustworthiness of a composite service.

A ranking method [4] which is a hybrid of matrix ranking method and QoS based fuzzy ranking method was proposed in this paper. This facilitates the inclusion of imprecise QoS constraints and also combines the advantage of having user preference. The usage of fuzzy sets and entropy normalization provides a ranking that is more effective.

In this approach, dominance relationships [5] are used for ranking. A balance between the number of dominating services and the number of dominated services is obtained and the results are plotted to obtain a rank for the various services. The dominance scores for both cases are determined using separate algorithms which first calculate the paradigm degree of match (PDM) and then calculate the service degree of match (SDM).

In the fuzzy approach for ranking [6], the attributes are converted into a fuzzy constraint specification problem which is then defuzzified to produce a quantifiable result. The fuzzy limits are used to determine if a service can be added to the rank list. Since the approach is fuzzy and not binary, the number of web services considered for filtering is more which an advantage of this method is. The problem in this approach is certain QoS criteria cannot be expressed in fuzzy logic.

The authors propose a reputation measure approach for web services. The approach employs three phases (i.e. feedback checking, feedback adjustment and malicious feedback detection) to enhance the reputation measure accuracy. A user survey form was first established to check the feedback ratings from these users who are lacking in feedback ability. Then the feedback ratings are adjusted with different user feedback preferences by calculating feedback similarity. Finally, the authors detect malicious feedback ratings by adopting cumulative sum method [7].

This survey [8] discusses various definitions, categories, sources and relationship of trust and focuses in depth on various trust management models and its issues for semantic web services.

In this paper, they employed Naive Bayes, Markov blanket and Tabu search to rank web services. The Bayesian Network is demonstrated on a dataset taken from literature. The dataset consists of 364 web services whose quality is described by 9 attributes. Here, the attributes are treated as criteria, to classify web services [9].

Oliveira et al [10] presents an online recommendation system that eases the matching of a user with the most relevant products and services. The designed system consists of three recommendation algorithms; two of them are already widely discussed in the literature, while the third one is new and was proposed to consider the trust relationship between users and their peers.

This survey [11] examines and explores the role of trust in service workflows and their contexts from a wide variety of literatures. Various mechanisms, architecture, techniques, standards, and frameworks are explained along the way with discussions.

A suite of protocols and mechanisms were described to protect the WS-AT services and infrastructure against Byzantine faults. The main contribution of this paper [12] is that it shows how to avoid naively applying a general-purpose BFT by exploiting the semantics of WS-AT operations to reduce the number of Byzantine agreements needed to achieve atomic termination of a Web Services Atomic Transaction. The cost savings are substantial when the number of Participants is large.

In this paper [13], criteria of Quality of Service are classified into different groups, and an automatic trust calculation is introduced. After that, an approach based on the Kalman Filter is presented to filter out malicious values and to estimate real values. Through aggregating the values provided by other consumers, the value of the trust in different QoS criteria can be obtained.

This paper [14] introduces a new approach based on Fuzzy Linear Regression Analysis (FLRA) to extract qualitative information from quantitative data and so use the obtained qualitative information for better modeling of the data. The extracted qualitative data is then used for modeling the data. The proposed approach is applied for the trust prediction of the delivered web-services based on a set of advertised QoS values.

Weina et al proposes a global trust service composition approach based on random QoS and trust evaluation, considering the multi-criteria assessment of service quality. Firstly, statistical test is employed to remove the uncertain outliers and to estimate the ideal value of the collected objective QoS data. Secondly, subjective QoS evaluations of providers and users are aggregated according to direct trust and recommended trust. Finally, services are composed through global QoS optimization [15].

In all the above approaches the candidate web service selection for composite web service consider either QoS ranking alone or trust value of the candidate service. We propose in this paper a new Web services selection model based on QoS ranking and Trust score. In section III the nonfunctional QoS values are taken into account for the appropriate selection of required services and trust score is calculated. Trusted Web Services Selection Model for Composite Web Service is presented in Section IV. Some experiments are presented in section V for illustrating how response time is minimized by using trust score based service selection for composite web service to enhance its overall performance.

3 Qos Aware Trusted Score Evaluation

This paper improves the performance and functional optimization of Composite web service. User's trust towards the composite service mainly depends on the successful execution and service quality.

There are two types of Web services Trust Evaluation: Direct Trust (User's own experience) and Indirect Trust (Other's feedback).Different users have different evaluations on the same web service. There may be false and malicious clients to raise or lower the evaluation scores of some services. In our approach trust is calculated by using both direct and indirect trust evaluation. Our work is divided into three phases. In the first phase direct trust value is calculated based on QoS values of the web services and web services present in the upper half is taken into account to participate in the second phase. In the next step we find the indirect trust value for the resultant web services of the first phase.

In second phase the web services are categorized into trusted and un trusted based on the average of direct and indirect trust values. Finally the resultant set consisting of web services with high QoS values and high Trust Score from which the concrete services can be selected to participate in the composition.

Since the processing speed of composite service is depending on each of its concrete services, our proposed work reduce the search time of the process by giving qualified services for the composition selection and increase the processing speed.

3.1 QoS ranking

In the first part of our work web services in the registry are classified using linear classifiers. Linear classifier is a data mining algorithm that classifies the web services into different categories according to the keyword. Classification algorithm depends on keyword supplied by web service provider at the registration time.

If the input feature vector to the classifier is a real vector, then the output score is

$$y = f(\vec{w} \cdot \vec{x}) = f\left(\sum_j w_j x_j\right),$$

Where **y** is a real vector of weights and **f** is a function that converts the dot product of the two vectors into the desired output. The weight vector is learned from a set of labeled training samples.

Often f is a simple function that maps all values above a certain threshold to the first class and all other values to the second class. A more complex f might give the probability that an item belongs to a certain class.

After classifying the services into subgroup the web services ranked based on their QoS parameters.

Parameter Name	Description	Units
Response Time	Time taken to send a request and receive a response	ms
Availability	Number of successful Invocations / total invocations	%
Throughput	Total Number of invocations for a given period of time	invokes/sec
Reliability	Ratio of the number of error messages to total messages	%
Latency	Time taken for the server to process a given request	ms
Cost	Cost of the web service	Rs

Consider RF is the Rank factor which is calculated as

$$RF = \Sigma W_i Q_j$$

Where W_i is the Weight given for the QoS parameter and Q_j be the QoS value of each web service. When several functionally and transactional wise equivalent WSs are available to perform the same activity, their QoS properties such as response time, availability, throughput, reliability, Latency and Cost become important in the selection process. In this paper we have taken into account the Response time (Q1), Availability (Q2), Throughput (Q3), Reliability (Q4), Latency (Q5) and Cost (Q6) as QoS values of the registered WS.

In the above QoS values certain values should be higher and certain values should be low for each WS. For example Availability and Throughput should be high where as Response time, Reliability, Latency and cost should be low. Therefore the weight for high QoS is given as +1(POSITIVE and weight for low QoS is given as-1 (NEGATIVE).

Based on the RF value the web services are sorted. The number of web services in the group is now divided into two sub groups based on the group size such that the upper half consisting of web services with high RF score and the bottom part consisting of web services with low RF score. The upper half resultant web services are considered and identified as eligible QBT concrete services for reference trust evaluation.

International Journal of Applied Engineering Research ISSN 0973-4562 Volume 10, Number 17 (2015) pp 37396-37402
© Research India Publications. http://www.ripublication.com

3.2 Trust Score Evaluation

In this part of our work QoS based trust (QBT) value for the concrete services which are identified with high RF factor were taken into account and undergone for trust evaluation using the QSBTS (Quality of Service Based Trusted Service) algorithm.

The users feedback (Reference Trust) and RF factor of each concrete service is considered and trust score is calculated using the following formula

$$TS = (RF + RT) / 2.0$$

3.2.1 QSBTS Algorithm:

Input: Group of candidate services with high RF score

Output: Group of candidate services with high Trust Score (TS)

T=0; TRUST[T]=0;UT=0;UNTRUST[UT]=0;

Step 1: for i=1 to n (where 'i' is the candidate service in a particular group)
{
Find RT_i value of each i
(RT-Reference Trust)

Step 2: if RF_i >= 3 and RT_i >= 3 then
Calculate TS
$TS_i = (RF_i + RT_i) / 2.0$

(RF & RT values ranges from 1to 5)
Step 3: if TS >= 3
{ Mark TR_i = "Trust"
T=T + 1
TRUST [T] = i
}
Else
{
Mark TR_i = "Distrust"
UT = UT+1
UNTRUST [UT] = i
}
}

4 Trusted Web Services Selection Model for Composite Web Service

In this approach the candidate web service is selected for the composite web service to participate in the composition based on its QoS value and trust value along with its functional requirements of service consumer.

Following are the steps to select best candidate web service for composite web service using the above proposed model:

(1) Web Service Provider sends the request to publish their web service along with the functionality and QoS values in the Registry.

(2) Based on Web service functionality it will be included in the classified group and its QoS RF value will be calculated and decided whether it comes under eligible group or not.

(3) Indirect trust value will be collected for eligible web service group by the trust evaluator.

(4) Trust evaluator calculates the trust score for each eligible web service by considering RF value and indirect trust (IR) value by using QSBTS selection algorithm.

(5) Each eligible web service is marked as "Trust" or "Distrust" depending on its trust score and web services with "Trust" stamp alone are registered in the UDDI registry and "Distrust" web services were rejected.

(6) The service consumer request web service for the particular functionality.

(7) Web Services in the registry for the requested consumer functionality will be assigned to the user as it was already stamped as "Trust".

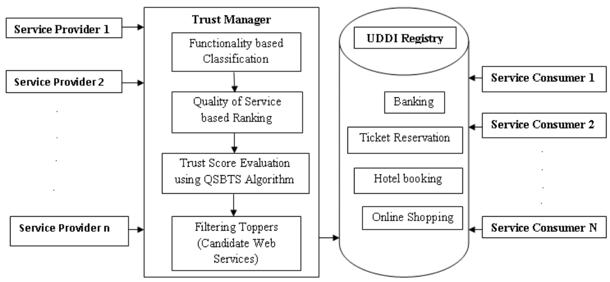

Figure 1 TWSSCWS Model for Trust Based QoS aware Service Selection for Composite Web Service

The proposed approach utilizing QoS values efficiently and also taking care of load balancing by providing group of web services for each individual functionally. The processing time of composite web service is depending on each candidate service performance. In our approach since each candidate service in the registry were already identified as fully eligible and trusted it reduces the processing time of composite service by reducing its time for web service selection.

5 Experiment Results

In the experiment, the candidate and composite web services were designed using.NET applications. The response time of the composite service was measured using HP Load runner performance testing tool. The objective of this testing is to analyze and report the application performance of three different bank purchase order XXX(Composite Web Service) functionality when 60 concurrent users are accessing the application. The response time are captured when 60 concurrent users choose 3 different net banking to complete the purchase order 60 users will login into the application, select product and checkout and enter shipment address. After that 20 user will navigate to Bank **A**, 20 user will navigate to Bank **B** and remaining 20 user will navigate to Bank **C** net banking site to complete the payment process.

International Journal of Applied Engineering Research ISSN 0973-4562 Volume 10, Number 17 (2015) pp 37396-37402

Table 1 Transaction points summary

Transaction Points (Candidate Web Services)	Description
T_01_Login	Measure the time taken to login to the application
T_02_Purchase Order	To Capture the response time of XXX application when user click purchase order button
T_03_Add Product	to measure response time when user add a product in his basket
T_04_Checkout	user check out with selected product
T_05_Shipment Address	user enters the shipment address and click continue
T_06_Netbanking Option	user opted out to choose net banking option
T_07_Launch Bank Site	It measure the time taken to navigate to bank site
T_08_Login to Bank Site	It measure the time taken to login to bank site
T_09_Answer Questions	It measure the time taken to Answer secret questions.
T_10_Payment	User will enter transaction Password and click confirm button. The tool will capture the Response time until the browser redirect to XXX site.
T_11_Logout	Logout of XXX application

Login, Purchase order, Add product, Checkout, Shipment Address, Net banking option, Launch Bank site, Login to Bank site, Answer Questions, Payment, Logout given in Table1 were the concrete service that are used by all the bank composite web service, Among the three composite services(Bank A, Bank B, Bank C) the proposed QoS aware trust based web service selection was implemented in Bank B composite web service and found that its response time was reduced compared to the other two banks and hence its processing speed increased.

Table 2 Response Time Summary

Transaction	Response Time		
T_01_Login	3.3		
T_02_Purchase Order	1.2		
T_03_Add Product	2.7		
T_04_Checkout	1.9		
T_05_Shipment Address	4.1		
T_06_Netbanking Option	2.5		
NetBanking	**Bank A**	**Bank B**	**Bank C**
T_07_Launch Bank Site	3.2	2.6	3.1
T_08_Login to Bank Site	2.1	2.4	2.1
T_09_Answer Secret Questions	2.9	2.6	2.7
T_10_Payment	3.5	3.1	3.2
T_11_Logout	0.9		

Table 3 Total Response Time of Bank A, Bank B and Bank C

Transaction	Response Time in Seconds		
	Bank A	Bank B	Bank C
T_01_Login	3.3	3.3	3.3
T_02_Purchase Order	1.2	1.2	1.2
T_03_Add Product	2.7	2.7	2.7
T_04_Checkout	1.9	1.9	1.9
T_05_Shipment Address	4.1	4.1	4.1
T_06_Netbanking Option	2.5	2.5	2.5
T_07_Launch Bank Site	3.2	2.6	3.1
T_08_Login to Bank Site	2.1	2.4	2.1
T_09_Answer Secret Questions	2.9	2.6	2.7
T_10_Payment	3.5	3.1	3.2
T_11_Logout	0.9	0.9	0.9
Total	**28.3**	**27.3**	**27.7**

From the above total response time mentioned in Table 3 it was clear Bank B's Payment process was faster than other 2, when 20 users are concurrently performing payment process in each of the net banking.

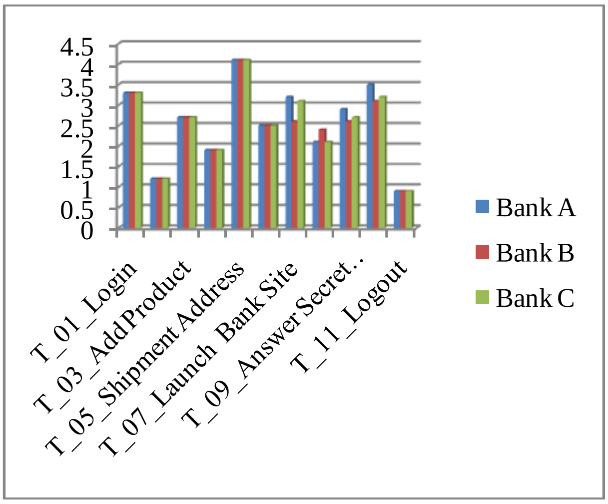

Figure 2 Comparison of Bank A, Bank B, Bank C Response time

6 Conclusion

In this paper, we have proposed the trusted QoS aware service selection model for composite web service to enhance its overall processing speed by reducing its candidate web services response time. The QoS values of all the candidate services that provide the same functionality were classified and ranked according to their ranking factor value. The trust value for the eligible candidate services were calculated by aggregating the rank factor and trust score. Since the overall processing speed of the composite web service is depending on its candidate services, different from the previous approaches this proposed model help to select best candidate services among the group of candidate services that provide the same functionality. For future work one may consider to enhance the security level of composite web service in terms of QoS values. By doing so the online transaction may be conducted in a secured manner with improved performance speed.

References

[1] R.Buvanesvari, V.Prasath, H.SanofarNisha, “A review of Fuzzy Based QoS Web Service Discovery”, Int. J. Advanced Networking and Applications, Volume: 04 Issue: 05 pp. 1752-1759, ISSN : 0975-0290,2013

[2] Fumiko Satoh and Takehiro Tokuda, “Security Policy Composition for Composite Web Services”, IEEE Transactions on Services Computing, Vol. 4, No. 4, pp. 314-327, 2011.

[3] Lei Li, Yan Wang, “A Subjective Probability Based Deductive Approach to Global Trust Evaluation in Composite Services”, 2011 IEEE International Conference on Web Services, 2011, pp. 604-611, 2011.

[4] R.Manoharan, A. Archana and Siddhika Nitin Cowlagi, “Hybrid Web Services Ranking Algorithm” IJCSI International Journal of Computer Science Issues, Vol. 8, Issue 3, No. 2, ISSN: 1694-0814, pp. 452-460, 2011.

[5] Dimitrios Skoutas, Dimitris Sacharidis, Alkis Simitsis, and Timos Sellis, “Ranking and Clustering Web Services using Multi-Criteria Dominance Relationships”, IEEE Transactions on Service Computing, pp.163-177, 2010.

[6] Vuong Xuan TRAN and Hidekazu TSUJI, “QoS based Ranking for Web Services: Fuzzy Approaches”, IEEE 4th International Conference on Next Generation Web Services Practices, pp. 77-82, 2008.

[7] S. Wang Q. Sun H. Zou F. Yang, “Reputation measure approach of web service for service selection”, IET Softw., Vol. 5, Iss. 5, pp. 466-473, 2011.

[8] V.Mareeswari, Dr.E.Sathyamoorthy, “A Survey on Trust in Semantic Web Services”, International Journal of Scientific and Engineering Research,Vol 3, Issue 2,ISSN: 2229-5518, pp. 1-5, 2012.

[9] Ramakanta Mohanty, V. Ravi, M. R. Patra, “ Classification of Web Services Using Bayesian Network” Journal of Software Engineering and Applications, Vol 5, pp. 291-296, 2012.

[10] A. D. R. Oliveira, L. N. Bessa, T. R. Andrade, L. V. L. Filgueiras e J. S. Sichman, “Trust-Based Recommendation for the Social Web”, IEEE Latin America Transactions, VOL. 10, NO. 2, pp. 1661-1666, 2012.

[11] Wattana Viriyasitavat, Andrew Martin, “A Survey of Trust in Workflows and Relevant Contexts”, IEEE Communications Surveys & Tutorials, VOL. 14, NO. 3, pp. 911-940, 2012.

[12] Honglei Zhang, Hua Chai, Wenbing Zhao, P. Michael Melliar-Smith, and Louise E. Moser, “Trustworthy Coordination of Web Services Atomic Transactions”, IEEE Transactions On Parallel And Distributed Systems, Vol. 23, No. 8, pp.1551-1565, 2012.

[13] M. Hadi Mashinchi, Lei Li, Mehmet A. Orgun, and Yan Wang, “The Prediction of Trust Rating Based on the Quality of Services Using Fuzzy Linear Regression”, 2011 IEEE International Conference on Fuzzy Systems, pp. 1953-1959, 2011.

[14] Weina Lu, Xiaohui Hu, Shangguang Wang and Xiaotao Li, “ A Multi-Criteria QoS-aware Trust Service Composition Algorithm in Cloud Computing Environments”, International Journal of Grid and Distributed Computing Vol.7, No.1, pp.77-88, 2014.

[15] A. Syed Mustafa1* and Y. S. Kumaraswamy, “Performance Evaluation of Web-Services Classification”, Indian Journal of Science and Technology, Vol 7(10), pp. 1674-1681, 2014.

[16] L. Li and Y. Wang, “Subjective trust inference in composite services”, In AAAI2010, pp.1377-1384, 2010.

[17] L. Li, Y. Wang, and E.-P. Lim, “Trust-oriented composite service selection and discovery”, In ICSOC/ServiceWave 2009, pp. 50-67, 2009.

[18] M. P. Papazoglou, P. Traverso, S. Dustdar, and F. Leymann, “Service-oriented computing: a research roadmap”, Int. J. Cooperative Inf. Syst., pp.223-255, 2008.

[19] PengchengXiong, Yushun Fan, And Mengchu Zhou, ” Web Service Configuration Under Multiple Quality-Of-Service Attributes “, IEEE Transactions On Automation Science And Engineering, Vol. 6, No. 2,pp. 311-321, 2009.

[20] L.-H. Vu, M. Hauswirth, and K. Aberer, “QoS-based service selection and rankingwith trust and reputation management” In CoopIS 2005, pp. 466-483, 2005.

[21] Y. Wang and L.Li, “Two-dimensional trust rating aggregations in service oriented applications”, IEEE Trans. Services Computing, pp.257-271,2011.

[22] Y. Wang and E.-P.Lim, “The evaluation of situational transaction trust in e-service environments”, In ICEBE 2008,pp. 265-272, 2008.

[23] Y. Wang, K.-J.Lin, D. S. Wong, and V. Varadharajan, ”Trust management towards service-oriented applications”, Service Oriented Computing and Applications, pp.129-146,2009.

[24] L. Xiong and L. Liu, ”PeerTrust: Supporting reputation-based trust for peer-to-peer electronic communities. IEEE Trans. Knowl. Data Eng., pp.843-857, 2004.

[25] Zhengping Wu, Alfred C. Weaver, “Dynamic Trust Establishment with Privacy Protection for Web Services”, Proceedings of the IEEE International Conference on Web Services, 0-7695-2409, 2005.

[26] Jian Wu, Liang Chen, Yipeng Feng, Zibin Zheng, “Predicting Quality of Service for Selection by Neighborhood-Based collaborative Filtering”, IEEE Transactions on systems, Man, and Cybernetics Systems,Vol 43,No 2,pp. 428-439, 2013.

Authors Biography

F. Ezhil Mary Arasi, Asst. Professor in SRM University has been serving the Education Profession for the past 9+ years. Earlier she was working as lecturer for St. Joseph's College, Trichy for about 3 years. Currently, she carries out Research in Service Oriented Architecture. She has guided more than 55 students in completing their MCA Graduation Projects.

Dr. S. Govindarajan, a PhD in Information Technology (IT), earlier had served major software MNC as a General Manager. Currently he works for SRM University as a Professor for Computer Applications Department since 2009. He has published more than 10 journals, which include 3 International Publications.

J. Antony Judi, Senior Systems Analyst, Accenture Private Limited, Over Ten years of experience in client facing roles carrying out effective test management, test planning, execution, reporting and software test automation management skilled in Data warehouse testing, Web services testing, testing in MIS and Banking domain.