Cloud computing: Issues and future direction

Conference Paper *in* Global Sci-Tech · January 2017

DOI: 10.5958/2455-7110.2017.00005.2

2 authors, including:

Mahfooz Alam
Aligarh Muslim University
34 PUBLICATIONS **313** CITATIONS

Cloud Computing: Issues and Future Direction

Imran Raza Khan[1] and Mahfooz Alam[2]

[1]Department of Computer Science and Engineering,
Institute of Technology and Management, Aligarh-202001, India
[2] Department of Computer Science,
Al - Barkaat College of Graduate Studies, Aligarh-202002, India

ABSTRACT

Cloud computing is a kind of internet – based computing that provides shared processing resources and data to computer and other devices on demand. Nowadays cloud computing is a recent field for researcher. There is no doubt that businesses can reap huge benefits from cloud computing such as cost savings, strategic edge, manageability, reliability, scalability, access to automatic updates. However, there are numerous issues in cloud computing like pricing, availability of service, power consumption, energy management, resource provisioning, VM provisioning, load balancing, security etc. So in this paper we focus on issues and challenges of cloud computing. Furthermore, the author also present the open research challenges in cloud environment.

Keywords: cloud computing, distributed system, virtual migration, SLA, homogeneous & heterogeneous workload.

1. INTRODUCTION

Cloud Computing which is commonly known as "internet based computing" facilitates us to create, organize and modify applications through internet without the using computer's hard drive. Cloud computing give us access over online storage, infrastructure and applications. Thus it has made our business application more mobile and collaborative. In other words, cloud computing is a means for enabling universal, useful, on demand network access to a pooled configurable computing resources for examples; networks, servers, storage, applications, and services that can be quickly provisioned and released without requiring much management efforts or interaction of service provider, lowering the time and cost involve in the whole process[1,2]. This cloud model has some important features, three service models and four deployment models.

1.1 MAIN FEATURES OF CLOUD COMPUTING

There are various features available for cloud computing such as follows:

- **Individual Service on Request**

A user can use the online resources whenever and he desires without interacting with each server through global net. Such resources include server time, network storage, software etc. Thus a user with an instant need at a particular time slot can access these computing resources in a convenient manner without resorting to human interactions with these resource providers.

- **Network Access on Wide Range**

Resources are available on the network which can be avail through various thick or thin client platforms such as mobile phones, laptops, tablets, workstations etc. These resources available on websites over the internet are easily accessible to its user.

- **Distribution of Resources**

The online computing resources are grouped in order to serve multiple consumers. A multi-tenant model is used along with different virtual and physical resources which are assigned and reassigned according to user's demands. The distribution of resources is independent process as in it the user can not control the physical parameters of the resources as they are invisible to their users such as location, formation and originality of the resources, but may be able to identify location at a higher level of system customization such as storage, data processing, and memory and network bandwidth. In cloud computing resources are grouped together in order to serve various users by making use of multi-tenancy of the virtualization model. Economies of scale and specialization are the two motivational factors working behind the cloud computing system.

- **Efficient Elasticity**

In cloud computing solutions to problems are available in a very short duration of time whenever they are required. Resources are easily provisioned and released automatically as solutions are in direct relationship with the inward and outward demand. The hardware and system limitations are corrected and modified according to the growing load on the server. The resources for the users, available for requirement appear to be unlimited and are sufficient in any quantity at any time.

- **Evaluated service**

Services like processing, storage, user's account, bandwidth etc are automatically optimizes and controlled by cloud system. These services are also evaluated according to user's requirements at some level of abstraction. In Cloud Computing the services which are utilized by the consumer can be easily controlled, monitored and reported, providing precision for both the consumer and provider of the consumed service.

- **Self Curing**

Sometimes there is a situation when an application fails in this situation cloud computing provide a baking copy of the application prepared to capture the failure without any disturbance. Each application has updated multiple copies, in case when an application fails one copy of application is always ready to take over the crash without disturbing its running state.

- **Multi-tenancy**

In any application at the same moment of time there is multi-tenancy in cloud computing. In this system infrastructure is shared by no of users and no one know about sharing. Multiple users can use the system infrastructure by vitalizing the server on the available machine pool. This process is carried out without compromising the security and privacy of user's data.

- **Linearly Scalable**

Services are linearly scalable in cloud computing. The work load in this system is divided into pieces and distributes it throughout the infrastructure. Linear scalability can be explained by an example: that if 1000 transactions per second are processed by one server, then 2000 transaction per second can be processed by two servers.

- **Service oriented system**

Cloud computing is a service oriented system- that is this system consist services which are created with the help of other discrete type of services. Independent Cloud Computing services are pooled together to form such service, so that we can re-use the services which are available or being created.

- **Service Level Agreement**

Service level agreements or SLA technology is used in cloud computing when there is heavy load on the server. The load is automatically adjusted in order to accomplish the service-level agreement. The load is easily managed when the services create additional instances of the application on more servers.

- **Virtualized**

In cloud computing the applications are completely isolated from the original hardware, environment and other virtual machines. Due to this isolation, if one virtual machine collapses it does not affect the work of other virtual machines and data does not get shared between virtual machines.

- **Stretchable**

Cloud computing services are very stretchable, i.e. these services can be used for different types of workloads, which can vary from a small consumer application load to a very large commercial application load.

1.2 SERVICE MODELS

Cloud computing is based on the service model or we can say that serve model is the reference model of cloud computing. Service model comprises of many different models but amongst them there are three basic models which are the backbone of service model; namely Infrastructure as a Service (IaaS), Platform as a Service (PaaS) and Software as a service (SaaS) [3,4,6]. Other models are included in 'Anything as a Service" model (XaaS), for examples; Business as a Service, Strategy as a Service, Network as a Service etc.

- **Infrastructure as a Service (IaaS)**

Iaas is the fundamental level of service model. In it resources are distributed as a service over the network i.e. virtual machines, virtual storage, servers etc. In this model all the infrastructure components (hardware, storage, software etc) are managed by the third party provider. The clients have no control over the infrastructure components and their operations. It is the third party provider who manages such tasks such as maintenance, backup or recovery planning. Iaas is a very scalable on-demand platform that can be adjusted according to the workload type. Its users pay on pay-per-use basis

- **Platform as a service (PaaS)**

In cloud computing Platform as Service model is used to deliver applications over the internet. Hardware and software tools are being delivered to their users by cloud providers as a service. The users cannot manage cloud infrastructure i.e. they don't need to install in-house software or hardware, this work is done by the cloud providers as they host hardware and software. The user has access only on the downloaded applications. This doesn't mean that entire business infrastructure is replaced by the PaaS, instead only key services are required by the users, e.g. Java development tools.

- **Software as a Service (SaaS)**

In cloud computing SaaS model distribute software as a service over the network. A third party hosts the application and distributes software amongst its various users. The users have no control over the cloud infrastructure, storage or the application capabilities. SaaS model removes the need for installing and running applications on in-house computers. It removes the maintenance and licence renewal, and support problem. Instead of buying the software the users just need to subscribe the SaaS offers and pay for it on the pay-as-you-go basis.

1.3 DEPLOYMENT MODELS

Deployment model is the key element of cloud computing. In general deployment means software is available and ready for use at customer site. Deployment model signify a particular type of cloud environment differentiated by size, ownership and access of the resources. A deployment model is of four types: Public, Private, Hybrid and Community.

- **Public Cloud**

Public cloud is the most common and familiar deployment model. Users access large amount of same data from public cloud. Everyone use the services that are provided by cloud computing. Public services such as Google, Amazon Elastic Computer Cloud (EC2), Facebook, Sun cloud, Linkedin etc. are the example of public cloud. The services of public cloud are usually free of charge but there is usually per-use pricing model for professionals. Professional cloud supplier hosts the public cloud. General public can easily access the system and services of public cloud due to its openness e.g. e-mail public cloud may be less secure.

- **Private Cloud**

The system and services of Private Cloud infrastructure are accessible within a single organization or private network which can be accessed by multiple users. Security level is very high in private cloud. Private cloud is hosted by an organisation, third party or a combination of both. Private Cloud involves allocation of space, hardware, and environmental control internally or externally, which must be refreshed time to time. Business can be enhanced using private cloud infrastructure but it requires high level security issues to stop serious vulnerabilities

- **Community Cloud**

In community cloud the resources are used by the whole community, i.e. by the group of organisations. This cloud is structured in such a way that it can be used by a particular group of consumers who have same concern, such as policy, security requirement, policy etc. Community cloud is hosted by a single or a group of organisations, a third party or a combination of both.

- **Hybrid Cloud**

The hybrid cloud as the name suggests is the fusion of private cloud and public cloud. The crucial activities are carried out by public cloud as they have more security issues, whereas non-crucial activities are carried out by public cloud. Although its infrastructure is a mixture of two different clouds whose entity remains unique, but they are bond together through their fundamental technology which transfers data and application. .

1.4 ADVANTAGES OF CLOUD COMPUTING

There are many advantages of cloud computing. Cloud computing can be very beneficial a business. Some advantages are given below:

- Applications can be accessed as resources over the network.
- Application can be configure or manipulated at any time.
- To access or manipulate software there is no need to install a software on the in-house computers.
- Platform as a Service Model in cloud computing offers online developmental/deployment tools and programming runtime environment.
- Every type of client has independent access over the cloud resources over the network.

- On-demand self service is offered in cloud computing. The client uses the resources without interacting with the cloud service provider. .
- Cloud computing operates at higher efficiencies with greater utilization, so cloud computing is regarded as highly cost efficient. It only requires an internet connection.
- Cloud computing is more reliable as it is based on load balancing technology

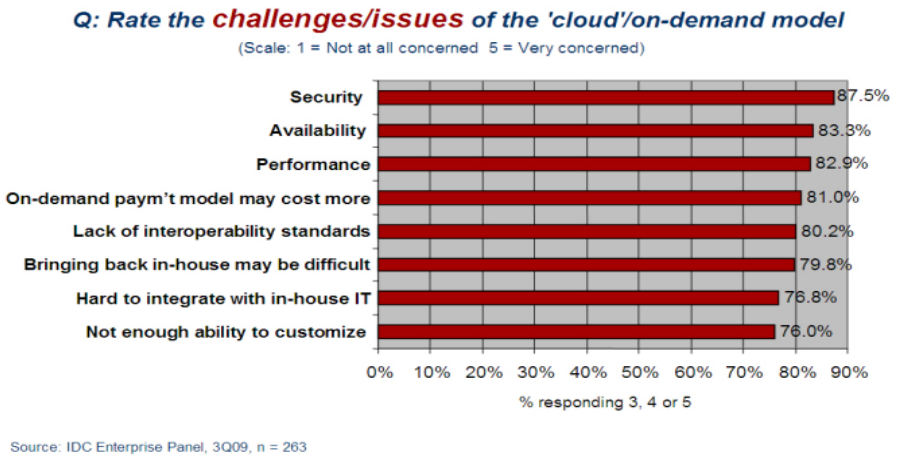
This paper is organized as follows: the authors describe the following part presents the cloud computing and its models, features and advantages. In part 2 describe the various issues in cloud computing environment. In parts 3, presents the future research direction for cloud computing and finally concluded the paper in part 4.

2. ISSUES IN CLOUD COMPUTING

Business industry has accepted the grown importance of cloud computing but the research on cloud computing is in its initial stage. However due to industrial development and growth new challenges keep emerging, while many issues have not been completely taken into account [5,7]. Some of the research issues and challenges are discussed below:

2.1 Security Issue

Security is the greatest challenge or issue of cloud computing according to International Data Corporation (IDC) as shown in fig below.



When we save our data or run our software into others hard disk using others CPU appears to be very risky. Organisation's data and software face serious risk of security issues like data loss, phishing, botnet etc. Some security concerns are given below:

- **Security concern 1**; Control on physical security is lost in cloud computing because resources are shared with other companies and no one knows where the resources are run.
- **Security Concern 2;** Laws are violated by the company which increase the risk of data seizure by the foreign government.
- **Security Concern 3;** There is storage incompatibility between different cloud services vendors when the user wants to shift from one cloud to another type of cloud (Google cloud is incompatible with Microsoft cloud).
- **Security concern 4;** There is no common standard to ensure the data integrity till now.

2.2 Costing Issue

The tradeoffs amongst computation, communication and integration must be considered by cloud consumer. Infrastructure cost is reduced significantly while migrating from one cloud model to other, but it raises data communication cost. For example, transferring

organisation's data cost to and from community cloud to public cloud and the cost per unit of computing resources used will be higher. Particularly this problem is prominent when consumer uses the hybrid cloud deployment model, because in this model data is distributed among number of public, private or community clouds.

2.3 SLA Issue

While shifting the core business from one cloud model to another consumer need to make sure the quality, availability, reliability and performance of the underlying resources. The consumer needs to get guarantee from the service provider on service delivery. This guarantee is given through service level agreements (SLAs). The issue lies in defining the SLAs; The SLA should be written in such a way that it satisfies the consumers' expectations. It must maintain a balance between expressiveness and complicatedness. Another issue is the different type of cloud will need different SLA meta-specifications. This also raises many implementation issues for the service providers.

2.4 Migration Issue

According to the IDC survey which was conducted in 2008, when data of organisations is shifted from one cloud to another there are some security or privacy issues. IT system like IT management and personal application are most easily moved. But organisations are less reluctant in moving from IAAS to SaaS cloud, because marginal functions are out sourced to the cloud and core activities are kept in house.

2.5 Predictable and unpredictable workloads

CPU, storage and network are all virtualized resources in cloud computing. Less power is required by these virtualized resources when compared to conventional type of data centres. Virtualized environment is made available to the user with the help of these virtual machines (VMs). Large fluctuating workloads get allotted to these VMs. The load may be hugely increase on (VMs) due to the growing demand of application. The workloads of these types can be classified as predictable and unpredictable workloads.

2.6 Homogenous and Heterogeneous Workload

In cloud there are basically two types of workloads namely homogeneous and heterogeneous. Workload with similar type of configuration (i.e. no of CPU required, RAM, storage and execution time required etc.) is called homogeneous workload [8,9]. However, heterogeneous workload is managed and hosted by different resource vendors at the same level or at different levels of configuration. So we have to develop cloud system in such a way that it can accommodate both type of workload.

2.7 Transactional workload and Batch workload

Transaction workload is different from Batch workload, as we required user input in case of transactional workload but in batch workload there is no need of user input. Online transactional system is an example of transactional workload. Transactional workloads are pre-emptive whereas batch workload is non-pre-emptive. Transactional workloads do not fluctuate but batch workload fluctuates. An efficient resource allocation algorithm is required to handle both these type of workloads.

2.8 Flexibility

Flexibility in cloud means how the fluctuation in the requirement of the resources can be handled dynamically. As the time increases, demand of the resources may grow, these demands must be automatically perceive by the cloud and should be enhanced. A cloud should have an efficient resource management facility.

2.9 Maximization of Resource and minimization of costs

The maximization of resource utilization and minimize overall cost of operation are the two important constraints in cloud. An uninterrupted service should be provided by a robust cloud to its users. For this purpose the cost of the service should be kept low. Efficient techniques should be adopted to monitor the resource usages and minimize resource usage cost.

2.10 Virtual Machine Migration

Insufficient resource handling in cloud can be handled by using Virtual machine migration method. In this method VMs can be migrated from one host to another host to accommodate the resources.

2.11 Efficient Energy Allocation

In cloud data centre the carbon emission is too high, due to processing of large number of computing recourses. Therefore such techniques should be adopted which can reduce the carbon emission and are energy efficient.

2.12 Handling Long Running Jobs

In cloud some types of jobs run for long hours. For these types of jobs resources should be available without any interruption or failure. Automatic techniques should be adopted to detect unavailability or failure and then automatically transfer the workload to the available resources. This process must be carried out in such a less time so that user can not notice the un-interruption or failure.

3. FUTURE DIRECTIONS OF CLOUD COMPUTING

Business potential of cloud computing has contributed a lot in the growing emission of carbon from ICTs, which raises a question upon the energy efficient and green nature of cloud computing. According to a forecast the carbon emission is increasing at triple folded rate between 2002 and 2020, which is presently 7.8 billion tons per year. Various reports show that cloud computing is a Green Technology, but at the same time there are numerous reports which show that cloud computing and data centres lead to alarming increase in CO_2 in the atmosphere. There are many features of Cloud frame work that make cloud computing much more Green, but to make it reality various technological efforts are still needed. Some of them are given below:

1. Software should be designed at various levels (compiler, algorithm, operating system and applications) in such a way that they increase system energy efficiency. For maintaining energy versus consumption tradeoffs, the resources should be allocated to the application based on required performance level.
2. To achieve green cloud computing, the cloud providers need to understand and measure the existing data centre power, power consumptions of servers, their cooling requirement and cooling designs, so that maximum level of efficiency is achieved. In addition, to measure the energy usage of all the components and services of cloud modelling tools are required.
3. All the important factors such as network, memory, cooling and CPU should be considered in the data centre for designing the holistic solutions in resource scheduling.
4. It is the social responsibility of both consumers and suppliers to make sure that health of human society is not threatened by the changes caused by the emerging technologies. If Cloud providers want to maximise the Green energy usage, they must deploy their data centres near renewable energy resources.
5. Proper analysis of overhead should be done before adding new technologies such as virtualization to get the maximum benefit in term of energy efficiency.

6. Electricity demands of the cloud computing need to be reduced, for this cloud provider must adopt some important measures in using renewable resources.

4. CONCLUSION

In this paper issues and challenges of cloud computing has been discussed. Cloud computing is still regarded as a new phenomenon which can bring revolution in the internet usage, but still this subject requires a cautious handling. Day-by-day technological advancements are giving birth to new technologies at a rapid rate, which have the capabilities of making human life easier. There are some challenges in the way of cloud computing which were analysed in this paper. In future, we can get a safe, virtual and economically feasible IT solution through the cloud computing.

AKNOWLEGEMENT

I am thankful to all the teachers for their precious guidance. I am also very thankful to Assist. Prof. Mahfooz Alam for his knowledgeable guidance, which has helped me to make this paper more descriptive. At last but not the least I would thank my parents and friends for their support and encouragement.

REFERENCES

1. Gray, J. (2008). Distributed computing economics. *Queue*, *6*(3), 63-68.
2. May, M. (2010). Forecast calls for clouds over biological computing. *Nature medicine*, *16*(1), 6-6.
3. Nelson, M. R. (2009). Building an open cloud. *Science*, *324*(5935), 1656-1657.
4. Knorr, E., & Gruman, G. (2008). What cloud computing really means. *InfoWorld*, *7*.
5. Daryapurkar, J. U., & Bagde, K. G. (2014). Cloud Computing: Issues and Challenges
6. Daryapurkar, J., & Bagde, K. (2014). The Multitenant Cloud Architecture.
7. Fritsch, D. W. (2008). Article name: Cloud computing als IT-Architecture und Outsourcing-Option. *Information week*, *May*, *19*.
8. Alam, M., & Varshney, A. K. (2016). A New Approach of Dynamic Load Balancing Scheduling Algorithm for Homogeneous Multiprocessor System. International Journal of Applied Evolutionary Computation (IJAEC), 7(2), 61-75.
9. Bokhari, M. U., Alam, M., & Hasan, F. (2016). Performance analysis of dynamic load balancing algorithm for multiprocessor interconnection network. Perspectives in Science, 8, 564-566.