Survey of Different Ranking and Prediction Techniques for QoS

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ABSTRACT
Increasing popularity of Cloud computing lead to research problem for building high quality cloud application . Quality of service provides valuable information for optimal decision. From the set of functionally equivalent service candidates optimal cloud selection is taken. In this paper different QoS ranking prediction techniques are studied .The techniques are collaborative filtering and cloud rank framework. Collaborative filtering techniques have three methods neighborhood, model based and memory based. In this ranking oriented approach accurate missing value prediction may not lead to accuracy ranking. Real-world invocations are required on the service candidates for obtaining Quality of Service (QoS) values. QoS ranking prediction is framework (Cloudrank framework) that avoids time-consuming and expensive real world service invocation. QoS ranking prediction framework for cloud services by taking advantages of past service usage experiences of other consumers.

Keywords
QoS, ranking, prediction, cloud computing, Cloudrank.

1. INTRODUCTION
In cloud computing shared configurable resources are provided to computers and other devices as services. Cloud computing popular in recent years and strongly promoted by the leading industrial companies. The applications which are deployed in cloud environment are typically large scale and complex.

Cloud application involve multiple cloud components which communicate with each other over application programming interfaces such as through web services as similar to traditional component based systems. Figure 1 shows cloud application 1 which is tourism website deployed in the cloud that provides various types of tourism services to customers. The no .of software component composes the business process of this cloud application where each component fulfils specified functionality.

As shown in fig.1 services (like airplane ticket services ,car rental services and hotel booking services)are invokes by some of these components to outsource part of business to other companies and this cloud services are provided and deployed in cloud by other consumers. Other cloud applications can also employ these cloud services. (e.g., cloud application 2 and cloud application 3 inFig.1). [1] Optimal service selection becomes important because there are a number of functionally equivalent services in the cloud. Service users refer to cloud applications .Cloud application use/ invoke the cloud services. In this in context of service invocation the user-side (or client side) refers to the cloud applications and server side refers to the cloud services.

Quality of Service (QoS) describes nonfunctional performance of cloud services. To select optimal cloud service from set of functionally equivalent services, QoS values of cloud services provide valuable information .This information assist to make decision for selection of cloud services. The software components are invoked locally in traditional component based system .Similarly in cloud application cloud services are invoked remotely.

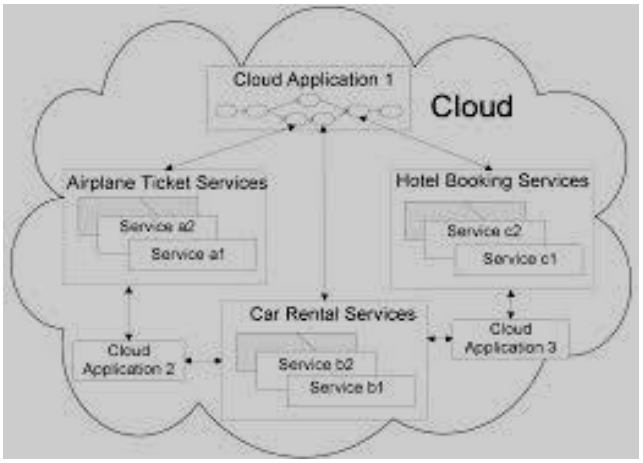

Fig 1: Servicen Oriented Architecture Example[1]

Component quality ranking of user can not be transferred directly to another user is major challenge in QoS driven component quality ranking .This is because the location of cloud application are quite different, so personalized component quality ranking is needed for different cloud applications. In this personalized approach is for evaluation of all candidate services at user side and rank services based on observed QoS performance. This approach is not possible practically as invocations of cloud services may be charged.

Cloud services are self contained and self describing computational cloud components .This components are designed to support user to service interaction by programmatic cloud method call. To build loosely coupled distributed, cloud services are major technique .Service oriented system are multimedia services, automotive system.

2. LITERATURE SURVEY
Zibin Zhang et al. proposed framework to provide personalized cloud component ranking for different designers of cloud application They proposed Quality of Service driven component ranking framework for cloud application by taking advantages of past component usage experience of different component users. They had presented collaborative quality ranking framework which is designed as four phase process They had calculated similarity of user with current user based on their ranking on the commonly invoked

components and set of similar users were found .After that they defined preference function to present quality priority of two component and they used greedy algorithm to rank components.[2]

Zibin Zhang et al. proposed Quality of Service ranking prediction framework for cloud services by taking advantages of past service usage experiences of other consumers. They also proposed framework for making Quality of Service ranking prediction requires no additional invocations of cloud services. They had also proposed two personalized Quality of Service ranking. prediction approaches to predict Quality of Service ranking prediction directly. They also conducted experiment by employing real world Quality of Service data including 300 distributed users and 500 real world web services.[1]

Cardellini et al. employed five generic Quality of Service properties such as execution price ,execution duration ,reliability ,availability and reputation .This are for dynamic cloud service composition. In collaborative filtering two approaches are used user based and item based. User based approach predict ratings of active users based on ratings of similar users .In item based approach predict ratings of active users based on computed information of item similar to those chosen by active users.[11]

Michel R. Lyu proposed evaluations on user dependent Quality of Service of Web services from distributed locations. A large number of Web service invocations are executed by service users under heterogeneous environments on real-world web services.[10]

Ardagna et al. used five Quality of Service properties those are execution time, price, reputation and data quality and availability for making adaptive service composition in flexible process. [11]

Debajyoti Mukhopadhyay et al. gave contribution in a Quality of Service framework for effective WS-Cloud Computing. The goal of the Quality of Service in agent is to support advanced Web Service Discovery with Quality of Service applied in registration, verification, certification, and confirmation.[6]

Yang et al. studied ranking oriented approach for ranking books in digital libraries. In this there is limited work in literature as it is employing collaborative methods for cloud services Quality of Service value prediction. The main reason for obstructing result is that there is no availability of large scale real world cloud service Quality of Service dataset.[1]

Shao et al. studied user based PCC method for Cloud service Quality of Service value prediction. Liu et al proposed ranking oriented collaborative filtering to rank movies.[2]

Jian Wu et al. presented a neighbourhood based CF approach called ADF to predict unknown Quality of Service values.They use A-cosine equation to compute the service-based similarity, add a data smoothing process to improve the prediction accuracy, and extract information from the Quality of Service of similar services to similar users to handle the data sparsity problem .In addition, a TNS strategy had been proposed to improve the scalability of ADF.[8]

Zibin Zheng et al. proposed an approach for predicting Quality of Service values of Web services by systematically combining the user-based PCC approach and the item-based PCC approach. They proposed a user collaborative mechanism for past web service Quality of Service information collection from different service users. Then, based on the collected Quality of Service data, a collaborative filtering approach is designed to predict web service Quality of Service values. Finally, a prototype called WSRec[4] is implemented by Java language and deployed to the Internet for conducting real world experiment.[4]

3. METHODOLOGY

In QoS ranking prediction there are different methods are used for predicting optimal cloud services. The methods used for Qos prediction are neighborhood-based approach, time-aware model-based approach, online approach and collaborative filtering approach etc. Quality of Service is based on nonfunctional performance of cloud service .It consider time dependent (i.e failure probability, response time and throughput) properties and also time independent properties like price, popularity. QoS management always refers to activities in QoS specification, evaluation, prediction, aggregation and control of resources.

3.1 Collaborative Filtering

There are different types of collaborative filtering methods that includes neighborhood based, model based and ranking based approaches. The neighborhood approach and model based approach are used for predicting cloud services QoS values for different service users. These approaches are also known as rating based approaches. The memory based collaborative filtering (i.e. neighborhood based approach) include user based and item based approach. User based approach predict ratings of active users based on ratings of similar users .In item based approach predict ratings of active users based on computed information of item similar to those chosen by active users. User based and item based approaches are used with PCC algorithm & VCC algorithm. The neighborhood approach has some disadvantages such as computational complexity is too high and it is not easy to find similar user at that time where user item matrix is very sparse.[11]

In model based collaborative filtering training dataset is used to train predefined model. There are different example of model based approaches (i.e. clustering model, aspect model and latent factor model)The neighborhood and model based approach are used to predict missing values in user item matrix accurately as possible. In ranking oriented approach accurate missing value prediction may not lead to accuracy ranking. Ranking based approach is aimed at predicting quality ranking of target cloud services instead of detailed QoS values.

3.2 Cloud Rank Framework

The user collaborative mechanism proposed by Zibin Zheng et al. for collecting client side QoS values of web services from different service users. Further they proposed two algorithms for Quality of Service prediction. In this they presented Cloud Rank framework. In this first they calculated similarity values of active user with training user based on their rankings on the commonly invoked cloud services. User's Qos rankings on commonly invoked services are compared by ranking similarity computation. Suppose there are three services in which two users have observed response time {1,2,5}and{2,3.5} resp. The response time values of this two users on services are different but their ranking are close as services are order in same way. Kendall Rank Correlation Coefficient (KRCC) is used to evaluate degree of similarity by considering number of inversion of service pairs which needs to be transformed one rank order to other. The KRCC values of users a and b can be calculated by

$$Sim(a,b)=(C-D)\ /((N(N-1))/2) \qquad [1]$$

Where N is no of services C is no of concordant pair and D is no of discordant pair. There are totally N(N-1)/2 pairs for N cloud services. Similarity values between current active user with other training user is calculated then similar user can be identified. Then algorithms are applied for accurate ranking prediction. This rating oriented approach must predict QoS values as accurate as possible so differences between predicted and true values are calculated and prediction accuracy is evaluated.

Table 3.1 Comparison between different methods

Method	Description with its merits	Disadvantages
Collaborative Filtering	CF has main goal to predict utility of items to particular user from user database CF are often distinguish by whether it is operated implicitly or explicitly. There are two approaches for CF 1. User based CF 2. Item based CF	• higher accuracy in rating prediction does not necessarily lead to effective ranking. • the ranking accuracy is low because the order in the service ranking list is not sensitive for these approaches. • Collaborative Filtering based ranking systems require a large scale of users to provide their QoS records So it is hard to be gathered and accurately describe users' preferences.
Greedy approach	This method is for ranking set of items which treats explicitly rated items and unrated items equally	It does not guarantee that explicitly rated item will be rank correctly
CloudRank 1 and CloudRank 2	In cloudrank1 reference values between items and employs calculated these values for making QoS ranking prediction. In Cloudrank2 confidence levels of different preference values which help achieve better ranking accuracy. CloudRank1 and CloudRank2 algorithms ensure that the employed services are correctly ranked.	When a user has multiple invocation of a cloud service at different time it is difficult to predict accurately.

4. CONCLUSION

In this paper the survey of different methods is studied. There are different methods are used to predict QoS ranking. Neighbourhood approach has several drawbacks. The personalized framework for QoS ranking is able to achieve prediction accuracy. Also it does not requires additional service invocation at the time of making QoS prediction.

5. REFERENCES

[1] Zibin Zheng, Xiamiao Wu, Yliei Zhang, Michael R Lyu and Jianmin Wang "QoS ranking prediction for cloud services", *IEEE Transactions on Parallel and distributed System,*Vol.24, No.6,pp.1213-1222, June2013

[2] Zibin Zheng, Yliei Zhang,and Michael R Lyu "CloudRank: A QoS Driven Component Ranking Framework for Cloud Computing", *IEEE International Symposium on Reliable Distributed Systems,* pp.184-193, 2010

[3] Zibin Zheng,,Hao Ma ,Michael R Lyu and Irwin King "QoS Aware Web Service Recommendation by Collaborative Filtering", *IEEE Transaction on service computing,* Vol.,4 No. 2, pp.140-152, Apr-June 2011

[4] Z.Zheng, H.Ma, M.R.Lyu, and I.King ,"WSRec: Collaborative Filtering Based Web Service Recommender System," *Proc .Seventh Int'l Conf. Web Services(ICWS'09),* pp.437-444, 2009

[5] Z.Zheng and M.R.Lyu, "WS-DREAM: A Distributed Reliability Assessment Mechanism for Web Services," *Proc.38th Int'l Conf. Dependable Systems and Networks(DSN'08),* pp.392-397, 2008.

[6] Debajyoti Mukhopadhyay, Falguni J. Chathly, Nagesh N. Jadhav, "QoS Based Framework for Effective Web Services in Cloud Computing", *Journal of Software Engineering and Applications,* pp952-960,2012.

[7] L.Zeng, B.Benatallah , A.H.Ngu, M.Dumas, J.Kalagnanam, and H.Chang, "QoS- Aware Middleware for Web Services Composition," *IEEE Trans. Software Engineering.,* Vol.30,no.5,pp.311-327,May 2004

[8] J.Wu, L.Chen, Y.Feng, Z.Zheng ,M.Zhou,and Z.Wu, "Predicting QoS for Service Selection by Neighborhood-Based Collaborative Filtering," IEEE Trans. System, Man, and Cybernetics, Vol.43, No.2, March 2013.

[9] H.Ma, I.King ,and M.R.Lyu , "Effective Missing Data Prediction for Collaborative Filtering," Proc.30th Int'l ACMSIGIR Conf. Research and Development in Information Retrieval(SIGIR'07), pp.39-46,2007.

[10] Zibin Zheng, Yliei Zhang,and Michael R Lyu "Distributed QoS Evaluation for Real World Web Services", *IEEE International Conference on Web Services* ,pp 83-90 2010.

[11] Mandeep Devgan, Kanwalvir Singh Dhinsa,"A Study Different QoS Management Techniques in Cloud Computing *"International Journal of Soft Computing and Engineering,*Vol.3 ,pp 37-41,July 2013.

[12] Y. Liu, A. H. Ngu, and L. Zeng, "QoS computation and policing in dynamic web service selection," in *Proc. Int. World Wide Web Conf.*, Manhattan, NY, 2004, pp. 66–73.

[13] L. Chen, Y. Feng, J. Wu, and Z. Zheng, "An enhanced QoS prediction approach for service selection," in *Proc. Int. Conf. Serv. Comput.*, 2011, pp. 727–728.