

# From Grid Computing to Cloud Computing & Security Issues in Cloud Computing

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**Abstract-** The cloud is a next generation platform that provides dynamic resource pools, virtualization and high availability. In starting the concept of the Distributed Computing and the Grid Computing is discussed. Then I have focused on the concept of Cloud Computing and its characteristics. This paper provides a brief introduction to the Cloud Computing platform and the services provided by it. This paper also contains some information regarding Cloud Storage. I have also given the comparison of the Cloud Computing with the Grid Computing. The prevalent problem associated with the Cloud Computing is the Cloud Security and the appropriate implementation of the Cloud over the network. I have discussed the policy, software and hardware security issues. Access Control and the use of the Digital Signature to enhance the data security of the Cloud is also discussed in this paper in short.

**Keywords-** Distributed Computing; Grid Computing; Cloud Computing; IaaS; Paas; SaaS; HaaS; StaaS; Virtualization; Security Issues

## I. INTRODUCTION

Cloud Computing is the development of parallel computing, distributed computing and the Grid computing. It works on the idea to make many normal computers together to get a super computer which can do a lot of things. Cloud computing is a new mode of business computing and it will be widely used in near future. However, there still exist many problems in cloud computing today. Data security and privacy risks have become the primary concern for people to shift to cloud computing.

## II. GRID COMPUTING

It is a form of distributed computing and refers to the use of several computers to solve a single problem at the same time. It uses networked, loosely coupled computers acting simultaneously to perform very large tasks. In Grid computing, a program is generally divided into many parts and these parts are allocated to several computers, often up to many thousands. Grid computing is used to solve scientific and technical problems which require a large amount of computing or access to large amount of data. Grid computing can be thought of as a distributed parallel processing system. Functionally, grids can be classified into computational grids and data grids. Computational Grids focus primarily on computationally intensive operations and Data Grids control sharing and management of large amount of distributed data.

### A. Characteristics of Grid Computing-

1. Grid is formed using Heterogeneous computers (different O.S. and hardware)

2. Grid is formed using Loosely coupled machines (grids are distributed in nature over a network)
3. Grid uses geographically scattered machines (not in a single location)
4. Resource handling is done by resource manager at each node as an independent unit

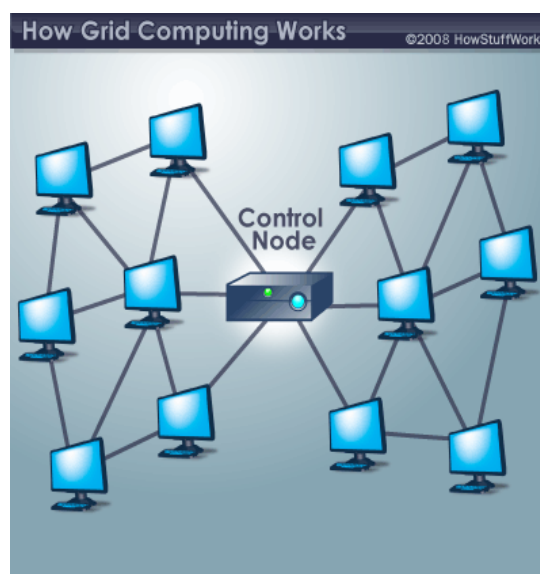


Fig. 1: Grid Computing

## III. CLOUD COMPUTING

Cloud is a virtualized pool of computing resources. It can rapidly deploy and increase workload by speedy providing physical machines or virtual machines [6]. It is used for delivering hosted services over the internet. It is a style of computing where dynamically scalable and often virtualized computing resources are provided as a service over the internet. In many cases, cloud computing services provide common business applications online that can be accessed using a web browser while storing software and data on the servers.

### A. Types of Cloud-

1. Public (External) Cloud
2. Private (Internal) Cloud
3. Hybrid (Combined) Cloud

### B. Characteristics of Cloud Computing-

1. dynamically scalable and elastic in nature
2. result of continuous evolution of data management technology
3. Users pay only for the required capacity

4. provides secure and dependable data storage center, so user need not to think about storing data and killing the viruses [4].
5. It does not need user's high level equipments, so reduces user's cost.
6. fully managed by service providers, so users need not know how the cloud runs.
7. High reliability
8. High extendibility
9. Extremely inexpensive
10. On demand service
11. Versatility
12. Virtualization

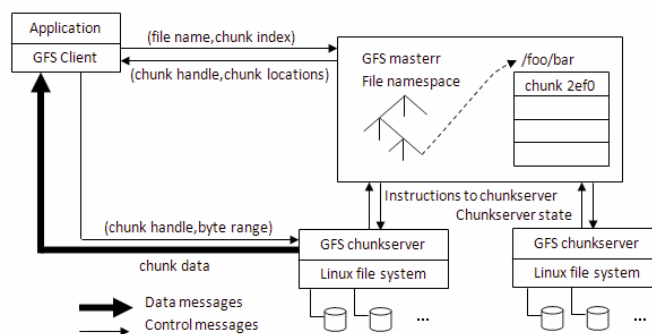


Fig. 4: Google File System architecture [1] [7]

## V. CLOUD STORAGE

It is a model of networked computer data storage where data is stored on multiple virtual servers, in general hosted by third parties, rather than being hosted on dedicated servers.

### A. Cloud storage system Architecture-

Look at the following fig to understand 'a typical cloud storage system Architecture [3]' -

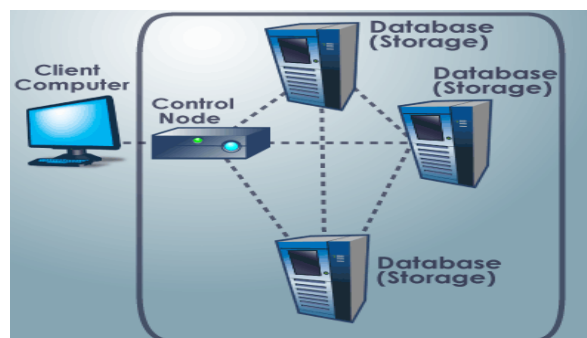


Fig. 5: A typical cloud storage system Architecture [3]

### B. Evolution of cloud storage-

To understand this evolution [3] look at the following figure 6.

## VI. SERVICES & LAYERS

### A. Services

There are mainly 3 services as mentioned below [5] :

1. *SaaS (software as a service)* - Service user can use the service from anywhere. Ex- Yahoo
2. *PaaS (platform as a service)* - Developers can create applications on the service provider's platform. Ex- Amazon web service
3. *IaaS (infrastructure as a service)* - It provides virtual server instance and block of storage on demand. Ex- GoogleApps.



## Cloud Computing

Having secure access to all your applications and data from any network device

Fig. 2: Cloud Computing

### IV. CLOUD COMPUTING EXAMPLES

1. Amazon EC2(Elastic Compute Cloud)
2. GoogleApps
3. IBM's Blue Cloud
4. Yahoo
5. Microsoft
6. Zoho
7. Mosso
8. Salesforce
9. GoGrid
10. ElasticHosts

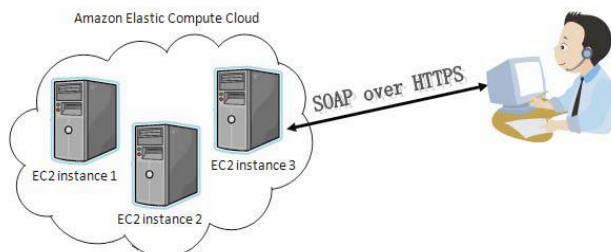


Fig. 3: Usage of Amazon Elastic Compute Cloud [1]

We can understand the technologies used in these examples, if we refer their architectures. See the above figures of Amazon EC2 and Google File System Architecture.

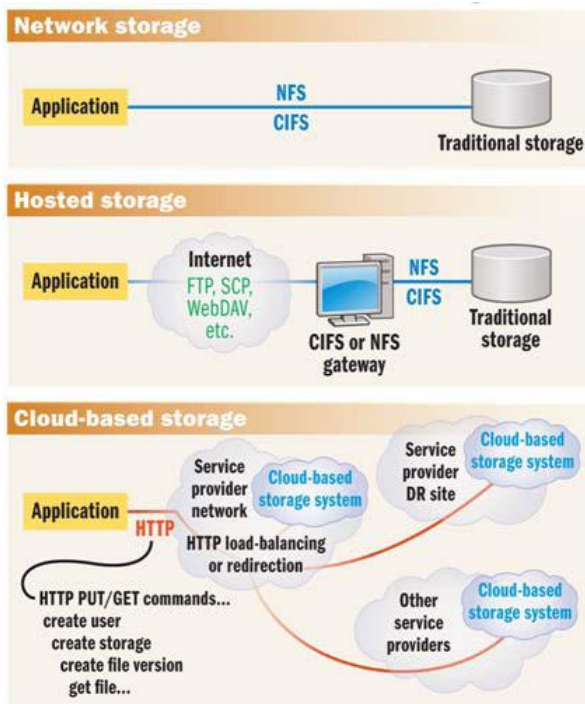


Fig. 6: evolution of cloud storage [3]

Some authors [3] [6] termed 2 more services as mentioned below:

1. *StaaS (Storage as a service)*
2. *HaaS (Hardware as a service)*

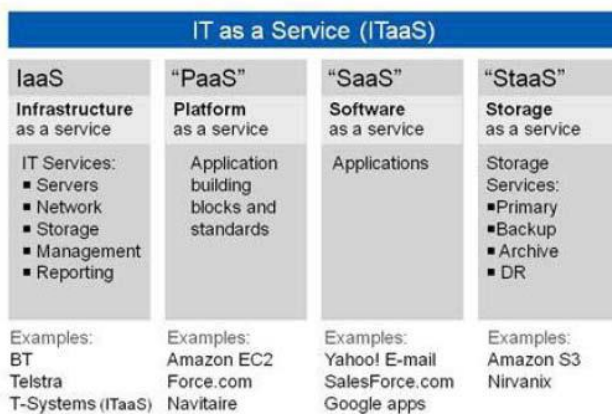


Fig. 7: Cloud Computing Services[3]

## B. Layers

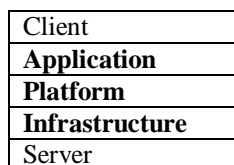


Fig. 8: Layers in Cloud Computing Model

There are 5 layers in Cloud Computing Model as discussed below:

1. *Client* : consists of software and hardware that relies on cloud computing for application delivery
2. *Application* : deliver software as a service (SaaS) over the internet.
3. *Platform* : deliver platform as a service (PaaS) over the internet.
4. *Infrastructure* : deliver infrastructure as a service (IaaS) over the internet.
5. *Server* : consists of software and hardware that are specifically designed for the delivery of cloud services.

## VII. CLOUD COMPUTING PLATFORMS

I am discussing the following 4 Cloud Computing Platforms and the comparison of these platforms for several characteristics [2] [10] –

1. Abicloud
2. EUCALYPTUS (Elastic Utility Computing Architecture for Linking Your Programs To Useful Systems)
3. Nimbus
4. Open Nebula

Table 1: The comparison of several cloud computing platforms

	Abicloud	EUCALYPT US	Nimbus	Open Nebula
Cloud Character	Public/Private	Public	Public	Private
Scalability	Scalable	Scalable	Scalable	Scalable
Cloud Form	IaaS	IaaS	IaaS	IaaS
Compatibility	Can manage EC2	Support EC2	Support EC2	Open, Multiplatform
Deployment	Pack and redeploy	Dynamical deployment	Dynamical deployment	Dynamical deployment
Deployment manner	Web interface drag	command line	command line	command line
Transplantability	Easy	common	common	common
VM Support	Xen, VMware	Xen, VMware	Xen	Xen, VMware
Web Interface	Libvirt	Web service	EC2 WSDL, WSRF	Libvirt, EC2, OCCI API
Structure	Open platform encapsulate core	Module	Light weight components	Module
Reliability	–	–	–	Rollback host and VM
O.S. Support	Linux	Linux	Linux	Linux
Development Language	C++, Python	JAVA	JAVA, Python	JAVA

## VIII. COMPARISON OF CLOUD COMPUTING & GRID COMPUTING

These two computing can be compared on the basis of their characteristics. The following table shows the comparison of these two computing.

Table 2: The comparison of Cloud and Grid Computing

Characteristic	Cloud Computing	Grid Computing
Service Oriented	Yes	Yes
Loose Coupling	Yes	Half
Strong fault tolerant	Yes	Half
Business model	Yes	No
Ease of Use	Yes	Half
TCP/IP Based	Yes	Half
High security	Half	Half
Virtualization	Yes	Half

## IX. SECURITY ISSUES

## A. Cloud Computing Issues-

There are several issues in Cloud Computing [6] [13] [14]. The main issue is the “Security Issue in cloud computing”. My main focus is on Security Issues. First of all, let us know that what are the common issues in cloud computing. Some of these cloud computing issues are given below-

1. Security
2. Privacy
3. Reliability
4. Legal Issues
5. Open source
6. Open standard
7. Compliance
8. Freedom
9. Long term viability
10. Availability and Performance
11. Data Usage
12. Sustainability and siting
13. Use by crackers

## B. Security Issues in Cloud Computing-

There are several security issues in Cloud Computing [5]. Some are given below-

## A. Policies:

- 1) *Inside Threats*- good supervision should be done for having trusted employees
- 2) *Access Control*-Digital signature can be implemented for access control.
- 3) *System Portability*- The problem of vendor lock-in should be handled. (**vendor lock-in**: If a company is dissatisfied with one cloud computing service- or if the vendor goes out of business- the firm can not easily and inexpensively transfer these services to another provider or bring it back in-house.)

## B. Software Security:

- 1) *Virtualization technology*-up to date version of virtualization product should be installed for the security reasons.
- 2) *Host Operating System*- should be up to date and secure from hackers
- 3) *Guest Operating System*- should be up to date and secure from hackers
- 4) *Data Encryption*-should be done on all the data for its safety.

## C. Physical security:

- 1) *Backup*- Either a backup plan should be provided automatically for each customer, or they can use the plans provided elsewhere in the cloud.
- 2) *Server Location*-It should be at appropriate place. Room should have adequate space and isolated. A Cooling System and Fire Suppression System should be installed there.
- 3) *Firewall*- Cloud Computing service providers should provide a complete firewall solution to their clients.

## X. CONCLUSIONS &amp; FUTURE WORK

Cloud Computing announced a low-cost super computing services to provide the possibility, while there are a large number of manufacturers behind, there is no doubt that cloud computing has a bright future. In future we can work on many issues like-

1. Security of cloud platform and data in transmission
2. Interoperation and standardization
3. Consistency guaranty
4. Continuously high availability
5. Dealt mechanisms of cluster failure in cloud environment
6. Synchronization in different clusters in cloud platform

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