

# A Study of Emerging Cloud Computing Technology Benefits and Challenges

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## Abstract

Cloud computing means accessing of data and programs over the internet rather than using computers and hard drive. The word cloud is used as a metaphor for internet thus cloud computing is a type of Internet based computing. Cloud computing is not about having a dedicated server but it involves sharing of resources. In a cloud computing environment there is a significant workload shift as local computers no longer have to do all the processing instead the network of computers in the cloud do all the processing. This paper discusses the concept of computing, its different service and deployment models, its benefits and challenges and how the challenges can be overcome.

## General Terms

Cloud computing, Cloud service provider,

## Keywords

Cloud computing, Benefits, Challenges

## 1. Introduction

Cloud Computing is a distributed technology of delivering IT services over the internet. All the resources/services are present on the cloud which is managed by a service provider. Cloud computing provides easy access of services to the users either free of cost or at nominal charges. There are mainly two types of cloud: Public cloud and Private cloud. A Public cloud can be accessed by anyone on the Internet whereas a Private cloud is accessible only to a limited number of users and thus requires authorization.

Cloud computing comprises of subscription based or pay-per-use services thus extending existing capabilities. When you store data or run programs from your hard drive its called local storage and computing as all the resources you need are physically close to you due to which access is fast and easy. In Cloud computing we access data and services over a network. The cloud aims to cut costs and allow the users to use a number of resources without owning them and a number of technologies as services, without requiring deep knowledge of the technologies. In a cloud computing environment the hardware and software demands on the user's side decrease but they must have cloud computing system's interface software. An example of cloud computing environment is a Web based e-mail service in which you log into your e-mail account remotely. The storage for your account does not exist on user's computer but on services' computer cloud [3].

## 2. Service Models of Cloud Computing

Cloud computing provides service according to different service models (Fig.1), which are as follows: (1) Software as a service (SaaS) (2) Platform as a service (PaaS) (3) Infrastructure as a service (IaaS).

**SaaS:** In this the business subscribes to an application it accesses over the internet. End user applications are delivered as a service [6]. This kind of service allows end users to access software through a Web browser or a front end application. A single instance of software runs on the server serving a large number of end users. It's a profitable system for both customers and end users as for customers there is no need for purchasing software licenses and for service providers, they need to maintain only one application thus the maintenance costs are low.

**PaaS:** Application platform or middleware as a service on which developers can build and deploy custom applications. It provides a development environment which allows users to develop an application thus application developers can develop and run their software applications without the need of buying the underlying hardware and software. This is like renting out the hardware and operating system from the cloud for running the applications from the cloud or for developing and testing new ones.

**IaaS:** In this Compute, Storage or other IT infrastructure is provided as a service. Players like Amazon, Google and Rackspace provide a service that can be rented out by other companies. In this, the organization outsources the equipment to support operations including storage, hardware, services and networking. The cloud/service provider is responsible for hosting, running and maintaining applications. The client pays on per-use basis. Eg website hosted on web.

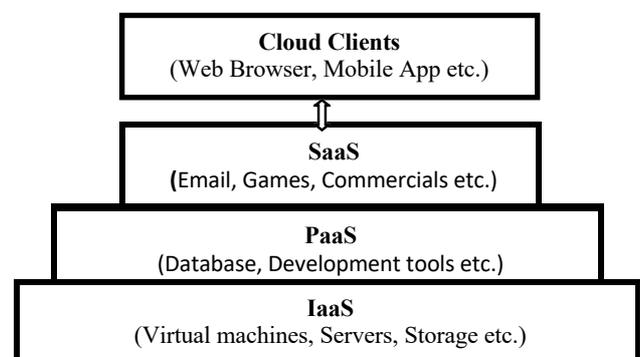


Fig.1 Service models of cloud computing

### 3. Deployment models of cloud computing

An agency can deploy cloud computing in several ways depending on the following factors: (1) where the cloud is to be hosted (2) security requirements (3) desire to share cloud services (4) customization capabilities.

The different deployment models are: (1) public cloud (2) private cloud (3) hybrid cloud (4) community cloud.

#### 3.1 Public cloud

This model (Fig.2) is characterized by public availability of the cloud services. The cloud services and resources are procured from a very large resource pool that is shared by all the end users. The services can be provided by the vendor free of cost or on pay-per-user basis. Public cloud employs techniques for resource optimization. Google is an example of public cloud.

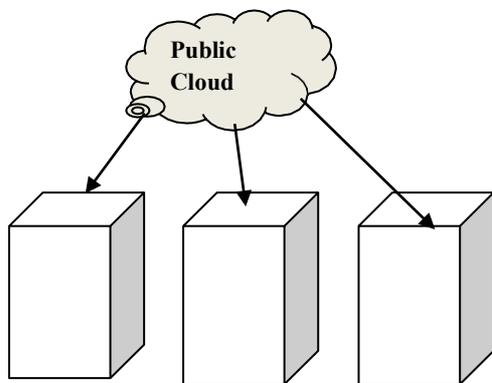


Fig.2 Public Cloud

#### 3.2 Private cloud

Private cloud computing systems (Fig.3) emulate public cloud services within the boundaries of an organization to make services available for a designated organization only. No one outside the organization can access the cloud services. The chief advantage of this is that the organization retains full control over corporate data, security and system performance. Security concerns are addressed by secure access VPN or by

physical location within the clients' network.

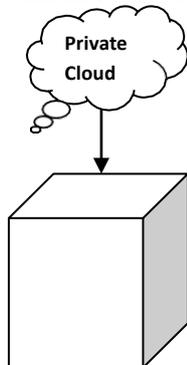


Fig. 3 Private Cloud computing system

#### 3.3 Community cloud

In a community cloud (Fig.4), organizations with similar requirements share a cloud. It can be thought as a generalization of private cloud. When organizations have a common set of requirements or customers they can combine assets to share computing resources and data.

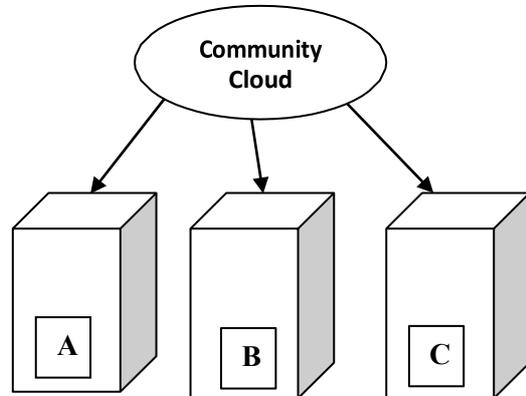
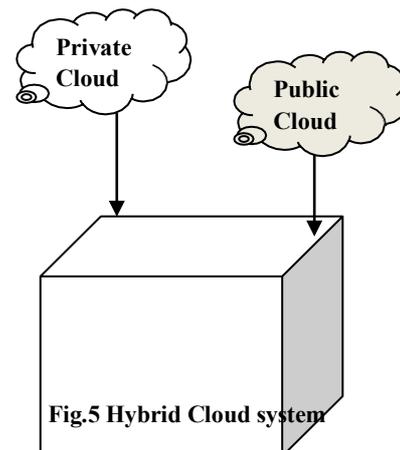


Fig.4 Community Cloud for organizations A, B and C having similar requirements.

#### 3.4 Hybrid cloud

A hybrid cloud system (Fig.5) combines services of different cloud systems like private and public clouds. Hybrid cloud is a mix of two or more different clouds.



### 4. Benefits of Cloud computing

Cloud computing offers a number of benefits which are as follows:

#### 4.1 Maximized server utilization

Most enterprises underutilize their server resources so cloud computing ensures that the resources are utilized in the best possible way as they are shared among many end users in optimum way.

#### 4.2 Cost effective

Cloud computing results in huge cost savings for the enterprises as they need not buy all the hardware and software. Let us take the case of a big organization, ensuring that all the employees have all the required hardware and software incurs a lot of cost so cloud computing is the best possible solution.

### **4.3 Scalability**

If a company wishes to expand then it is required to invest in hardware and software licenses which involve a lot of cost. Cloud computing provides an extra processing buffer at a low cost without the capital investment.

### **4.4 Shortened software development time**

Cloud computing uses the Service oriented architecture (SOA) based approach to software development in which application developers use services of the cloud through Web services. Any new software can be developed online connecting reusable application building blocks together.

### **4.5 Reduced time for implementation**

Cloud computing provides the processing power and data capacity as needed, in real time. This saves a lot of time as in traditional approach weeks or months are needed to get all the required resources for implementation.

## **5. Challenges of cloud computing**

Cloud computing involves various challenges which are as follows:

### **5.1 Security issues**

In cloud computing environment end users data (sometimes confidential data as well) is stored in the cloud and not at the user's end thus security of data is a major concern. CSPs must ensure proper security of users data. Some cloud service providers may have less transparency than others about their security policies.

### **5.2 Authorization**

When users are given authorization rights to access the cloud's data then Cloud service Provider needs to ensure that only authorized entities are allowed to access the cloud.

### **5.3 Data location**

Cloud computing technology allows cloud servers to reside anywhere thus the users may not know the physical location of their data. Technically this is not of any importance but this is an important issue for data governance requirements.

### **5.4 Disaster recovery**

It is a matter of great concern for the enterprises as their data may be scattered around multiple servers and geographical areas. In the cloud computing model the Cloud service provider may outsource the recovery process to a third party.

### **5.5 Application sharing and multi-tenancy of data**

This is also a major concern of cloud computing systems as data is comingled and resides across many servers present at different geographical locations and applications are shared among the end users. Security and privacy issues are thus of major concern.

## **How to overcome the challenges of cloud computing**

(1) For ensuring confidentiality of users data in the cloud the concept of encryption can be used. Data encryption means storing the data in a coded form using some algorithm so that only the desired users can decode the data and no one else will be able to misuse it.

(2) For cloud security policy the enterprise needs to have a detailed understanding of the service level agreements that stipulate the level of security provided by the cloud service provider.

(3) The responsibility of security and privacy is shared between the cloud service provider and the customers. The sharing levels depend on the service models, as follows [4]:

SaaS: cloud service providers are more responsible for the security and privacy of applications.

PaaS: Customers are responsible for protecting the applications they build and cloud service provider has to ensure isolation of customer's applications and workspaces from one another.

IaaS: Customers secure the operating systems, applications and the content. Cloud service provider provides some basic data protection.

Enterprises are under pressure of improving business practices but they need to ensure that in cloud computing environment their sensitive data will remain secure, authentic, accurate, and available and will satisfy certain compliance requirements.

## **6. Cloud computing Infrastructure**

In companies where cloud computing is a new and exploratory concept, not much infrastructure is needed. A desktop workstation with some cloud computing software and network access are sufficient.

In companies where cloud computing is the backbone of business and is central to day to day business operations, cloud computing infrastructure needs to be robust. The infrastructure needs to be intelligent with the following four properties:

### **6.1 Transparency**

Transparency means that the services must be delivered to the user regardless of the physical implementation within the cloud. The actual implementation of services in the cloud is hidden from the user. This is a form of virtualization where multiple resources appear to the user as a single resource. For eg when a user is accessing a service of the cloud, a single server may be needed but as more users access the cloud

services it may be required to add more servers. These additional servers will be added to the existing servers without interrupting the service.

### **6.2 Scalability**

Cloud computing service providers must provide on demand dynamic application scalability. This means if an organization needs more resources then the service provider must be able to provide on demand resources in real time. This is not so easy and requires restructuring and re architecting of the network.

### **6.3 Intelligent monitoring**

The control node in the cloud needs to have intelligent monitoring capabilities. It will need to know when a particular server is overburdened and when network is affecting applications performance then it must find out which applications and services are getting affected and take appropriate actions for handling the situation.

### **6.4 Security**

If the security of the cloud is at stake, then all the clouds' data and services are at risk. Thus, the mega data center of the cloud must be architected with security in mind.

## **7. Conclusion**

Cloud computing is the need of the hour as it offers huge savings in cost and allows enterprises to focus on their business rather than on technical aspects. It fulfills the demands in real time thus ensuring smooth functioning for the authorized entities access the data and confidentiality of sensitive data. Cloud service providers need to take care of these risks.

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