A Collaborative Ranking Approach for Discovery and Selection of Cloud Services

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INTRODUCTION

Cloud computing is gaining dominance over the last few years along with its various features such as, on-demand ease of access of computing resources as well as software services. Computing facilities are designed and utilized as a service using virtualization techniques and used as automated business logic in both public and private sectors. Along with various benefits data privacy, data confidentiality and trust establishment are considered to be the main security concerns for an organization to move its data to the cloud platform (Xu et al., 2015; Elfirdoussi, Jarir & Quafafou, 2012). The hasty developments of cloud computing means that cloud services have become the main computing mode on the Internet. Numerous services are offered over cloud to offer analogous functionalities. Despite the fact, the difficulty in identifying trustworthy services has fascinated the attention of researchers (Xu et al., 2015; Elfirdoussi, Jarir & Quafafou, 2012). For this reason, the concepts of trust and reputation had been brought to assess the reliability of cloud services (Li, Zhou, & Yang, 2012).

Reputation is a prejudiced assessment of a cloud service based on personal experience of individual or the advocacy of other users. In recent times, a variety of reputation systems have been proposed to deal with the challenges posed by open and dynamic cloud service environments (Itani, Ghali, Kayssi, & Chehab, 2014). The focus of majority of these systems is on computation of reputation ratings, reputation management, experience, and other features of dynamic environments and provides an appropriate solution to users (Malik & Bouguettaya, 2009; Rathore & Suman, 2013a, 2013b,2013c, 2016; Yuan, An, & Wang, 2009; Trang, Zhao, & Yang, 2010). However, the survival of biased ratings affects the accuracy of trust evaluations to a great extent. At present, the focus of these reputation models are mainly on the accuracy of trust evaluations (Wang, Zheng, Sun, Zou, & Yang, 2011; Malik & Bouguettaya, 2009a,2009b); however, these existing methods are limited by personality preference.

At present, to deal with the issue of trustworthiness, computation of the reputation is one of popular method (Elfirdoussi, Jarir & Quafafou, 2012). Reputation is the subject of a lot of interdisciplinary research and can be defined as "the collected and processed information about an individuals' behavior as observed by others" (Wang, Chao, Lo, Lin, & Wang, 2011). The user can trust the service to a certain extent, based on aggregated feedback given by earlier consumers can be considered as the reputation score of a cloud service. A common attribute in existing cloud computing models is that a universal reputation score is designed through these reputation systems and the value is the same for all consumers. It is commonly used in profit-making location, such as eBay's feedback mechanism or Epinions (Li, &

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Wang, 2011). However, in general the reputation is potentially subjective. Feedback ratings are based on the individual's usage experience of a cloud service, which always needs to be seen in the context of the users experience and expectations of a service.

Consider for example two cloud service consumers A (denoted as CA) and B (denoted as CB). They are both looking for a cloud storage service. An industry expert has extremely precise requirements for confidentiality. CB is an amateur whose main aim is to obtain cheap storage. Now consider CB a free storage service is expected to be extremely glad as the cost is minimal and if usability is ok he/she will rank this service very highly. CA might read the small print regarding data policies and is likely to find issues that are not to her liking; so they would rank the service somewhat lower. Of course both are correct in their individual rankings. A global reputation score would not reflect the service users accurately.

Recently, extensive research work has been carried out on reputation prediction of cloud service in which Collaborative Filtering (CF) is extensively used (Xu et al., 2015; Wang, Chao, Lo, Lin, & Wang, 2011; Itani, Ghali, Kayssi, & Chehab, 2014). The classic procedure of CF is firstly to recognize a identical users set or services with identical ratings based on Pearson Correlation Coefficient (PCC), and secondly to use the similar users ratings and/or services to make predictions. Historical feedback ratings contributed by different cloud users are the basis for this prediction. Therefore, the prediction accuracy of CF approaches is highly influenced by the trustworthiness of the user-contributed feedback ratings. However, the present CF approaches uses a theory that all consumers-contributed feedback ratings are trustworthy (Xu et al., 2015; Wang, Chao, Lo, Lin, & Wang, 2011). However, a few feedback ratings can be unreliable due to certain reasons in reality: 1) some users may always give the maximal/ minimal values for the services, (2) cloud service consumers who may be at the same time cloud service providers, intentionally give higher feedback ratings to their own services and terrible mouthing to others services. Therefore, it is significant to consider data credibility to enable more robust service QoS value prediction.

Most existing reputation computation approaches compute service reputation based on QoS parameter and service level. These approaches have a high degree of dependency on the service user's feedback ratings services (Li, Zhou, & Yang, 2012; Li, & Wang, 2011; Trang, Zhao, & Yang, 2010; Malik & Bouguettaya, 2009a, 2009b; Wang, Zheng, Sun,, Zou, & Yang, 2011). Assessment of service reputation at QoS parameter level requires that each QoS parameter should be monitored and tracked dynamically because QoS may change over time. Reputation assessment at service level based on a user's feedback rating also bears many problems, such as bias towards positive feedback ratings (Malik & Bouguettaya, 2009a, 2009b). Another problem with user's feedback rating is to ensure its accuracy and trustworthiness that users provide without even knowing much about the service (Wang, Zheng, Sun, Zou, & Yang, 2011; Le-Hung, & Aberer, 2009).

In order to address aforesaid weaknesses, a collaborative ranking approach along with a cloud service reputation model is proposed in this book chapter for detecting the malicious users' feedback rating and evaluating the service reputation. The proposed approach computes the service reputation to discover and select best services over cloud with the combination of user's rating and access rate (Yuan, An, & Wang, 2009; Rathore & Suman, 2013a, 2013b, 2013c, 2016). The former is dependent on user's feedback which is reported after the invocation of services. The later is the access rate, which is obtained through active monitoring of every service to be invoked by service consumer. Malevolent feedback rating using similarity computations are detected by presented approach and reduces the effect of user feedback preferences by Pearson correlation coefficient. An algorithm is also presented for the proposed approach. Wide-ranging experimental result shows that the presented approach can be helpful in improving the reliability of cloud services to be discovered.