

# Review of Cloud Computing & Security Concerns of Cloud Computing

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## Abstract:

The Paper begins with the introduction of cloud computing and discuss the advantages, and need of cloud computing in current era. The paper will also include types of clouds, stake holders of cloud computing, service models of cloud computing and the security concerns of cloud computing.

The idea of centralized computation, distributed storage data center services and grid computing provided by third party service providers is not a new one. The cloud computing is a generalization of centralized, distributed and grid computing. The main aim of cloud computing is to provide Information Technology Services to the users on demand basis with high level of accuracy, availability and reliability. Using cloud computing the users don't need to pay for the hardware and software components in order to get service from cloud service providers. The users also need not to bother about the maintenance of equipments. It is the responsibility of cloud service providers to provide computational power and to provide time to time maintenance services. The users only need to pay the nominal charges and in most cases the cloud services are almost free. As the users use third party equipments for computation and storage purposes, there is an issue of security. To expose data to third party service providers is a big risk as there is always a possibility of data leakage to unauthorized users.

## Keywords

Cloud, Cloud Computing, Stakeholders, Security Concerns, Risks, Service Model, Privacy

## 1.0 BASICS OF CLOUD COMPUTING

We are living in the age where we don't rely only on local computing power and storage space for fulfilling our computational and storage needs. Today every one of us have access to remote computational power and online remote storage space that we easily use to

process data and to store data in these online storage areas. The main advantage of this concept is that we can have access to such resources every time irrespective of the location and time. All this is possible due to the emerging of Cloud computing.

The development of Cloud computing is new one but the concept of cloud computing emerged in 1969. The cloud computing is an advanced distributed computing. Due to the development of computer networks the utility of computer increases to many folds. During 1990s the advancement of computer networks give rise to new form of computing known as grid computing that allows users to use computing power on demand basis. The grid computing in turn gives rise to the development of cloud computing. It was the *Google's CEO Eric Schmidt* who shows interest in cloud computing and in 2006 he coined the term cloud computing. The cloud computing can be thought as an aggregate of computers networked together in various geographical locations that operate together to provide service to cloud users. The cloud users don't need to worry about installation of software, licensing issues, maintenance of hardware and software. Further the users use these services either free or on pay and use basis. They pay only as much as they need to use. Therefore cloud computing results in less expenditure, less effort, high productivity, high reliability, high availability and sufficient security.

Providing cloud computing service requires big data centers that are build on grid computing architecture. The cloud users view the virtual view of the actual hardware installed in data centers. The virtualization is the main idea behind cloud computing as it provides the abstraction and the users don't need to know about the physical architecture and physical infrastructure used to provide service to them.

## 2.0 Types of Cloud:

Based upon the types of access to the cloud, the cloud can be classified into three types:

### 2.1 Private Cloud

Private cloud is a cloud service that is usually provided and maintained within an organization and used only by the employees working in the organization. The security issues are minimal in private cloud as there is no access to the cloud services from outside the organization.

### 2.2 Public Cloud

Public cloud is a cloud that is usually maintained to provide service to common public that may include any organization, individual etc., with no restrictions. The cloud services are provided to cloud users on demand basis. This type of cloud has great deal of security concerns as the cloud has access to everyone.

### 2.3 Hybrid Cloud

This cloud is a combination of private and public cloud. This type of cloud is composed of multiple internal and external cloud service providers. The most common example of this type of cloud exists when some company with private cloud connects to public cloud services.

## 3.0 Cloud Computing Stakeholders.

There are number of persons that are associated with the cloud computing at one or the other level. We can divide them into three types:

### 3.1 Cloud Providers:

The cloud providers include those that provide cloud services like infrastructure, computing resources, storage, data centers to cloud users

### 3.2 Cloud Users:

These are the application program developers who develop various product using services offered by cloud providers.

### 3.3 End Users:

This class of users uses the service of application programs developed by cloud users. The end users use the services as pay-as-you-go basis.

## 4.0 Why Cloud Computing?

The advantages of cloud computing varies from one class of users to another. Following are the various advantages that cloud computing provides to each class of user.

#### 4.1 Cloud Providers View

- Due to the technological advances, the computational power, capacity of storage devices and other resources has increased significantly. It is not possible to utilize such powerful infrastructure efficiently if used by one user only. Large companies that provide service to users need to utilize various infrastructures in an efficient way. So they can offer the service to various users on pay and demand basis.
- Any organization having large data centers in place need to make little investments in order to provide cloud services using already deployed infrastructure.

#### 4.2 Cloud Users View

- Cloud users don't need to purchase their own computational and storage infrastructure. They can just use and pay for the service used from cloud service providers.
- The cloud users don't need to worry about the maintenance of the infrastructure they are using.
- The users will get the advantage of scalability. They can incrementally get resources as per their demand.
- The users get the illusion that they are having all the resources available due to the concept of virtual technology.

#### 5.0 Increasing Demand for Cloud Computing

As already stated cloud computing is not a new concept. It is an evolution of grid computing and distributed computing. The growing demand for cloud computing in recent times is because of some recent technological developments and business models. Some of the reasons for the increasing demand on cloud computing are:

1. **New developments in business and scientific world:** Modern business enterprises are interested in knowing the customer needs, shopping patterns, product demands in order to take efficient business decisions. This requires analysis of huge online data and thus arises the demand of cloud computing

2. **Highly interactive applications:**

Applications like weather forecasting, and some social media applications that collect information from other users or from automatic sensors are becoming more popular. Storing and processing such huge collection of data is possible only due to cloud computing and cloud storage.

3. **Parallel processing:** cloud can be used to operate on large volumes of data using parallel batch processing and thus hides operational complexity of parallel processing of hundreds of cloud computing servers.

4. **Extensive Application Programs:** some modern application programs like MATLAB are so computing intensive that a single computer is not able to process on such data. For such applications cloud computing is one of the solution to do efficient processing in cost effective manner.

#### 6.0 Cloud Service Models

The reference model on which the cloud computing is based is usually known as cloud service model and can be categorized into three main types:

- **Infrastructure as a Service (IaaS)**
- **Platform as a Service (PaaS)**
- **Software as a Service (SaaS)**

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

Under this service model the users has the flexibility to use lower level services like CPU clocks, Memory Allocation with operating system level control to the developers. The example of this service is Amazon EC2

- 6.2 **Platform as a Service (PaaS):**

Under this service the users can use development environment to build their own applications that can run on cloud service provider's platform that supports security, deadlock handling, transaction management, robustness, scalability and availability. The applications developed using PaaS are then offered to users as SaaS using web browsers. E.g. - Google App Engine.

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

Under this cloud service single application software can be used by number of customers using multitenant architecture. The customer can use application software without any investment in servers, software development or software licensing. The cloud service providers can use one application to serve number of users at low cost as the cost of

maintenance is very low as compared to traditional hosting. Google docs is one example of SaaS where the users can create, edit, delete and share their documents, spreadsheets or presentations whereas Google have the responsibility to maintain the software and hardware. Another example includes the online conversion of documents from one type to another like online conversion of PDF to DOCX file.

### 7.0 Security Concerns:

In order to store data in the cloud, the most important concern is the security of data. The protection of data is not only desirable during data transmission from cloud to client and vice versa but also within the service provider's storage medium. To achieve this security the service providers offer various security levels for the data stored in cloud storage medium. The security levels are based on the resources available to cloud users like availability of data, cost of operations, bandwidth, priority etc. Along with the security features, the cloud service provider should ensure data availability to the cloud users under various circumstances. The cloud service provider may provide top level security with data access controlled by password protection, encryption in storage mediums, and authorization tests to make sure that the data is accessible only by authenticated and authorized users and no one else. But this level of security will lead to data availability issue. For example if a user forgets his login credentials he might not be able to retrieve his own data and thus challenging data availability.

Another type of service provider provide relatively moderate levels of security and privacy techniques for the data stored on cloud service providers data centers but also guaranteed data availability with various vulnerabilities in some extreme threat models.

A number of cloud services have faced number of issues. For example the recent Dropbox issue that exposes user data after the update of service provider's software. Others issues arise in the cloud storage where the malicious users gain access to data stored on cloud and the users /service provider came to know about the attack after the damage was done. In some cases the protection of cloud data was entirely kept as user's responsibility but it may cause data availability issues if user forgets his login credentials.

The success of cloud service depends on how best the features of security, privacy and availability of data are integrated together. Most users don't use cloud storage due to absence of sophisticated security measures and proper recovery procedures.

### 8.0 Security Issues in Cloud Computing

The cloud computing is a great innovation in the world of computing, but the advantages do not come for free. There are various security issues associated with the cloud computing. As the biggest demand of cloud is availability, there are various concerns that must be dealt with in order to provide risk free availability of data. Some of the concerns include:

#### 8.1 Security:

As the cloud service is provided by some third party, there is always a risk to access to data by unauthorized users. In spite of security assurance from cloud vendors by providing password protected to cloud services there is always a security risk to sensitive data and any security breach would result in loss of crucial data and business secrets.

#### 8.2 Privacy:

The biggest concern about cloud computing is privacy. As the data and information management is performed by third party cloud service providers, the privacy of the data is no longer maintained as the sensitive and confidential data is handed over to third party vendors.

#### 8.3 Lock in / Dependence:

After Using cloud service from one vendor it is not easy switch from one vendor to another and hence the user becomes dependent on the vendor whose service he is using.

#### 8.4 Isolation Failure:

This is one more risk associated with the use of cloud computing that involves the failure of isolation mechanism that separates storage, memory, routing between the different tenants.

#### 8.5 MANAGEMENT INTERFACE COMPROMISE

In case of public cloud provider, the customer management interface are available only through internet .

### **8.6 INSECURE OR INCOMPLETE DATA DELETION**

Sometimes user wants to delete the data from cloud storage. There is a possibility that data will not get deleted completely due to availability of multiple copies of data in cloud system.

### **9.0 Conclusion**

The paper begins with the concept of Cloud computing and discusses the evolution of cloud

computing from grid computing and distributed computing. The paper also highlights the basic merits of cloud computing. I also give a brief introduction about types of clouds, various stakeholders of cloud computing and the need of cloud computing from various view points.

The various reasons for the requirement of cloud computing is discussed followed with the service models of cloud computing. Finally the paper includes the discussion on security concerns and security issues of cloud computing. From all this discussion we reached the conclusion that the future lies with the cloud computing, but the success of cloud computing relies entirely on how effectively the concepts of data security, privacy, integrity, reliability are integrated.

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