Quality of Services in Cloud Computing: Issues, Challenges and Analysis

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Abstract - Cloud Computing is spreading its roots at very high rate in this era. The Quality of Service plays a vital role in Cloud applications which is expanding in various sectors of business, electronic government, automotive systems, multimedia services, process control and finance. The biggest hurdle in the cloud is the management of applications and allocation of the required resources to such applications there by providing better performance, authenticity and higher computing. This paper covers the Quality of Services in cloud environment and focuses on issues, and the challenges related to Quality of Service possibly arising in the cloud management.

Keywords: Quality of Service (QoS), Cloud Computing, Cloud Framework, Data centers, Service Level Agreement (SLA).

I. INTRODUCTION

Cloud computing is a popular way of communication which is affecting daily life of the people. The technical and economic advancements take this technology into another direction. The cloud technology is based upon the internet connections for the machines as a backbone. It is a convenient way of assessing the on demand resources on the internet through the shared pool i.e. networks, servers, storage applications, and services [3]. Cloud computing has proven its popularity in this current era because of the on-demand capacity management model[7].

The framework for cloud computing includes Software-as-a-Service (SaaS), Infrastructure-as-a-Service (IaaS), and Platform-as-a-Service (PaaS). These are described as under:

- *Software-as-a-Service (SaaS):* A Software Distribution model in which applications are hosted by service providers and made available to the clients on the internet, thereby minimizing the need to install and executes the application on the client machine [1, 4]. The key provider who uses SaaS is Amazon Web Service, Salesforce, Google Apps, Facebook and many more.

- *Platform-as-a-Service (PaaS):* A computing platform where user does not need to buy or install the hardware and software in the cloud infrastructure. It consists of applications for computing that are required by the consumer. PaaS also provides various resource management functions for on-timer scheduling of processes [1, 4].
- *Infrastructure-as-a-Service (IaaS):* It consists of various resources like storage, network and processing capacity required by the user. The client can regulate the cloud environment as a service and client has to pay only for the duration of time whenever they avail the services. This results in the faster service delivery with low cost. The client can still use the service without the awareness of the storage location. This is also called Hardware-as-a-Service (HaaS) [1].

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The Cloud computing is build up with various interconnected data servers. Cloud applications without data centers are not possible. There are many data centers viz Amazon, Salesforce.com, Google [1] and many more where cloud applications are running brilliantly. Figure 1 shows the use of various data centers for the end users of cloud computing environment.

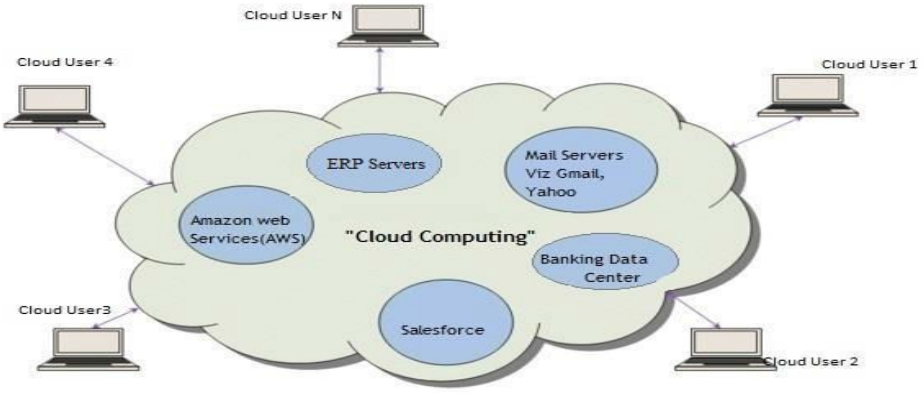


Figure 1: Data Centers using Cloud Computing

Mail Servers: The mail servers were general clouds for internet users. The data centers were initially launched in April 2008. The application runs in a Platform-as-a-Service (PaaS) for developing and hosting web applications in Google managed data centers [23]. Many Google apps can be found on various cloud servers for diverse kind of computing and many Google apps are free of charge for client.

Banking data servers: To ease the workload of the employees in the banking sector and to provide banking to users with better connectivity and availability. The emergence of banking data centers came into existence in 20th century. Examples are Rackspace, Finacle and many more.

Amazon web Service: Amazon Web Services (AWS) launched in 2006 caters the need of clients with high scalable cloud computing platform with high availability and dependability, offering the flexibility to the existing users to build a huge range of cloud applications. AWS protect the confidentiality, integrity, and availability of their customers' systems. Securing data is of the utmost important to AWS, as is maintaining customer trust and confidence [22].

Enterprise Resource Planning (ERP) data Servers: This data center came into existence in 1990 but in present technological era, these are running enormously in the cloud environment. It is business processes management software which embeds with various applications for the organizations or businesses. This technology functions as a backend of the offices. The system created from these applications can share data across various departments of an enterprise. It is considered as a very important tool because it combines various organizational systems and produces error-free transactions [27].

Salesforce.com: This is the first cloud application launched in 1999. In 2015, the figures reached upto $50 billion in terms of market capitalization [25]. It is one of the high valued cloud applications in American companies. Salesforce offers a large range of products which covers the entire scope of cloud computing. Client need not to install any software or hardware. It is an easy going application which requires no setup cost [25, 26].

The cloud technology has shown an impact on the various enterprise data centers and opted maximum private and public cloud architectures. The performance, security, dependability and management of the resources are the major area of concern in cloud computing [5]. QoS is a fundamental concept for cloud users who believe that QoS levels minimize the operational cost and allocate the resources to the clients. The latest migration of instagram backend stack from Amazon Web Services public cloud into Facebook's data centers has setup secure connections between Amazon's Elastic Compute Cloud (EC2) and a facebook data center [6]. The

Active Queue Management (AQM) approach ensures the acceptable way of network which is answerable for user [11]. The data interconnection with secured connection in cloud using IEEE802.11am standard and many more other secure standards states that QoS assures the network output, management delay as well as the large amount of signal loss [12].

Being a communication network as a backbone, these networks transport the various applications and high quality of data which includes video streaming and real time voice data thereby providing optimality. The QoS manages the bandwidth, delay and jitters (delay variations) up to the optimum level [8]. The Cloud environment focuses on optimality in terms of resources, performance and cost for the cloud users, so as to provide them the best services to exploit various computer resources associated with user applications. The services in cloud computing depend upon the Service Level Agreement (SLA). The Signed Agreement between the customer and the service provider includes functional and non- functional of the services mentioned in the SLA [21]. The major factors violating the SLA include pricing and the penalties if agreement is breeched.

This Paper focus on how effectively the infrastructure incarnate and dynamically maintain the platforms constructed by cloud resources and services. Those applications may incline SLA's characterizing timeliness, high availability, scalability, trust security. This paper is organized as follows. The work related to QoS is discussed in section II. In section III the QoS issues and various challenges are listed. A case study and analysis are discussed in section IV. The paper is concluded in section V and finally the future scope is discussed in section VI.

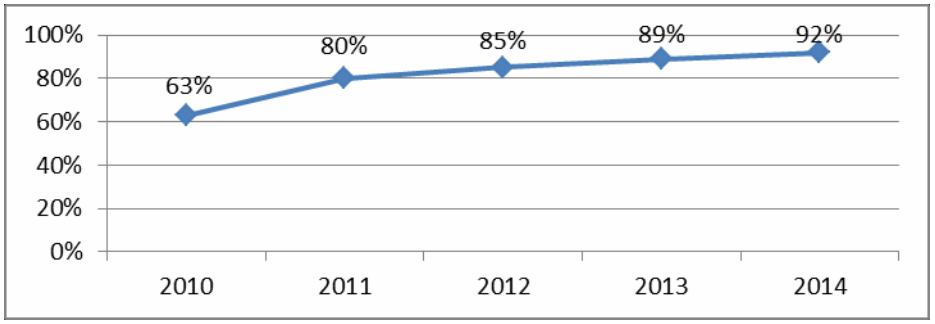
II. RELATED WORK

The cloud computing needs high speed broadband is for good Quality of service (QoS) so that cloud based application can be used with high speed which includes the minimum response time, less latency rate and reduced amount of loss of packets [3,9]. The management of QoS in cloud, by various enterprises leads to the limited visibility and control over the qualities served by the vendors. Performance and availability of resources is considered when applications are embedded in the cloud network [14]. Around 50% of the poor QoS matters when changes in the configuration [12]. The various types of tools and techniques are used to maintain the QoS within the network using segments of the available network to particular types of traffic.

QoS presents the non-functional characteristics of the Cloud services. The dynamic cloud services consist of five generic QoS properties viz execution price, execution duration, reliability, availability, and reputation. The flexible processes, includes adaptive service composed of execution time, availability, price, reputation, and data quality. An efficient service composition approach considers both generic QoS properties and domain-specific QoS properties. Various QoS measurement of Cloud services as been introduced in the SLA, such as IBMs WSLA technique and the work from HP [2]. Data security, integrating applications into different systems, Service level Agreements and the management tools can enhance the Quality of Service (QoS). Management methods can control the high programmability of the peripheral resources in the cloud system for effective QoS [5].

[16] lists the factors driving adoption of cloud computing "Overall IT cost reduction, reduced risk of IT disruption from external factors such as natural disasters, greater overall business agility and flexibility, enhanced IT infrastructure efficiency and faster deployment time". The work on effective management of the cloud usage that may affect the bandwidth quality and the cost incurred in using the new tools is under progress [16].

A survey was held in New Zealand in 2013 which shows the usage of cloud server used in various computing environments. Above 60% of organizations planned to raise their estimated income in the coming years. It is also being recorded that mostly NZ organizations worried about the email, storage and the productivity of the cloud services [17].



Graph 1: Usage of Cloud Computing in New Zealand [17]

After DropBox was launched in June 2007, its download reached 200 million in Sept 2013 and thereafter it was drastically reached upto 300 million in May 2014. It was initially deployed in Public clouds. The main focus was on the online backup, file sharing and file synchronization. Recently its being recorded that 66% of the file synchronization in the application needs redeploying and the recorded percentage is changing frequently [13]. This cloud application needs to be managed or improved for its services in uploading the file which happens because of the smaller bandwidth.

III. QoS IN CLOUD: ISSUES AND CHALLENGES

The aim of cloud computing is to effectively exploit the shared pool of various resources so as to optimize the computing. To maintain the cloud platforms, Cloud resources and services various issues and challenges are associated.

Issues: There a major issue associates with management of cloud services results to the catastrophe. With the increasing trend of the cloud services it become more difficult to investigate the QoS for cloud.

The prime concern is the security and privacy during the transmissions of the resources in Cloud. The study shows that many companies like facebook, Amazon, Google are bit concerned about the data which should be kept confidential to share with other companies with high bandwidth rate with having less delay. Choice of Database is a crucial component in the software stack of many cloud hosted applications [15]. The various existential issues associated with the cloud server are:

- *Managing and ensuring application in QoS*
- *Cost*
- *Increasing services for users*
- *Slow applications when hosted on Sever with more Errors*
- *Guaranteed own SLA's*
- *No Data limits*
- *Performance of the applications*
- *System backlog*

The cloud applications need to be managed properly online so that it can serve best to its clients. This may lead to various viz delay, jitter or packet loss associated with real-time applications [1]. Traditionally, fault tolerance software's was quiet costlier but got reduced when cloud services came into the existence.

Challenges: The main challenge is to solve scalability and the dependability issues in managing the QoS in Cloud Computing [14]. Figure 2 shows the CloudDB framework for a management of the application-defined SLA for cloud hosted database. The below mentioned architecture manages the input and output of the database in cloud applications. The SLA Checker checks the results of monitoring module and make comparisons against the application defined SLA and reports if SLA is violated. Basically, it checks how many SLA's has been violated [15].

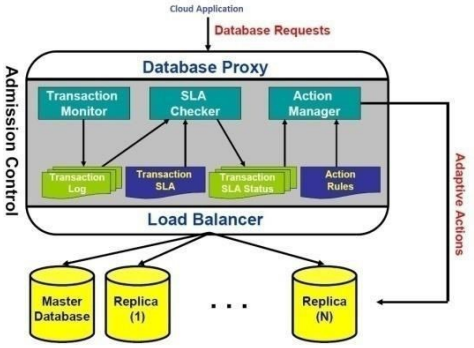


Figure 2: Framework for CloudDB AutoAdmin [15]

[14] Suggests some activities that should be taken into the consideration:

(1) New tools and devices should be used for examining the visibility Limitation. This can be done by timely data monitoring and the predictions.
(2) IT managers should spread the awareness of the Service Level Agreement.
(3) Managing the QoS by integrating different architecture models into the cloud is a bigger challenge. This can be achieved by choosing the appropriate database model like RDBMS and MySql.
(4) The activity which should also be taken care is the redeployment which should be easy enough to change automatically.
(5) Managing the services in Big Data in the cloud [20].

To resolve the visibility issue a Visibility-as-a –Service should be introduced so that the client can monitors the traffic. This will help in storing the data traffic in the data centers through internet. Resources like overprovision policy should be taken into consideration that will do the proper allocation of the resources to the client system [10]. This policy is possible enough to degrade this issue if there is availability of enough resources. We can get the Optimum resource utilization by providing each hosted application with the availability of the resources which guarantees that the application SLA will not be breached. There is lack of QoS datasets for which datasets needs to be developed to solve the performance issues and it should be widely used in cloud environments. To avoid the traffic delay a model has to be made to know how to prioritize the traffic in QoS. Another challenge includes huge data storage as a service and backup plan for large scale companies.

IV. ANALYSIS

New Zealand based company Telecom bears a problem to serve the customers with deep application visibility as discussed in the case study considered [18]. Another major concern is that SLA's are not notable time to time which affects the cloud services. The unused resources which are available at run-time are one of the issues concerned in cloud services. The middleware architecture can overcome this problem but still the problem arises due to the space limitation.

Table 1, depicts the latest survey on best cloud storage service in New Zealand (Year 2015). There are three largest cloud storage services with different benefits namely Dropbox, Google Drive and OneDrive. Google Drive and OneDrive both offer 15% of free storage in Gigabytes. Further, it shows that DropBox has maximum bonus in GB. The cost is the other factor where Dropbox is charging for one tier as Google drive has 5 subscriptions cost where it is the one of the maximum Charges [19].

Apps / *Factors*	***Dropbox***	***OneDrive***	***Google Drive***
Free Storage	2%	15%	15%
Maximum Bonus	16%	8%	0%
Cost	1TB £7.99/mth	1TB £5.99/mth	30 TB $299.99/mth

Table 1: Suvey of cloud applications in New Zealand [19]

V. CONCLUSION

The cloud providers encounter various issues and challenges to strike a balance between the management of required resources at low cost and improving the QoS to its clients. QoS can be improved by selecting appropriate database models and by the proper SLA's. Redeployment of the resources on the internet can boost up the QoS in cloud environment. The various technologies and models assures to improve the performance of QoS however the main challenge is to spread the awareness of the visibility as a service among the cloud users. Identifying both the new tools and techniques can optimize cloud service providers with better QoS.

VI. FUTURE SCOPE

The issues that are mentioned in this paper will be a sizzling topic for the future researchers. The future scope of cloud computing may include reduction of the cost, SLA's, availability of resources and choosing right database models will be the main areas for researchers.

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