International Journal of Engineering & Technology
CENTRE OF PROFESSIONAL RESEARCH PUBLICATIONS
ISSN 2049-3444

International Journal of Engineering and Technology Volume 4 No. 9, September, 2014

A Proposed Framework for Ranking and Reservation of Cloud Services

Mamoun Hussein Mamoun, Eslam Mohamed Ibrahim
Faculty of Computer and Information Sciences
Mansoura University, Egypt

ABSTRACT

With the growth of cloud computing, many organizations started to offer cloud services to various consumers on the basis of their functional and non-functional requirements. Currently there is no software framework which can automatically index cloud providers based on their needs. Due to plethora and the verity of cloud service offering, in this paper, we propose a new framework for ranking and reservation the cloud services which is based on a set of cloud computing specific performance and QoS attributes. Also, it provides an automatic best fit and a guaranteed delivery. Furthermore, it creates healthy competition among Cloud providers to satisfy their Service Level Agreement (SLA) and improve their Quality of Services (QoS).

Keywords: *New in Cloud Computing, Cloud Service Measurement, Quality of Service, Service Level Agreement, Proposed Framework.*

1. INTRODUCTION

Cloud computing can be defined as “management of resources, applications and information as services over the cloud (internet) on demand”. Instead of purchasing actual physical devices servers, storage, or any networking equipment, clients lease these resources from a cloud provider as an outsourced service [1].

There are three types for providing services of cloud. These three models are often referred to as the “**SPI Model** (Software, Platform and Infrastructure) [2]”.

- Software as a Service (SaaS): Customers obtain the facility to access and use an application or service that is hosted in the cloud.
- Platform as a Service (PaaS): Customers obtain access to the platforms by enabling them to organize their own software and applications in the cloud.
- Infrastructure as a Service (IaaS): The facility provided to the customer is to lease processing, storage, and other fundamental computing resources.

Three different ways in which the cloud services can be deployed :

- Public cloud: In Public cloud, customers can access web applications and services over the internet. Each individual customer has its own resources which are dynamically provided by a cloud providers. These providers facilitate multiple customers from multiple data centers, manages all the security measures and provides hardware and infrastructure for the cloud customers to operate. The customer has no idea about how the cloud is managed or what infrastructure is available. Customers of Public Cloud services are considered to be untrusted.
- Private cloud : In private clouds customers has complete control over that how data is managed and what security measures are in place while data processing in cloud. The customers of the service are considered “trusted.” Trusted customers of service are those who are considered to be part of an organization including employees, contractors, & business partners.
- Hybrid Cloud : Hybrid Clouds are a combination of public and private cloud within the same network. Private cloud customers can store personal information on their private cloud and use the public cloud for handling large amount of processing demands.

Performance measure is in fact a major issue for many users and it is considered as one of the major obstacles for cloud computing [3][4]. For example, enterprises that depend on Service Level Agreement (SLA), e.g. a Web page has to be rendered within a given amount of time.

Those enterprises expect cloud providers to make Quality of Service (QoS) guarantees. Therefore it is crucial that cloud providers offer SLAs based on performance features — such as response time, accuracy, reliability, cost, elasticity and throughput. However, cloud providers typically base their SLAs on the availability of their offered services only [5, 6, 7]. Therefore, there is currently a clear need for users — who have to deal with this performance — to better understand the performance variance in a cloud.

A typical cloud storage SLA articulates precise levels of the services such as availability of the services which are in operation. In the context of intense economic competition, different cloud storage providers supply a variety of services with different SLAs, which are proportional to the cost. That is, users interested in more reliable SLA must pay more. Moreover, as the total size of user objects in the cloud storage reach up to several exabyte (260 bytes), it can impose enormous cost on users. Therefore, optimal selection of cloud storage providers in terms of higher availability and lower cost is a crucial decision to users.

Due to several business benefits offered by Cloud computing, many organizations have started building applications on Cloud infrastructure and making their businesses agile by using flexible and elastic Cloud services. But moving applications and/or data into the Cloud is not straight forward. Numerous challenges exist to leverage the full potential that Cloud computing promises. These challenges are often related to the fact that existing applications have specific requirements and characteristics, that need to be met by Cloud providers [9].

Other than that, with the growth of public Cloud offerings, for Cloud customers it has become increasingly difficult to decide which provider can fulfil their Quality of Service (QoS) requirements. Each Cloud provider offers similar services at different prices and performance levels with different set of features. While one provider might be cheap for offering terabytes of storage, renting powerful VMs from them might be expensive.

Therefore, given the diversity of Cloud service offerings, an important challenge for customers is to discover who are the “right” Cloud providers that can satisfy their requirements. Often, there may be trade-offs between different functional and non-functional requirements fulfilled by different Cloud providers. This makes it difficult to evaluate service levels of different Cloud providers in an objective way such that required quality, reliability or security of an application can be ensured in Clouds. Therefore, it is not sufficient to just discover multiple Cloud services but it is also important to evaluate which is the most suitable Cloud service.

In this paper, we propose a framework for ranking and reservation the cloud services which is based on a set of cloud computing specific performance and QoS attributes.

The rest of paper is organized as follows. In the next section, we present a related work for the proposed framework. Section 3 describes the proposed framework with its key components. Section 4 shows The hierarchical structure of QoS attributes for ranking. Section 5 presents a case study in which the ranking and reservation of the proposed framework is explained. Section 6 concludes this article.

2. RELATED WORK

Cloud computing aims to distribute a network of virtual services so that consumers can access them from anywhere in the world on payment at competitive costs depending on their Quality of Service (QoS) requirements [10]. Cloud computing systems may flock thousands of internationally dispersed consumers at any given time. These consumers may access diverse types of services that have varying requirements depending on the type of consumers, services and resources involved [11].

In [12], the authors have proposed a novel framework for ranking and advanced reservation of cloud services using Quality of Service (QoS) attributes. In some situations, due to the vast number of requests, the providers are not able to deliver the requested services within requested time. To avoid this scenario, ranking technique is very much useful. All QoS characteristics are explained. But for implementation all QoS characteristics are not used.

In [9] and [13] , the authors proposed a framework to measure the quality and prioritize Cloud services. This framework makes significant impact and creates healthy competition among Cloud providers to satisfy their Service Level Agreement (SLA) and improve their Quality of Services (QoS). They proposed an Analytical Hierarchical Process (AHP) based ranking mechanism which can evaluate the Cloud services based on different applications depending on QoS requirements. This proposed technique is used only for quantifiable QoS attributes such as Accountability, Agility, Assurance of Service, Cost, Performance, Security, Privacy, and Usability. It is not suitable for non-quantifiable QoS attributes such as Service Response Time, Sustainability, Suitability, Accuracy, Transparency, Interoperability, Availability, Reliability and Stability.

In [14] , the authors have proposed a QoS ranking prediction framework for Cloud services by taking past service usage experiences of consumers. This framework is to avoid the time-consuming and expensive real-world service invocations. This framework requires no additional invocations of Cloud services when making QoS ranking prediction. Collaborative filtering method is used to predict QoS for web services only, it can be used for cloud services also. Here Pearson Correlation Coefficient is used to calculate the similarity between users.

In [15], the authors have proposed a generic QoS framework for Cloud workflow systems. This framework consists of four components such as QoS requirement specification, QoS-aware service selection, QoS consistency monitoring and QoS violation handling. However the data communication and knowledge sharing between the components for different QoS dimensions is not suitable for solving complex problems such as multi QoS based service selection, monitoring and violation handling.

The goal is to satisfy the users’ QoS requirements by selecting the best IaaS service. Together, the combined services can offer the best cloud service to the users through our selection system.

3. PROPOSED FRAMEWORK

Our proposed framework consists of multiple clouds and a services processing unit. The services processing unit consists of three units: provision unit, ranking unit and reservation unit. The overall architectural diagram of the proposed framework is depicted in Fig.1:

3.1 Provision Unit

Provision unit acts as a central market place between the cloud customers and the service providers. by:

- Submitting users requests to the services providers.
- Collecting all requests and offers.

- generating a unique id for each and every requests and offers.
- Providing mapping for all the submitted offers and request after issuing the unique id.
- Submitting offers to the ranking unit.
- Collecting the ranked offers and submitting it to users.
- Collecting users choice of resources for the reservation unit.

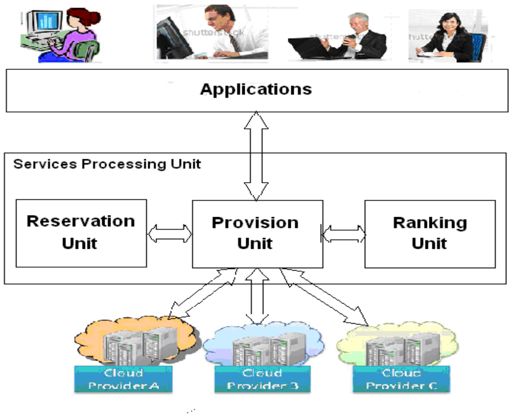

Fig 1: The Proposed Cloud Framework

3.2 Ranking Unit

When there are multiple service providers, there will be confusion that which service they can use and what is the basis for their selection. To avoid this scenario ranking mechanism is included. The ranking unit provide ranking of cloud services by forming hierarchical structure of the QoS attributes. The QoS attributes are computed and classified as top level, first level and second level. Then the relative weights for each attributes are assigned randomly. After that the RSRM and RSRV are calculated for each attributes. Finally all the second level RSRVs are aggregated to compute the RSRM of first level attributes and all the first level RSRVs aggregated to find the final RSRM.

3.3 Reservation Unit

Advanced reservation unit generate a unique reservation id for every reservation request. After that it will get the users choice of resources, reservation time and period. With those details the reservation unit will check the availability. If the requested resources are available for the requested time the unit will lock the reserved resources for the reserved period.

4. HIRARACHICAL STRUCTURE OF QoS ATTRIBUTES FOR RANKING

The hierarchical structure of QoS attributes provides the classification of QoS attributes needed by the customers for selecting the appropriate service providers based on: cost, performance, assurance, security, usability, agility, accountability [16] :

- Cost

The first question that arises in the mind of organizations before switching to Cloud computing is that whether it is cost-effective or not. Therefore, cost is clearly one of the vital attributes for IT and the business. Cost tends to be the single most quantifiable metric today, but it is important to express cost in the characteristics which are relevant to a particular business organization.

- Performance

There are many different solutions offered by Cloud providers addressing the IT needs of different organizations. Each solution has different performance in terms of functionality, service response time and accuracy. These organizations need to understand through these properties how well their applications will perform on the different Clouds and whether these deployments meet their expectations.

- Assurance

This characteristic indicates the likelihood of a Cloud service that it will perform as expected or promised in the SLA. Every organization looks to expand their business and provide better services to their customers. Therefore, reliability, resiliency and service stability become an important factor for them before they decide switching to Cloud services.

- Security

Data protection and privacy are the important concerns of nearly every organization. Hosting data in other organizations control is always a critical issue which require stringent security policies employed by Cloud providers.

- Usability

For fast usage of Cloud services, the usability plays an important role. The more easy to use and learn a Cloud service is, more faster an organization can switch to Cloud services.

- Agility

The most important advantage of Cloud computing is that it adds to the agility of an organization. The organization can expand and change quickly without much expenditure. Agility in SMI is measured as a rate of change metric.

- Accountability

This group of QoS attributes is used to measure various Cloud provider specific characteristics. This is important to build trust of a customer on any Cloud provider. No organization will want to deploy its applications and store their critical data in a place where there is no accountability of security exposures and compliance.

5. CASE STUDY

Here the cloud environment is created for three Cloud services from three Cloud Providers and two users request ($requirement_1$,$requirement_2$). The QoS data is collected from various evaluation studies for three IaaS Cloud providers: Amazon EC2, Windows Azure, and Rackspace [17]. [18], [19]. The collected data given in Table 1.
We set different priorities and numeric weights for users request (see Table 2), the results coming from the computing process is as follows:

- The relative ranking of all the Cloud services can be decided based on the resultant RSRV for each requirement as:

- For $requirement_1$: $RSRV_1$ = (0.3424, 0.2702, 0.3874).Based on the user 1 requirements, then Cloud services are ranked as $S_3 > S_1 > S_2$.
- For $requirement_2$: $RSRV_2$ = (0.3770, 0.2919, 0.3269).Based on the user 2 requirements, then Cloud services are ranked as $S_1 > S_3 > S_2$.
-

- A cloud service comparisons for users requests can be visualized in Figure 2 and Figure 3. It can be observed that, for $requirement_1$ and $requirement_2$, cloud service S_3 is best in terms of performance of the machine and minimum cost, however it is one of the lowest in terms of security. Therefore, S_3 is a good alternative for the scientific community where security is a lower priority requirement and data is publicly available. On the other hand, Cloud service S_2 is the best in terms of security and accountability which may be a key requirement for a user from a commercial organization.

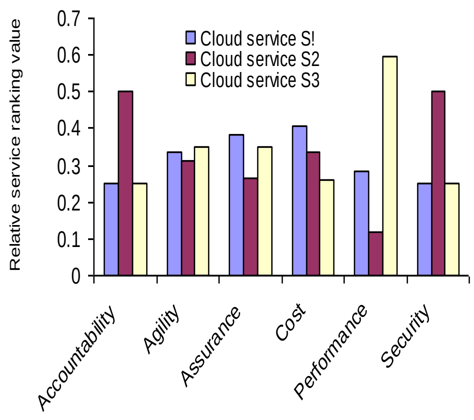

Fig 2: Clouds services comparison for $requirement_1$.

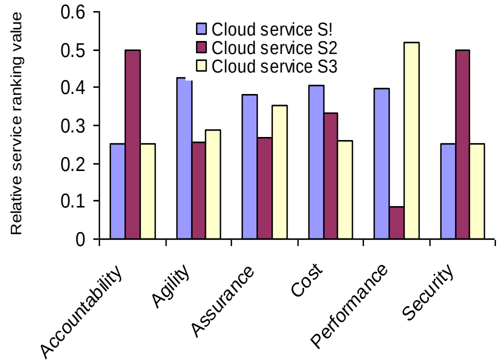

Fig3: Clouds services comparison for $requirement_2$.

6. CONCLUSION

The proposed framework exhibits an improvement over existing frameworks already being employed. The main advantage of it is to provide ranking and reservation schemes by which the customer can access the right resources at right time without fail. Also, it helps the cloud customers to choose the best service provider who satisfy their QoS requirements. Furthermore, for the user who wants to choose the best providers based on his requirements must use our proposed framework by neglecting all unnecessary attributes or by increasing the weight of their required attributes.

REFERENCES

[1] A Malik, M. Mohsin, "Security Framework for Cloud Computing Environment: A Review", Vol. 3, No. 3, pp. 390-394, March, 2012.

[2] "Security Guidance for Critical Areas of Focus in Cloud Computing", in Cloud Security Alliance (ASA), April, 2009.

[3] J. Schad, J. Dittrich, J. Arnulfo, "Runtime Measurements in the Cloud: Observing, Analyzing, and Reducing Variance", in Proceedings of the VLDB Endowment, Vol. 3, No. 1, 13-17 September, Singapore, 2010.

[4] M. Armbrust, A. Fox, R. Griffith, A. D. Joseph, R. Katz, A. Konwinski, G. Lee, D. Patterson, A. Rabkin, I. Stoica, M. Zaharia, "Above the Clouds: A Berkeley View of Cloud Computing", in EECS Department, UCB, Techn.Rep.UCB/EECB, February, 2009.

[5] 3ters, http://www.3tera.com.

[6] Amazon AWS, http://aws.amazon.com.

[7] Rackspace, http://www.rackspacecloud.com.

[8] Y. Mansouri, A. Nadjaran, R. Buyya, "Brokering Algorithms for Optimizing the Availability and Cost of Cloud Storage Services", in 2013 IEEE International

Conference on Cloud Computing Technology and Science, Vol. 1, pp. 581-589, 2013

[9] S. Kumar, S. Versteeg, R. Buyya "A framework for ranking of cloud computing services", in Future Generation Computer Systems; Vol. 29, No. 4, pp. 1012-1023. June, 2013.

[10] R. Buyya, C. Yeo, S. Venugopal, J. Broberg, I. Brandic, "Cloud computing and emerging IT platforms: vision, hype, and reality for delivering computing as the 5th utility", in ELSEVIER of Future Generation Computer Systems, Vol. 25, No. 6, pp. 599–616, Jun., 2009.

[11] Mohamed Firdhous, Suhaidi Hassan , Osman Ghazali", A Comprehensive Survey on Quality of Service Implementations in Cloud Computing", in International Journal of Scientific and Engineering Research, volume 4, Issue 5, pp. 118- `123, May, 2013.

[12] Mr. K. Saravanan, M.Lakshmi Kantham, "An enhanced QoS Architecture based Framework for Ranking of Cloud Services", in the Proceedings International Journal of Engineering Trends and Technology (IJETT) , Vol. 4, Issue 4, pp. 1022-1031, April, 2013.

[13] J. Saurabh Kumar Garg, Steve Versteeg and Rajkumar Buyya, "SIMCloud: A Framework for Comparing and Ranking Cloud Services" in 4th IEEE International Conference in Utility and Cloud Computing, pp. 210-218, Dec., 2013.

[14] Zibin Zheng, Xinmiao Wu, Yilei Zhang, Michael R. Lyu and Jianmin Wang, "QoS Ranking Prediction for Cloud Services", Published in IEEE Transactions on Parallel and Distributed Systems, Vol. 24, No. 6, pp. 1213-1222, June, 2013.

[15] Xiao Liu, Yun Yang, Dong Yuan, Gaofeng Zhang, Wenhao Li and Dahai Cao, " A Generic QoS Framework for Cloud Workflow Systems", in Ninth IEEE International Conference on Dependable, Automatic and Secure Computing, pp. 713- 720, Dec., 2011.

[17] J. Saurabh Kumar Garg, Steve Versteeg and Rajkumar Buyya, "A Framework for Ranking of Cloud Computing Services", in ELSEVIER of Future Generation Computer Systems Vol. 29, No. 4 , pp. 1012- 1023, June, 2013.

[18] A. Li, X. Yang, S. Kandula, M. Zhang, " CloudCmp: comparing public cloud providers", in Proceeding of the 10th ACM SIGCOMM conference on Internet measurement, Melbourne, Australia, pp. 1-14, Nov., 2010.

[19] A. Iosup, N. Yigitbasi, D. Epema, "On the performance variability of production cloud services", in Proceedings of IEEE/ACM International Symposium on Cluster, Cloud, and Grid Computing, CA, USA, pp. 104-113, May, 2011.

Table 2. User request weights

weight / user request	w_1	w_2	w_3	w_4	w_5	w_6
$Requirement_1$	0.05	0.10	0.20	0.30	0.30	0.05
$Requirement_2$	0.05	0.05	0.20	0.40	0.20	0.10

Table 1. Case Study

Top Level QoS (Weights)	1st Level Attributes (Weights)	2nd Level Attributes (Weights)	Service 1 (S1)	Service 2 (S2)	Service 3 (S3)	$Requirement_1$	$Requirement_2$
Accountability (w_1)	Level: 0-10 (1.0)		4	8	4	4	4
Agility (w_2)	Capacity (0.6)	CPU (0.5)	9.6	12.8	8.8	6.4 GHZ	9 GHZ
		Memory (0.3)	15	14	15	10 GB	12 GB
		Disk (0.2)	1690	2040	630	500 GB	700 GB
	Elasticity (9.4)	Time (1)	80-120	520-780	20-200	60-120 Sec	70-120 Sec
Assurance (w_3)	Availability (0.7)		99.95%	99.99%	100%	99.9%	99%
	Service Stability (0.2)	Upload Time (0.3)	13.6	15	21	--	--
		CPU (0.4)	17.9	16	23	--	--

		Memory (0.3)	7	12	5	--	--
	Serviceability (0.1)	Free Support (0.7)	0	1	1	--	--
		Memory (0.3)	24/7, Phone, Urgent Response, Diagnostic Tools	24/7, Phone, Urgent Response, Diagnostic Tools	24/7, Phone, Urgent Response	24/7, Phone	24/7, Phone, Urgent Response
Cost (w_4)	On-Going Cost (1.0)	VM Cost (0.6)	0.68	0.96	0.96	<1 $/hour	<1 $/hour
		Data (0.2)	10	10	8	100 GB/month	120 GB/month
		Storage (0.2)	12	15	15	1000 GB	1000 GB
Performance (w_5)	Service Response Time (1.0)	Range (0.5)	80-120	520-780	20-200	60-120 Sec	70-120 Sec
		Average Value (0.5)	100	600	30	--	--
Security (w_6)	Level: 0-10 (1.0)		4	8	4	4	4