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A Survey on Predicting Uncertainty of Cloud Service Provider Towards Data Integrity and Economic

Mahesh K[1], Dr. Yogesh Kumar Sharma[2], Dr. M Laxmaiah[3]
[1]PhD Scholar, CSE Department, JJT University, Rajasthan, India
[2]Associate Professor, JJT University, Rajasthan, India
[3]Professor & Head of IIIC, CSE Department, CMR Engineering College, Telangana, India

ABSTRACT

Cloud computing is an advanced service provider technology. It offers various services to the end users as IaaS, PaaS and SaaS. Even it performs well uncertainty becomes an open issue for service providers which does not meet the data integrity and economic factors due lack of predicting uncertainty. In this paper we conducted in depth survey on uncertainty predicting methods and adapted novel strategies to fix uncertainty problems. The existed works failed to explain various technical stuff. We touch different sources of uncertainty like dynamic elasticity, dynamic performance changing, virtualization, loosely coupling application to the infrastructure, among many others not explained predictable sources of uncertainty. In most existing solutions, it is assumed that VMs are predictable and stable in their performance. In actual cloud infrastructures these assumptions do not hold. Providers might not know the quantity of data and computation required by users. We provide a view of uncertainty and its classification in different scenarios from high performance computing, grid computing and cloud Infrastructures to exscale with its opportunities and challenges of its mitigating.

Keywords : Uncertainty, Cloud Computing, Resource Provisioning, Classification, Scheduling, Data Integrity.

I. INTRODUCTION

Decision makers always suffer from the prediction of upcoming software and products. The prediction is difficult due to the wide range of factors involved and the complexity of their interrelationship they could not able to explain the various developments and growth trends in various engineering technologies and affected various factors such as technical, economical, political, social and behavioural in nature. The relationship between technology change, society, political issues and economical issues is highly complex for analysis and study.

When cloud computing is becoming popular by building high end quality cloud applications. Cloud computing is Internet-based computing, whereby shared configurable resources (e.g., infrastructure, platform, and software) are provided to computers and other devices as services. Majority of literature on cloud computing is focusing on technical issues and / or drivers and constraints in cloud computing adoption. This paper attempts to identify the cloud computing trend using external events.

Motivation and Contribution Institutions are shifting their data onto the cloud. Cloud services are provided by CSPs. Users need to contact CSPs to get their job done. Thousands of providers are available in the market. They all claim that they are providing best cloud services to users. To select the appropriate CSP for the user is a skilful job. This selection procedure is

assisted by CSB. CSB is responsible for coordinating with CSPs and to provide
SLA based service provisioning to the CC. Present research paper has following contributions:

- Identify and define Quality standards pertaining to cloud services.
- Study Major CSB frameworks for selection of CSP from existing literature.
- Propose Quality Based Cloud Service Broker framework QCSB for selection of optimal CSP and ranking of candidate CSPs.
- Implement proposed framework and analyse results.

II. LITERATURE SURVEY

Hyun-Seung Oh reported that "technological forecasting methods are tools which are used for planning and decision making in order to obtain insight on the future of a technology, group of technologies or undiscovered technologies, and their direction of change and advance over the longer time" [4].

Generally, technology forecasting methods are classified into two main approaches, quantitative methods and qualitative methods. Nave methods, averaging methods, exponential smoothing methods, regression analysis, time series analysis and the Box-Jenkins methodology are quantitative methods. Quantitative methods can be sub divided into Time-series methods and causal methods.

Cloud Service Brokers for Cloud Service Provider Selection

In this section, we shall carry out a literature survey on cloud service brokers. Primary objective of these CSBs is CSP selection.

1. SMICloud [8], this broker model was developed by Cloud Service Measurement Index Consortium.
2. A Cloud Broker Architecture for Multicloud Environments [9], Cloud broker architecture introduced for handling operations in multicloud environment.
3. Towards Cooperative Cloud Service Brokerage for SLAdriven Selection of Cloud Services [10].
4. CloudCmp [11], this framework compared various cloud service providers. To take up a case study Amazon AWS, Google AppEngine, Google AppEngine and RackSpaceCloud servers providers were compared.
5. Towards Multi-Criteria Cloud Service Selection [12], Paper discussed methodology of Cloud service selection procedure in a generalized and abstract way.
6. A Cloud Service Broker for SLA-based SaaS Provisioning [13], Author introduced a Broker based framework for SaaS provisioning.
7. An efficient QoS framework for Cloud Brokerages Services [14], QoS framework was introduced for brokerage services. Multi criteria optimization technique was employed to study non dominant sets.
8. SLA based Service Brokering in Intercloud Environments [15], Generic architecture of cloud service broker was proposed to manage intercloud environment.
9. An End to End QoS Mapping Approach for Cloud Service Selection [16], in this framework first users' QoS requirements were assigned to right QoS specifications of SaaS and then these specifications further mapped to optimal IaaS service.
10. QoS Ranking Prediction for Cloud Services, CloudRank [18], this model considered past experience of users to measure QoS ranking prediction of cloud services. CloudRank1 and

CloudRank2 were two QoS ranking predictions proposed by it.

11. Fuzzy Cloud Service Selection Framework [17], research proposed a novel fuzzy framework for cloud service selection. Fuzzy concepts were used during the process. Different quality metrics were considered.
12. Cloud Brokerage Architecture for Efficient Cloud Service Selection [19] Research presented cloud broker architecture for selecting a optimal cloud service. A novel data structure Bcloud-tree was used to maintain CSPs information.
13. CompatibleOne: The Open Source Cloud Broker [20], The open source cloud broker CompatibleOne was based on open standards CDMI and OCCI. It used a object oriented description model CORDS.
14. Design of Cloud Service Brokerage System Intermediating Integrated Services in Multiple Cloud Environment [21], Research introduced Anybroker, a cloud service brokerage system. It addressed mainly IaaS services. Broker supported integrated service provisioning and SLA based service lifecycle management.
15. PuLSaR: Preference-based cloud service selection for cloud service brokers [22], User preference based cloud service broker PuLSaR (Preference-based cLoud Service Recommender) was introduced for cloud service selection. Broker used MCDM technique for optimizing its services.
16. Cloudle: A Multi-criteria Cloud Service Search Engine [23] Authors proposed a multi criteria cloud service search engine Cloudle. It assisted cloud consumer to select optimalcloud services according to their requirements.
17. QBROKAGE: A Genetic Approach for QoS Cloud Brokering [24] Number of Cloud service providers are increasing day by day. Now, to select optimal Cloud service provider is a tactful job. Paper discussed this issue, to get rid of this situation, paper introduced the concept of cloud broker. Broker helped cloud consumer in discovering, considering and comparing services of different Cloud service providers.
18. Towards a unified customer aware figure of merit for CSP selection [25] Paper proposed a framework that assisted users to select appropriate Cloud service providers according to their need.
19. Cloud Broker for Reputation-Enhanced and QoS based IaaS Service Selection [26] Role of cloud broker was highlighted in the paper. It helps to select appropriate Cloud service providers for cloud user based on quality parameters. Reputation of provider was also considered during the selection procedure of CSPs.
20. Credible Service Selection in Cloud Environments [27] Research discussed challenge of selecting suitable cloud service for user according to customized requirements. It also focused on effectiveness and accuracy of cloud service selection. It identified unreasonable and eliciting credible assessments.
21. GABE: A Cloud Brokerage System for Service Selection, Accountability and Enforcement [28] Research proposed a novel framework GABE – Cloud Brokerage system for Service selection, Accountability and Enforcement. It addressed the significant barrier of cloud service selection and data security related services.
22. Cloud Broker Based Trust Assessment of Cloud service providers [29] Present research focused on mechanism to evaluate trustworthiness of the providers. Trust framework was proposed which considered

real-time cloud transactions to model the trustworthiness of providers.

23. Trustworthy Cloud service provider Selection using Multi Criteria Decision Making Methods [30] Research discussed the trust issue while selecting any cloud service from open and anonymous environments; this built the confidence and provided a reliable service to Cloud user. Here trust based model assisted the user to select optimal services according to requirements.
24. MMBcloud-tree: Authenticated Index for Verifiable Cloud Service Selection [31] CSBs have been offered additional layer of computation to assist cloud service choice and administration for CC.
25. Multi-Criteria IaaS Service Selection based on QoS History [32] Growth in number of Cloud services make selection difficult for users. One has to form formal decision making strategies to assist decision maker in selecting optimal Cloud service that satisfies the client's necessities.
26. CloudEval: A Cloud Service Selection Model based on User-Specified Quality of Service Level [33] Research proposed a framework which chose cloud services on the basis of nonfunctional parameters and user mentioned QoS objectives.
27. A Hybrid Multi-Criteria Decision-Making Model for a Cloud Service Selection Problem Using BSC, Fuzzy Delphi Method and Fuzzy AHP [35] Research proposed a hybrid MCDM model for IaaS cloud service selection problem using balanced scorecard (BSC), fuzzy Delphi method (FDM) and fuzzy analytical hierarchy process (FAHP).
28. Cloud Services Selection Based on Rough Set Theory [36] Research presented an application of Rough set theory in Cloud services selection.

III. RESEARCH METHODOLOGY

Scientific approach has been followed for literature survey of existing CSBs. Here we employ descriptive review method. We collect significant materials of research domain mainly from online sources. Renowned online databases like IEEE Xplore, Springer, ScienceDirect (Elsevier) have been searched. We use different keywords for searching like Cloud Broker, Cloud Service Broker, Quality issues of Cloud Service Brokers, Cloud Service Broker for Cloud Service Provider selections etc.

Quality Metrics

Following quality metrics are relevant to service selection. These are the part of service level agreement document. This document is settled before the start of any service. CC registers his/her service level requirements with broker which form the part of SLA; CSPs also entitled their service offering to broker which also constitute to SLA document.

Availability [5][6]: It is uptime of cloud service during a specified time interval.

$$\alpha = t/ts$$

where $0 \leq \alpha \leq 1$, t and ts represent uptime and total time of service. As value of α approaches to 1, availability increases.

Reliability [6]: It calculates assertion level (free from any software or hardware fault) of cloud service.

$$\rho = 1 - \frac{n}{n_s}\ ;\ 0 \leq \rho \leq 1$$

where n and ns represent number of failed and total operations in particular time interval. As value of ρ approaches to 1, reliability increases.

Security [7]: It calculates data security in cloud. To measure it main factors are:

Confidentiality: It measures data kept in the cloud is secure from any unauthorized access, and secrecy of data is maintained.

$$\text{Confidentiality} = \frac{\text{Total No. of access to service} - \text{No. of unauthorized access to service}}{\text{Total No of access to service}}$$

Data Integrity: It measures that data kept in the cloud could only be modified by authorized user only. Data integrity maintains accuracy and consistency of data.

$$\mathit{Data\ Integrity} = \frac{\text{Percentage of accuracy after modification}}{\text{Percentage of accuracy before modification}}$$

Cost [7]: It includes any type of expenditure incurred during cloud services. Mainly two types of cost involved:

- On demand cost: It includes the cost of hiring VMs, data cost and storage cost.
- Reservation cost: It includes onetime fee and usage fee
- Service Response time [7]: It is waiting time for a user to get a response of his/her request.

Response time = $\sum i\ Ti\ /$, Ti is the time elapsed between sending a request and getting a response.

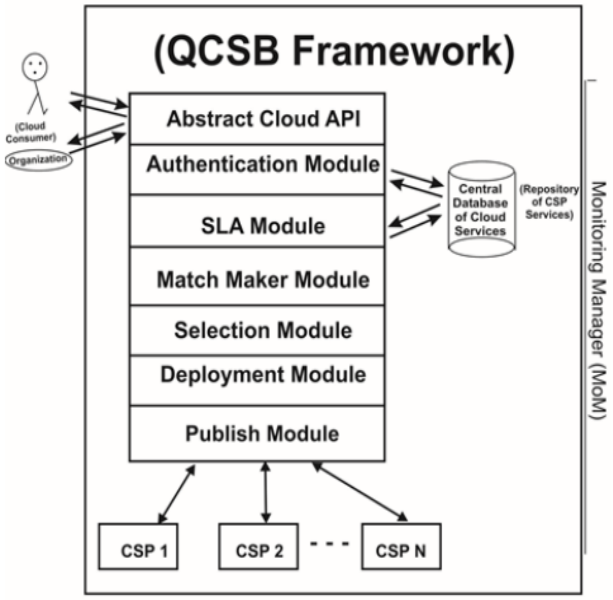
Throughput [8]: It calculates number of tasks accomplished by cloud services per unit of time.

$$\text{Throughput} = \frac{\text{n}}{\text{Te(n, m)} + \text{To}}$$

Where Te(m,n) is the execution time of running n tasks on m machines. To is the time overhead delay.

IV. QCSB : DEVELOPMENT OF QUALITY BROKER FRAMEWORK

CC/Organisations will submit his/her Quality of Service (QoS) requirements for CSP selection to the QCSB through Broker's GUI. This GUI will form Abstract Cloud API. When CSP selection process will be over, derived results will be returned through this API. All the requests made to QCSB will be stored in Request Buffer (RB). Once a certain request will be fulfilled, next request will be taken from this buffer.



QCSB will have certain core modules:

1. Authentication Module: It will validate the CC credentials.
2. SLA Module: This module will decide and negotiate quality constraints mentioned in the service level agreement between CC and CSP.
3. Match Maker Module: It will search for CSP which will fulfill user quality requirements. It will also contact a Ranking Module (RM). RM will assist in ranking CSPs according to ranking algorithm.
4. Selection and Deployment Modules: These modules will select and employ required CSP for CC.
5. Publish Module: It will maintain list of cloud services of CSPs. CSP will contact this module if there will be any change in its services.

QCSB Algorithm:

Input: Maximum value of Reliability Relmax, Minimum value of Cost Costmin, Maximum value of Availability Avlmax. These values of quality criteria are the threshold values provided by CC

1. For all Cloud Service Providers ‘P’ Do
2. If (CSP_Rel(P) >= Relmax && CSP_Cost(P) <= Costmin && CSP_Avl(P) >= Avlmax)
3. Select P for Candidate list of CSPs ‘L’.
4. Else
5. Discard P.
6. Endif
7. Endfor
8. If Sizeof (L) > 0 then
9. Let L = {P1, P2, P3,…, Pk} be candidates CSPs.
10. Apply AHP(P1, P2, P3,…, Pk) technique on Candidate CSPs. // AHP (Analytical Hierarchical //Process) technique is for match making
11. Perform pairwise comparison between CSPs based on quality criteria (Reliability, Cost and Availability).
12. Perform comparison between quality criteria based on objective (here objective is to locate optimal CSP).
13. Finally calculate priorities of CSPs w.r.t. objective.
14. Let Lpri = {Pri1, Pri2, Pri3,…,Prik} be a list of priorities of CSPs.
15. Sort Lpri in descending order.
16. Select CSP Pi corresponding to the first priority item of list Lpri.
17. Let Lranking be a list of CSPs derived from Lpri.
18. Return Pi and Lranking .
19. Else
20. Return Null
21. Endif

Stability: Standards / Associations / Organizations No clear standards or lack of standards [25][26] is one of the constraints in cloud computing adoption. From the study of 12 standard organizations / associations, it has been observed that the major issues covered by the standards are security, SLA, cloud computing architecture/model. Also, the standard organizations/associations and their proposed standards are increasing from the introduction of cloud computing.

Issue	Association or Organization
Authentication and Authorization	NIST
Confidentiality	NIST
Integrity	NIST
Identity management	NIST, OASIS
Security	NIST, ISO, CSA, DMTF, OCC, ETSI, OMG-CSCC, SNIA, OASIS.
Availability	NIST
Risk assessment	ISO
Control objectives	ISO
Interoperability	ETSI
Portability (Data/ Software)	DMTF, ETSI
Reversibility	ETSI
Mitigation of risks and vulnerabilities	TM Forum
Service level agreement	NIST, ISO, DMTF, ETSI, OMG-CSCC, SNIA, TM Forum
Cloud computing architecture / model	NIST, ISO, DMTF, OCC, OGF, OMG-CSCC, CCIF, OASIS, TM Forum.
Cloud storage architecture/model	SNIA

The study [15] examines the technological, organizational and environmental factors affecting cloud service adoption. Key identified factors impacting cloud computing service adoption are as follows

Technological	Organizational	Environmental
i) Relative advantage ii) Compatibility iii) Complexity iv) Trialability	i) Increased collaboration ii) Increased traceability and auditability iii) Convincing IT managers	i) Security and legal issues ii) Perception of the term "cloud"

The cloud computing is widely acknowledged by practitioners and researchers as a valid solution for data storage and processing in both business and scientific computing. While having many advantages cloud computing still has many drawbacks, especially in the areas of security, reliability, performance of both computing and communication, to list just a few. They are strengthened by the uncertainty, which accompanies all of these shortcomings. The vast majority of the research efforts in scheduling assume complete information about the scheduling problem and a static deterministic execution environment. However, in the cloud computing, services and resources are subject to considerable uncertainty during provisioning. We argue that the uncertainty is the main hassle of cloud computing bringing additional challenges to end-users, resource providers, and brokering. They require waiving habitual computing paradigms, adapting current computing models to this evolution, and designing novel resource management strategies to handle uncertainty in an effective way.

There is a research on cloud computing examining the uncertainty phenomena in users' perceptions of the qualities, intentions and actions of cloud providers, privacy, security, availability, etc. among other aspects of cloud computing (Trenz et al., 2013).

But still, the role of uncertainty in the resource and service provisioning, provider investment and operational cost, programming models, etc. have not yet been adequately addressed in the scientific literature.

Quality Values of CSPs

CSP	Reliability	Cost	Availability (%)
Amazon	0.5	2.5	99.99
Microsoft Azure	0.7	2.7	99.95
Rackspace	0.4	2.1	99.90

There is a variety of types and sources of uncertainty. The following Table describes some of them and briefly explain their impact on service provisioning: dynamic elasticity, dynamic performance changing, virtualization with loosely coupling applications to the infrastructure, resource provisioning time variation, inaccuracy of application runtimes estimation, variation of processing times and data transmission, workload uncertainty, processing time constraints (deadline, due date), effective bandwidth variation, and other phenomena.

	Sources of uncertainty															
Parameters	Data (variety, value)	Virtualization	Jobs arrival	Migration	Energy consumption	Fault tolerance	Scalability	Cost (dynamic pricing)	Resource availability	Elasticity	Consolidation	Communication	Replication	Cloud infrastructure	Elastic provisioning	Provisioning time
Effective performance		•	•	•	•			•	•	•	•	•	•	•	•	•
Effective bandwidth	•		•	•	•		•	•	•	•		•	•	•	•	•
Processing time		•	•	•	•			•	•	•	•	•	•	•	•	•
Available memory	•		•	•	•	•	•	•	•	•	•			•	•	•
Number of processors		•	•		•		•	•	•	•	•			•	•	•
Available storage	•			•	•	•	•	•	•	•				•	•	•
Data transfer time	•			•	•			•						•	•	•
Resource capacity		•	•			•	•	•		•				•	•	•
Network capacity	•			•		•	•	•						•	•	•

V. UNCERTAINTY

In spite of extensive research of uncertainty issues in different fields in the past decades ranging from physics, computational biology to decision making in economics and social sciences, a study of uncertainty for cloud computing systems is still not available. There are numerous types of uncertainties associated with cloud computing, and one ought to account for aspects of uncertainty in assessing the efficient service provisioning. Mitigating impact of uncertainty on the performance, reliability, safety, and robustness of cloud systems is rapidly growing research topic. Uncertainty analysis should become an essential part of design of resource and service provisioning strategies. This paper presents our understanding of how to model cloud computing with uncertainty addressing resource provisioning in hybrid private-public cloud environment, dynamic self-adaptive distributed brokering, elastic clouds, and optimization of related problems to deliver robust resource management solutions, where the main

objective is not to find an absolute optimum but rather solutions that behave good and insensitive to different

uncertainties. High performance objectives could leads to too risky execution policies. Uncertainty can be viewed as the difference between the available knowledge and the complete knowledge. It can be classified in several different ways according to their nature (Tychinsky, 2006).

(1) The long-term uncertainty is due to the object is poorly understood and inadvertent factors can influence its behaviour.
(2) Retrospective uncertainty is due to the lack of information about the behaviour of the object in the past.
(3) Technical uncertainty is a consequence of the impossibility of predicting the exact results of decisions.
(4) Stochastic uncertainty is a result of probabilistic (stochastic) nature of the studied processes and phenomena, where the following cases can be distinguished: there is are liable statistical information; the situation is known to be stochastic, but the necessary statistical information to assess its probability characteristics is not available; a hypothesis on the stochastic nature requires verification.
(5) Constraint uncertainty is due to partial or complete. Ignorance of the conditions under which the solutions have to be taken.
(6) Participant uncertainty occurs in a situation of conflict of main stakeholders: cloud providers, users and administrators, where each side has own preferences, incomplete, inaccurate information about the motives and behaviour of opposing sides.
(7) Goal uncertainty is associated with conflicts and inability to select one goal in the Sources of uncertainty Data.
(8) Towards Understanding Uncertainty in Cloud Computing Resource Provisioning Andrei Tchernykh, Uwe Schwiegelsohn, Vassil Alexandrov and El-Ghazali Talbi decision or building multi objective optimization model. It addresses the problem of competing interests and multi-criteria choice of optimal decisions under uncertainty; Condition uncertainty occurs when a failure or a complete lack of information about the conditions under which decisions are made.
(9) Objective uncertainty occurs when there is no ambiguity when choosing solutions, there is more than one objective function to be optimized simultaneously, and there exists a possibly infinite number of Pareto optimal solutions.

Cloud computing parameters and main sources of their uncertainty																
Parameter/ Parameter	Energy consumption	Fault tolerance	Scalability	Cost (dynamic pricing)	Resource availability	Elasticity	Consolidation	Communication	Replication	Cloud infrastructure	Elastic provisioning	Provisioning time	Data (variety, value).	Virtualization	Migration	Jobs arrival
Effective performance	X				X		X		X		X	X	X		X	
Processing time		X	X			X										
Effective bandwidth	X			X					X		X		X	X	X	X
Processing time			X			X	X			X		X				
Available memory	X	X			X			X		X			X			X
Number of processors					X				X		X					
Available storage			X				X						X	X		X
Data transfer time	X			X			X			X		X				
Resource capacity				X			X			X			X			
Network capacity	X	X		X			X		X		X			X		X

These uncertainties can be grouped into: parameter (parametric) and system uncertainties. Parameter uncertainties arise from the incomplete knowledge and variation of the parameters, for example, when data are inaccurate or not fully representative of the phenomenon of interest. They are generally estimated using statistical techniques and expressed probabilistically. Their analysis quantifies the effect of input random variables on model outputs. It is an integral part of reliability based and robust design. The efficiency and accuracy of probabilistic uncertainty analysis is a trade off issue.

This type of uncertainty is not reducible since it is a property of the system itself. System uncertainties arise from an incomplete understanding of the processes that control service provisioning, for example, when the conceptual model of the system used for service provisioning does not include all the relevant processes or relationships. It is reducible if more information is obtained. It can be modelled by probability theory, evidence theory, possibility theory, and fuzzy set. Robust system synthesis minimizes the impact of uncertainties on the system performance. It has traditionally been performed by either a probabilistic approach or a worst case approach. Both approaches treat uncertainty as either random variables or interval variables. In reality, uncertainty can be a mixture of both. Monte Carlo simulation can be used to perform robustness assessment under an optimization framework. The probabilistic approach is considered as the most rigorous approach to uncertainty analysis and its mitigating due to its consistency with the theory of decision analysis.

VI. RELATED WORK

Programming Uncertainty

Uncertainty understanding has to lead to discoveries in how to design cloud applications in efficient way. Most of cloud applications require availability of communication resources for information exchange between tasks, with databases or end users. To deal with this dynamics, either programmer must explicitly write adaptive programs or cloud software must deal with the uncertainty. The user adaptive solutions are based on enormous programming effort. For an effective utilization of the Cloud, the programs must be decoupled from the execution environment. Programs should be developed for uniform and predictable virtual services, thus, simplifying their development.

Cloud application model has to allow high level representation of computing and communication based on the nature of the problem, and independent of the executing environment. Mapping computation on machines, balancing the loads among different machines, removing unavailable machines from a computation, mapping communication tasks and balancing the communication loads among different links have transparently be provided by the runtime system.

The proposed communication aware model creates space for optimization of many existing solutions to resource allocation as well as developing completely new scheduling schemes of improved efficiency.

Resource Provisioning

A key dimension of scheduling policies concerns with how to map a set of tasks to a set of resources. Typically, there are two ways: static scheduling and dynamic scheduling. In the static approach, detailed information about job and processor characteristics and network's topology characteristics are known in advance making possible to achieve a near optimal schedule for some problems. The static approach makes a schedule only when a task is ready (Rodriguez et al., 2003). Unfortunately, the performance of cloud resources is hard to predict, because these resources are not dedicated to one particular user, and, besides, there is no knowledge of network's topology.

Furthermore, in general, due to the virtualization technique, it is impossible to get exact knowledge about the system. Effective characteristics are changing over the time. Therefore, providers are always searching how to improve the management of resources to ensure Quality of Service (QoS). The shifting emphasis towards a service-oriented paradigm led to the adoption of SLAs as a very important concept. The use of SLAs is a fundamentally new approach for job scheduling. With this approach, schedulers are based on satisfying QoS constraints regardless uncertainty. The main idea is to provide different levels of service (SL), each addressing different set of customers to guarantee job delivery time depending on the SL.

Load Balancing

One of the possible techniques to solve problems of the computing and communication imbalance associated with uncertainty is the load balancing that allows improving resource allocation. For efficient load balancing, it is important to define: the notions of the system under load /overload; who and when initializes load balancing; number of jobs to be migrated; time slot used for migration; number of VMs chosen for migration, etc. It helps to achieve a high resources utilization and quality of service by efficient and fair allocations of computing resources.

Adaptive Scheduling

The scheduling of jobs on multiprocessors is generally well understood and has been studied for decades. Many research results exist for different variations of this single system scheduling problem. Some of them provide theoretical insights while others give hints for the implementation of real systems. However, the adaptive scheduling problem has rarely been addressed so far. Unfortunately, it may result in inefficient resource allocation and bad power utilization. One of the structural reasons for the inefficiency in on-line job allocation is the occupation of large machines by jobs with small processor requirements causing highly parallel jobs to wait for their execution.

Knowledge-free Approach

The authors consider a scheduling with task replications to overcome possible bad resource allocation in presence of uncertainty, and ensure good performance. They analyze energy consumption of job allocation strategies exploring the replication thresholds, and dynamic component deactivation. The main idea of the approach is to set replication thresholds, and dynamically adapt them to cope with different objective preferences, workloads, and Grid properties. The authors compare three groups of strategies: knowledge-free, speed-aware, and power-aware. First, they perform a joint analysis of two metrics considering their degradation in performance.

Scheduling with Uncertainty

In recent years, probability theory and statistical techniques are incorporated into the scheduling to treat uncertainties from different sources. A comprehensive survey in this area, main results and tendencies can be found in the book (Sotskov and Werner, 2014). The approaches that use stochastic and fuzzy methods and important issues of robustness and stability of scheduling are discussed.

Uncertainty about the future is considered in two major frameworks: stochastic scheduling and online scheduling. Stochastic scheduling addresses problems in which the properties of tasks, e.g. processing times, due dates, and their arriving time are modelled as random variables, which exact values are not known until they arrived and are complete, respectively. Online scheduling is characterized by no knowledge of future jobs arriving. Decisions can be made each time when job is arrived. Only jobs that arrive before are known. (Megow, 2005, Megow et al., 2006, and Vredeveld, 2012) consider a model for scheduling under uncertainty that combines online and stochastic scheduling. Jobs arrive over the time and there is no knowledge about future jobs.

VII. CONCLUSION

Predicting uncertainty of cloud service provider towards data integrity and economic is becoming a great issue now a days for the cloud providers. The uncertainty affects computing environments and scheduling problems. To address this problem a novel resource management techniques are required. To have services of cloud users can contact the cloud service provider. There will be huge number of CSP available in the market but the issue is to have perfect provider who can satisfy the user requirements and can predict uncertainty.

We also conducted an intensive literature survey which gives us an abandon base to perform our task easily for selecting proper models, methods and implementation tools. Any our survey has given a confident that our methods are better than the existed. The cloud service can be done by cloud service broker and is a present research issue. Quality metrics and detailed survey on present cloud service broker frameworks were given. These quality metrics helped in enforcing standards on cloud service providers. We also tried to have a Quality based Cloud Service Broker framework QCSB. This algorithm may give proper solutions to the proposed problems. Finally we conclude that proposed framework QCSB not only assist cloud computing to locate optimal Cloud Service Provider for cloud services but also rank candidate CSPs according to user quality preferences.

VIII. REFERENCES

[1]. D Kandpal. "Role of Service Brokers in Cloud Computing", Z. Mahmood (ed.), Cloud Computing:Methods and Practical Approaches, Computer Communications and Networks, Springer-Verlag London, DOI 10.1007/978-1-4471-5107-4_5, pp. 87-105. 2013.

[2]. F Liu, J. Tong, J. Mao, R. Bohn, J. Messina, L. Badger and D. Leaf, "NIST SP 500-292: NIST Cloud Computing reference architecture", Recommendations of the National Institute of Standards and Technology, pp. 1-35, 2011.

[3]. S Ried, "Cloud Broker - A New Business Model Paradigm", Deriving More Business And Economic Models From Cloud Computing, pp. 1-19, 2011.

[4]. S Mukherjee and S. Loganathan, "Role of Broker in InterCloud Environment", Z. Mahmood (ed.), Continued Rise of the Cloud, Computer Communications 119 and Networks, Springer-Verlag London , DOI 10.1007/978-1-4471-6452-4_5, pp. 119 - 144, 2014.

[5]. J Y. Lee, J. W. Lee, D. W. Cheun and S. D. Kim, "A Quality Model for Evaluating Software-as-a-Service in Cloud Computing", Seventh ACIS International Conference on Software Engineering Research, Management and Applications, pp. 261-266, 2009.

[6]. X Zheng, P. Martin, K. Brohman and L. D. Xu, "CloudQual: A quality model for cloud services", IEEE Transactions on Industrial Informatics, vol. 10, no. 2, p. 1527-1536, 2014.

[7]. Saravanan and Kantham, "An enhanced QoS Architecture based Framework for Ranking of Cloud Services", International Journal of Engineering Trends and Technology (IJETT) - Volume 4, Issue 4, pp. 1022 - 1031, 2013.

[8]. S K. Garg, S. Versteeg and R. Buyya, "SMICloud: A framework for comparing and ranking of cloud services", Fourth IEEE international conference on utility and cloud computing, pp. 210- 218, 2011.

[9]. J L. L. Simarro, I. S. Aniceto, R. M. Vozmediano, R. S. Montero and I. M. Llorente, "A Cloud Broker Architecture for Multicloud

Environments", John Wiley & Sons. Inc. Published, pp. 359-376, 2014.

[10]. E. Badidi, "Towards Cooperative Cloud Service Brokerage for SLA-driven Selection of Cloud Services", Springer International Publishing Switzerland, R. Silhavy et al. (eds.), Software Engineering in Intelligent Systems, Advances in Intelligent Systems and Computing 349, DOI: 10.1007/978-3-319-18473-9_27, pp. 271-281, 2015.

[11]. A. Li, X. Yang, S. Kandula and M. Zhang, "CloudCmp: Comparing Cloud service providers", ACM, Copyrights, 2010.

[12]. Z. U. Rehman, F. K. Hussain and O. K. Hussain, "Towards Multi-Criteria Cloud Service Selection", 2011 Fifth International Conference on Innovative Mobile and Internet Services in Ubiquitous Computing, DOI 10.1109/IMIS.2011.99, pp. 44-48, 2011.

[13]. E. Badidi, "A Cloud Service Broker for SLA-based SaaS Provisioning", IEEE, pp. 61-66, 2013.

[14]. M. Usha, J. Akilandeswari and A. S. S. Fiaz, "An Efficient QoS framework for Cloud Brokerage Services", International Symposium on Cloud and Services Computing, pp. 76-79, 2012.

[15]. F Jrad, J. Tao and A. Streit, "SLA Based Service Brokering in Intercloud Environments", CLOSER 2012 - 2nd International Conference on Cloud Computing and Services Science, pp. 76-81, 2012.

[16]. R. Karim, C. Ding and A. Miri, "An End-To-End QoS Mapping Approach for Cloud Service Selection", IEEE Ninth World Congress on Services, pp. 341-348, 2013.

[17]. M. Tajvidi, R. Ranjan, J. Kolodziej and L. Wang, "Fuzzy cloud service selection framework", IEEE 3rd International conference on Cloud networking (cloudnet), 978-1-4799-2730-2, pp. 463-468, 2014.

[18]. Z. Zheng, X. Wu, Y. Zhang, M. R. Lyu and J. Wang, "QoS Ranking Prediction for Cloud Services, IEEE Transactions on Parallel & Distributed Systems, Digital Object Identifier 10.1109/TPDS.2012.285, pp. 1-11, 2012.

[19]. V. N. Dondapati, "A cloud brokerage architecture for efficient cloud service selection", Masters Theses. Paper 7256, Spring, pp 1-46, 2014.

[20]. S. Yangui, I. J. Marshall, J. P. Laisne and S. Tata, "CompatibleOne: The Open Source Cloud Broker", J Grid Computing, DOI 10.1007/s10723-013-9285-0, Springer, 2013.

[21]. D. Kang, S. Son and J. Kim, "Design of Cloud Service Brokerage System Intermediating Integrated Services in Multiple Cloud Environment", International Journal of Computer, Electrical, Automation, Control and Information Engineering Vol:8, No:12, pp.2129-2134,2014.

[22]. I. Patiniotakis, Y. Verginadis and G. Mentzas, "PuLSaR: preference-based cloud service selection for cloud service brokers", Journal of Internet Services and Applications, a Springer Open Journal, DOI 10.1186/s13174-015-0042-4, pp 1-14, 2015.

[23]. J. Kang and K. M. Sim, "Cloudle: A Multi-criteria Cloud Service Search Engine", IEEE Asia-Pacific Services Computing Conference, 978-0-7695-4305- 5/10, DOI 10.1109/APSCC.2010.44 ,pp. 339-346, 2010.

[24]. G. F. Anastasi, E. Carlini, M. Coppola and P. Dazzi, "QBROKAGE: A Genetic Approach for QoS Cloud Brokering", IEEE International Conference on Cloud Computing, 978-1-4799-5063-8/14, DOI: 10.1109/ CLOUD.2014.49, pp. 304-311, 2014.

[25]. B E. Zant and M. Gagnaire, "Towards a unified customer aware figure of merit for CSP selection", El Zant and Gagnaire Journal of Cloud Computing: Advances, Systems and Applications, a SpringerOpen Journal, DOI 10.1186/s13677-015-0049-1, pp 1-23,2015.

[26]. R Annette, A. Banu and Sriram, "Cloud Broker for Reputation-Enhanced and QoS based IaaS Service Selection", Proc. of Int. Conf. on Advances in Communication, Network, and Computing, CNC, Elsevier, pp 815-824, 2014.

[27]. L. Qu, "Credible Service Selection in Cloud Environments", Ph. D. Thesis Macquarie University, pp 1-207, 2016.

[28]. S. Sundareswaran, "GABE: A Cloud Brokerage System for Service Selection, Accountability and Enforcement", Ph.D. Thesis The Pennsylvania State University, pp 1-135, 2014.

[29]. P. S. Pawar, "Cloud Broker Based Trust Assessment of Cloud Service Providers", Ph.D. Thesis, City University London, pp. 1-219, 2015.

[30]. M. Supriya, K. Sangeeta and G. K. Patra, "Trustworthy Cloud Service Provider Selection using Multi Criteria Decision Making Methods", Engineering Letters, 24:1, EL_24_1_01, pp. 1-10, 2016.

[31]. J. Li, A. Squicciarini, D. Lin, S. Sundareswaran and C. Jia, "MMBcloud-tree: Authenticated Index for Verifiable Cloud Service Selection", IEEE Transactions on Dependable and Secure Computing, DOI 10.1109/TDSC.2015.2445752, pp 1-14, 2015.

[32]. Z. U. Rehman, O. K. Hussain and F. K. Hussain, "Multi-Criteria IaaS Service Selection based on QoS History", IEEE 27th International Conference on Advanced Information Networking and Applications, DOI 10.1109/AINA.2013.158, pp 1129-1135, 2013.

[33]. C. L. Hsu, "A cloud service selection model based on user-specified quality of service level", CS & ITCSCP, DOI: 10.5121/csit.2014.4706, p.p. 43-54, 2014. [34] S. Sundareswaran, A. Squicciarini and D. Lin, "A Brokerage-Based Approach for Cloud Service Selection", IEEE Fifth International Conference on Cloud Computing, 978-0-7695-4755-8/12, DOI 10.1109/CLOUD.2012.119, pp 558-565, 2012.

[34]. S. Lee and K. K. Seo, "A Hybrid Multi-Criteria Decision-Making Model for a Cloud Service Selection Problem Using BSC, Fuzzy Delphi Method and Fuzzy AHP", Springer Science+Business Media New York, DOI 10.1007/s11277-015-2976-z, pp. 1-19, 2015.

[35]. Y. Liu, M. Esseghir and L. M. Boulahia, "Evaluation of Parameters Importance in Cloud Service Selection Using Rough Sets", Scientific Research Publishing, DOI: http://dx.doi.org/10.4236/am.2016. 76049, pp. 527-541, 2016.

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