Systematic Literature Survey using Quality Parameter for Cloud Computing

Preeti Sirohi, Amit Agarwal, Piyush Maheshwari

Abstract*: *Cloud Computing technology provides on-demand services to its consumer. This encourages the cloud service providers of offer variety of services to its users. The increasing demand of cloud services has brought several cloud providers in the market offering services having different Quality of services parameters. The user face the challenge in selecting the right services which could meet their requirements. The service selection is therefore a complicated process and is considered an NP hard problem. In order to solve the service selection problem there are various techniques, frameworks and algorithms which are proposed and designed for assisting cloud service selection. In this paper, we explored basics of cloud computing and different types of service selection techniques which are effective in cloud technology. These techniques are classified into multi criteria decision making, trust based, optimization techniques and others. The comparisons among various proposed work of the author are discussed for bringing more clarity in the topic.

Index Terms*: *Cloud Computing, Service Selection, Algorithm.

I. INTRODUCTION

The increasing popularity of Information and Communication Technology (ICT) has made computing as one of the utility services like electricity, water, gas and telephone. Cloud Computing model provides facility to its user for providing access to the offered resources, application and services over the network**. C**loud environment also gives an opportunity to its users for accessing leased infrastructure, reliable hardware resources and software applications from anywhere in the world [1]. There are several cloud providers which offers different types of cloud services, but the requirement of the cloud user keeps on changing continuously. The increase in the number of cloud providers offering diversity of cloud services makes the challenge for the cloud consumer in deciding the services which can fulfill their requirement from the pool of available services. QoS in cloud computing ensures the consumer that the services taken by them are secure and reliable. These services are offered by the provider through the medium like data centers which themselves are based on various virtualized computation and storage technologies [2].

The cloud SOA delivers various IT related resources in form of web based services like Software as a Service (SaaS) Platform as a Service(PaaS) and infrastructure as a Service (IaaS) [3]**.** Cloud service model depends on the type of cloud deployment requested by the consumer interested in accessing the cloud services. Cloud technology relies on four deployment models Public Cloud, Private Cloud, Hybrid Cloud and Community Cloud [4]**.** There are many challenges seen in cloud computing environment firstly cost effective utilization of resources, second selection of cloud services as per user's requirement and maintaining security in data storage [26]. Everyday a wide range of services are added rapidly by the provider and are made available to the user through the internet. The challenge for service selection and ranking according to the user specific requirement has become a serious research issue for the decision maker [5]**.**There are two challenges which address the problem of service selection in cloud according to the user customized requirements. First, collection of all the possible services offered by the cloud provider is a difficult task. The second challenge is the selection of optimal services which are offered by different cloud providers offering different quality of service (QoS) attributes. The above challenges related to the selection of the best services and selection of optimal composition of services is defined as an NP hard problem [6]. To address cloud computing service composition several approaches were explored including multi-criteria decision making (MCDM) [7] and the multi-criteria optimization technique [8] for service selection in cloud environment. The research paper gives a literature review of various cloud service selection and optimization techniques which helps in easing down the decision related to service selection and composition. A table based taxonomy is designed which comprises of various technique and algorithm used in service selection in cloud environment. The discussion on the literature will help the researchers in identifying the areas where there are still open research challenges and this will motivate them to explore the untouched or less touched area in the field of service selection in cloud

The research paper is organized as follows: After the introduction, the paper covers all the existing cloud service selection techniques and ranking methods in section 2. Comparisons and extensive discussions on objective of investigated research , the service selection techniques is done in section 3. Quality of Service (QoS) parameters used in the review literature are identified and classified in section 4. Research challenges and future research directions are studied in section 5 and summarization of the research paper is done in section 6.

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Preeti Sirohi, Department of Computer Science, Institute of Management Studies, Ghaziabad, India

Amit Agarwal, Department of Computer Science, University of Petroleum and Energy Studies, Dehradun. India.

Piyush Maheshwari, Department of Computer Science, Amity University Dubai, Dubai.

II. EXISTING CLOUD SERVICE SELECTION TECHNIQUES

In this section all the existing cloud service selection approaches has been explored and various parameters on which the researchers have explored various methods like MCDM –based cloud service selection [9] Technique for Order of Preference by Similarity to Ideal Solution (TOPSIS) [10], Elimination and Choice Expressing Reality (ELECTRE) [11], Simple Additive Weighting Method (SAW) [12], Dynamic Programming [13], Greedy Algorithm [14], Particle Swarm Optimization [15], Genetic Algorithm [16]. Various techniques and algorithm used in these approaches are discussed on the basis of QoS parameters and their implementation in the cloud environment. Different approaches and techniques are used for ranking the cloud services and cloud provider which facilitates the decision maker in identifying the best services which can fit into the requirement of the user and business. A detailed literature survey is done in which the research papers from 2003 till date are covered so that the increase in the approaches can be discussed and the limitations which were existing in the previous year in their model or approaches can be discussed and overcome by the current approaches and technique.

Table 1: Summary of Selection Approaches of Cloud Services

Reference	Technique / Algorithm	Framework	QoS Parameters	Cloud	Approach
Godse and Mulik (2009) [14]	AHP	A case study Of SaaS product selection for SFA	Functionality ,Architecture, Integration, Usability,Vendor Reputation ,Cost	SaaS	MCDM
Karim et. al. (2013)[16]	AHP	Case Study Based Approach Proposed a set of rules to perform the mapping Process	QoS Attributes	SaaS, IaaS	MCDM
Goncalves et.al(2015) [15]	AHP	Results are deployed in Amazon	Non Functional QoS attributes	SaaS	MCDM
Charmissi et.al (2013)[17]	FuzzyELECTRE	Tuned construction of projects	Risk (Delays and Failures) are at lowest rank Damages, unsafe working , accidents of machinery	Other	MCDM
Silas et. al.(2012) [11]	ELECTRE	SSM_EC middleware	Subjective (turnaround time, Service Cost, Trust, Reliability)	IaaS	MCDM
Chou et.al. (2007) [18]	Fuzzy Simple Additive Weighting	Solving facility location selection problem	Subjective and Objective attributes	Other	MCDM
Goscinski and Brock (2010) [19]	Dynamic Programming	Resource Via Web Services Framework		SaaS PaaS IaaS	OT
Zheng et. al. (2013)[20]	Greedy Algorithm	QoS ranking prediction framework	Subjective parameters are	SaaS	OT
He et.al. (2012) [21]	Greedy algorithm	MSS Optimiser (Multi-tenant SaaS Optimiser)	Cost, response Time, Availability, Throughput	SaaS	OT
Wang et. al. (2013)[22]	PSO	Cloud –based web services (CWS) composition approach	QoS Parameter	SaaS	OT
Kang et.al. (2012) [23]	PSO	PSO-GODSS (global optimization of dynamic web service selection based on PSO) algorithm	QoS	SaaS	OT
Yeet. al (2011) [24]	Genetic algorithm	QoS model , genetic Algorithm	Time , price, Availability and Reputation	SaaS	OT
Pan et. al. (2015) [25]	Trust Approach	Trust Modelling Method	QoS Parameters	IaaS , PaaS, SaaS	Trust Approach

The objective of the research is to achieve a comprehensive view of various approaches of cloud service selection. Table 1 below gives a brief overview of various researches done by the using various technique and if the framework or any other technique or algorithm has been used for calculating the best result. The selection approaches discussed in the table below are studied on the basis of the technique or algorithm the authors have used , the QoS parameters studied plays an important role as there parameters are later used in further analysis of the importance of few parameters over others. The table1 also shows the type of cloud service model on which the study has been conducted and the type of approach which is used. The reference is also mentioned for the authors who want to explore the work further in this area.

III. QUALITY OF SERVICE PARAMETERS

QoS plays an important role in service selection, based on the literature review done in the paper QoS parameters are identified in all the applied approaches proposed by the authors and these QoS parameters are important in doing analysis about making decision for the service selection by the decision maker. In this section , we attempted to extract the importance of different QoS parameters in the field of research. Figure 5 shows various QoS parameters like trust, Throughput, Availability, Uptime, Risk, Efficiency, Reputation, Security and Scalability. In order to obtain the most important and effective QoS parameters, the frequency of occurrences of these parameters in the literature are calculated and plotted in the bar graph. The graph shows that some of the attributes are treated as more important in comparison to others and is taken by most of the researcher at the time of service selection in cloud like Cost, Response time, Availability. While the parameters including Capability, correctness etc. are not studied much in the literature.

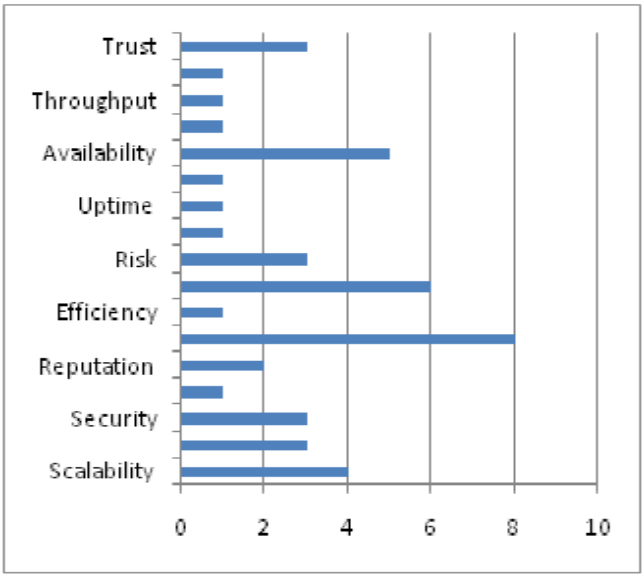

Fig 1: QoS parameters according to their relevance

Figure 1 shows the important QoS parameters and which are repeated in various studies and proposed work by the researchers. The quality parameters shows the number of repetition which are there in the literature. The graphical representation of figure1 is shown in the table below. The parameters which are more frequently opted by the user at the time of service selection is mentioned in the table below.

Table 2: QoS Parameters in reference their importance in selection of services

QoS Parameters	No of Repititions in QoS
Scalability	4
Reliability	3
Security	3
Usabaility	1
Reputation	2
Cost	8
Efficiency	1
Response Time	6
Risk	3
Latency	1
Uptime	1
Capability	1
Availability	5
Accuracy	1
Throughput	1
Correctness	1
Trust	3

IV. IDENTIFIED ISSUES IN CLOUD SERVICE SELECTION

This section discussed some of the open challenges in cloud service selection approaches which have not been studied enough in the literature.

* Lack of an efficient approaches and literature for dealing with the subjective parameters.
* Lack of consideration of the criteria falling into both Subjective and Objective Assessment.
* Lack of service evaluation factors considered in Multi-Tenancy service selection.
* Lack of standards and protocols to evaluate cloud performance.
* Lack of long term performance evaluation and dynamic service selection strategy.

Many techniques and approaches have been developed which facilitates the cloud brokers [27] in analyzing the user requirement and helps them in identifying the optimal services when there are multiple objective functions. An efficient cloud service ranking approach can be developed which will help in providing optimal solution which can meet the user requirement in case of multi-objective problem. Various evolutionary algorithms have been designed which helps in providing optimal solution in less time. These algorithms works on non-dominated sorting approach which aims in providing ranking to the services. The existing algorithms focus on reducing the number of comparisons required to identify the optimal service. The reduction in the number of comparisons will improve the overall computational complexity. The existing approach main focus is on lowering down the number of comparisons which will enhance the overall performance of the algorithm.

V. CONCLUSION AND FUTURE WORK

In the research paper, a comprehensive study and analysis of the existing literature is done. The challenges faced by the user while selecting the appropriate services according to their requirements is discussed in detail. Different techniques and algorithm proposed by various authors which are used for service selection are described in detail and how the QoS parameters helps in the decision making. The literature survey done in the research paper is through the proposed work and comparing various techniques and parameters used for service selection. The taxonomy of cloud service selection is divided into multi criteria decision making, trust based study, optimization techniques and other approaches. The identification of limitations and issues in the existing literature is discussed which laid a foundation for future research directions. In future author also plans to explore the muti objective optimization approaches for service selection as the user have various objectives at time of service selection and therefore traditional approaches will not be an effective method for cloud service selection.

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