International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181

Vol. 1 Issue 10, December- 2012

Cloud Computing In Distributed System

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Abstract

With the development of parallel computing, distributed computing, grid computing, a new computing model appeared. The concept of computing comes from grid, public computing and SaaS. The basic principles of cloud computing is to make the computing be assigned in a great number of distributed computers, rather than local computer or remoter server. The two key advantages of this model are ease-of-use and cost-effectiveness. Though there remain questions on aspects such as security and vendor lock-in, the benefits this model offers are many. This paper explores some of the basics of cloud computing with aim of introducing cloud computing in distributed system. The purpose of this paper is to explore key concepts and ideas surrounding the security challenges of cloud computing, with particular reference to configuration having considerable impact on securing cloud services. There are considerable benefits of cloud computing systems, however this paper will primarily focus on the limitations that have emerged through inaccurate configuration setups of both the platforms and applications, and how these might be addressed. It also will highlight some research work in the area that offers possible solutions to the identified issues in Cloud security and the future of cloud computing in India.

***Keywords*— Cloud computing, Grid computing, Cloud Architectures, Scalable web applications, SaaS, IaaS, PaaS, cloud computing analysis, Amazon EC2, AppEngine , Azure.**

1. INTRODUCTION

Distributed computing is a field of computer science that studies distributed systems.

A **Distributed System** consists of multiple autonomous computers that communicate through a computer network. The computers interact with each other in order to achieve a common goal. Distributed computing also refers to the use of distributed systems to solve computational problems. In distributed computing, a problem is divided into many tasks, each of which is solved by one or more computers. [1]

Cloud computing is often considered as merely a new application for classic distributed systems. [2]Cloud computing is a computing paradigm, where a large pool of systems are connected in private or public networks, to provide dynamically scalable infrastructure for application, data and file storage.

With the advent of this technology, the cost of computation, application hosting, content storage and delivery is reduced significantly.

Cloud computing is a practical approach to experience direct cost benefits and it has the potential to transform a data center from a capital-intensive set up to a variable priced environment. The main character of cloud computing is in the virtualization, Distribution and dynamically extendibility.

Distributional refers to the physical node which the computation uses is distributed. Dynamic expandability is refers to through the dynamic extension virtualization level, then achieves carries on the management, the expansion, the migration, the backup through the hypothesized platform, all sorts of operations will be completed through the virtualization level.

The idea of cloud computing is based on a very fundamental principal of "reusability of IT capabilities".

The difference that cloud computing brings compared to traditional concepts of "grid computing", "distributed computing", "utility computing", or "autonomic computing" is to broaden horizons across organizational boundaries.

Forrester defines cloud computing as: "A pool of abstracted, highly scalable, and managed compute infrastructure capable of hosting end-customer applications and billed by consumption." [3]

1.2 Grid vs. Cloud Computing

The term "grid computing" denotes dividing a large task into many smaller ones that run on parallel servers. [7] Wikipedia provides a vague, citation-less definition broadly describing grid computing as "a form of distributed computing whereby a 'virtual super computer' is composed of a cluster of networked, loosely coupled computers acting in concert" to carry out processor-intensive large tasks.

[8]According to IBM, the key advantage is that cloud computing not only is able to divide a large computational task into many smaller tasks to run on parallel servers, but could also support "non grid environments", such as a three-tier web site architecture (i.e. separation of presentation, application logic and database, e.g. the Model-View Controller (MVC)) that runs "standard or Web 2.0 applications". By that IBM probably stresses that large, resource intensive community websites could be built and run efficiently upon cloud architectures.

2. What is Cloud Computing?

"A Cloud is a type of parallel and distributed system consisting of a collection of interconnected and virtualized computers that are dynamically provisioned and presented as one or more unified computing resources based on service-level agreements established through negotiation between the service provider and consumers." [4]

Cloud computing is a comprehensive solution that delivers IT as a service. It is an Internet-based computing solution where shared resources are provided like electricity distributed on the electrical grid.

Computers in the cloud are configured to work together and the various applications use the collective computing power as if they are running on a single system. The flexibility of cloud computing is a function of the allocation of resources on demand.

This facilitates the use of the system's cumulative resources, negating the need to assign specific hardware to a task.

Before cloud computing, websites and server-based applications were executed on a specific system.

With the advent of cloud computing, resources are used as an aggregated virtual computer. This amalgamated configuration provides an environment where applications execute independently without regard for any particular configuration.

2.1. Cloud Computing Architecture

[12] When talking about a cloud computing system, it's helpful to divide it into two sections:

1) ***Front end***
2) ***Back end***

They connect to each other through a network, usually the Internet. The front end is the side the computer user, or client, sees. The back end is the "cloud" section of the system.

1) ***Front end***

The front end includes the client's computer (or computer network) and the application required to access the cloud computing system. Not all cloud computing systems have the same user interface. Services like Web-based e-mail programs leverage existing Web browsers like Internet Explorer or Firefox. Other systems have unique applications that provide network access to clients.

2) ***Back end***

On the back end of the system are the various computers, servers and data storage systems that create the "cloud" of computing services. In theory, a cloud computing system could include practically any computer program you can imagine, from data processing to video games. Usually, each application will have its own dedicated server.

A central server administers the system, monitoring traffic and client demands to ensure everything runs smoothly. It follows a set of rules called **protocols** and uses a special kind of software called **middleware**. Middleware allows networked computers to communicate with each other. Most of the time, servers don't run at full capacity. That means there's unused processing power going to waste. It's possible to fool a physical server into thinking it's actually multiple servers, each running with its own independent operating system. The technique is called server virtualization. By maximizing the output of individual servers, server virtualization reduces the need for more physical machines.

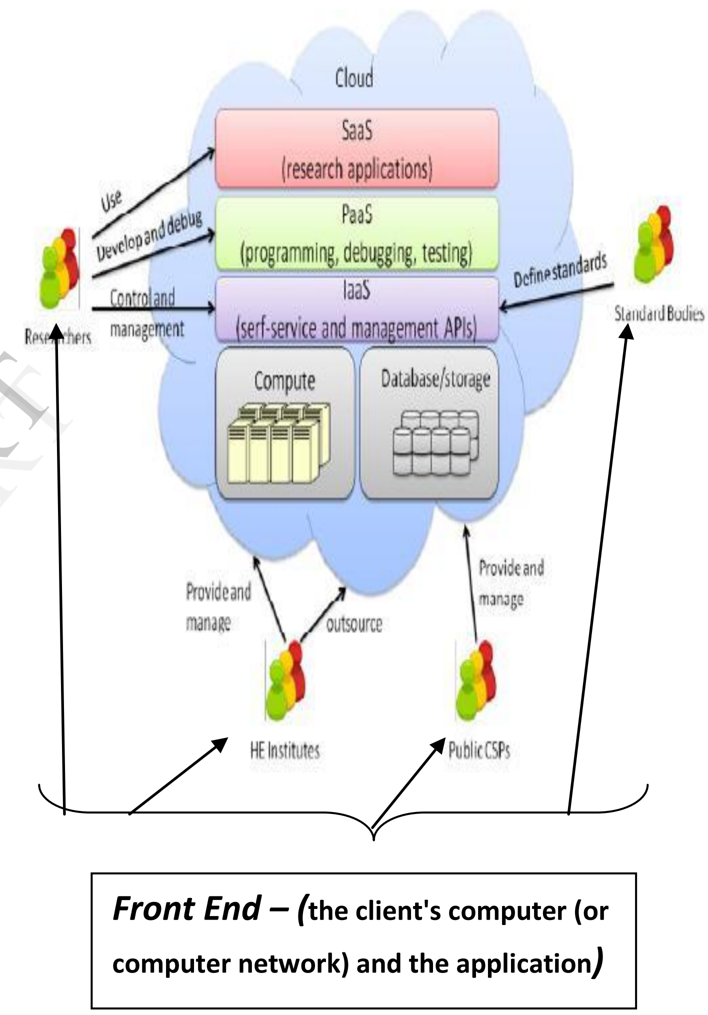

Figure 1 . Front End Of Cloud Architecture

If a cloud computing company has a lot of clients, there's likely to be a high demand for a lot of storage space. Some companies require hundreds of digital storage devices. Cloud computing systems need at least twice the number of storage devices it requires to keep all its clients' information stored. That's because these devices, like all computers, occasionally break down. A cloud computing system must make a copy of all its clients' information and store it on other devices. The copies enable the central server to access backup machines to retrieve data that otherwise would be unreachable. Making copies of data as a backup is called **redundancy**.

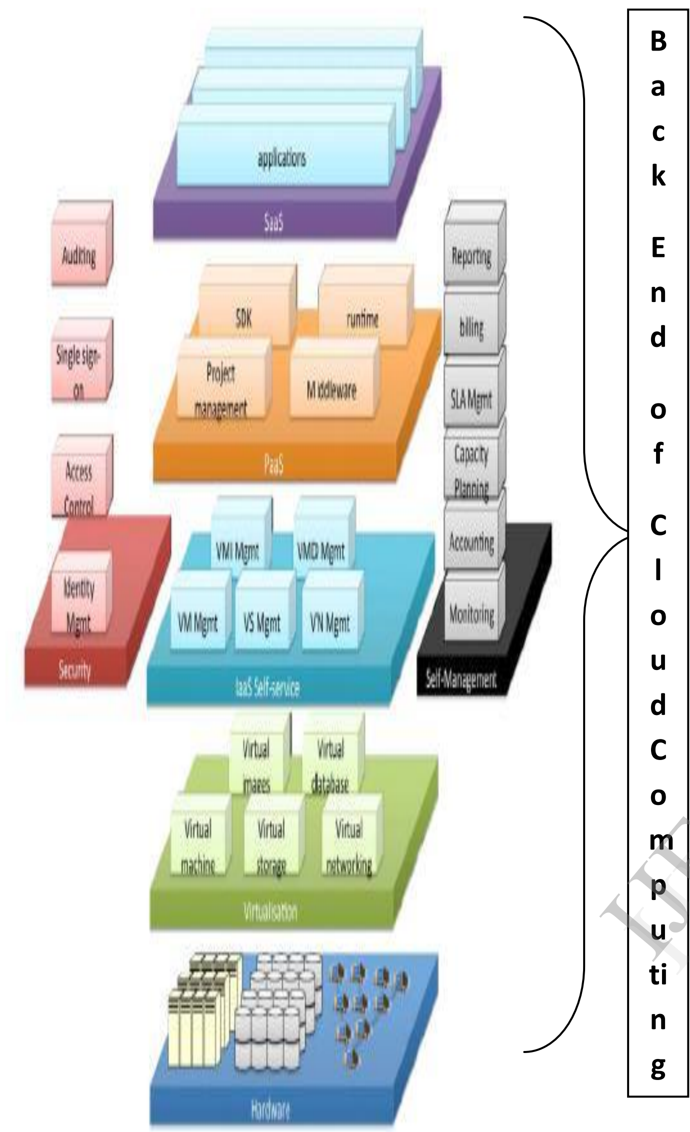

Figure 2 . Back End Of Cloud Architecture

2.2. Cloud Characteristics

Cloud computing exhibits the following key characteristics:[10]

- **Empowerment**
- **Agility**
- **Application programming interface** (API)
- **Cost**
- **Device and location independence**
- **Multi-tenancy** enables sharing of resources and costs across a large pool of users thus allowing for:
    - **Centralization**
    - **Peak-load capacity**
    - **Utilization and efficiency**
- **Reliability**
- **Scalability**
- **Performance**
- **Security**
- **Maintenance**

Cloud Computing Essential Characteristics	
Characteristic	**Definition**
On-demand self-service	The cloud provider should have the ability to automatically provision computing capabilities, such as server and network storage, as needed without requiring human interaction with each service's provider.
Broad network access	According to NIST, the cloud network should be accessible anywhere, by almost any device (e.g., smart phone, laptop, mobile devices, PDA).
Resource pooling	The provider's computing resources are pooled to serve multiple customers using a multitenant model, with different physical and virtual resources dynamically assigned and reassigned according to demand. There is a sense of location independence. The customer generally has no control or knowledge over the exact location of the provided resources. However, he/she may be able to specify location at a higher level of abstraction (e.g., country, region or data center). Examples of resources include storage, processing, memory, network bandwidth and virtual machines.
Rapid elasticity	Capabilities can be rapidly and elastically provisioned, in many cases automatically, to scale out quickly and rapidly released to scale in quickly. To the customer, the capabilities available for provisioning often appear to be unlimited and can be purchased in any quantity at any time.
Measured service	Cloud systems automatically control and optimize resource use by leveraging a metering capability (e.g., storage, processing, bandwidth and active user accounts). Resource usage can be monitored, controlled and reported, providing transparency for both the provider and customer of the utilized service.

Table 1. Cloud Characteristics

As can be observed in the characteristics listed in figure, there are many approaches and nuisances to cloud computing. Benefits to the enterprise, as well as risks, will vary depending on the types of service and deployment models selected.

2.3. Understanding Public & Private Cloud

[9]There are many considerations for cloud computing architects to make when moving from a standard enterprise application deployment model to one based on cloud computing. There are public and private clouds that offer complementary benefits, there are three basic service models to consider, and there is the value of open APIs versus proprietary ones.

A) Public, Private, and Hybrid clouds

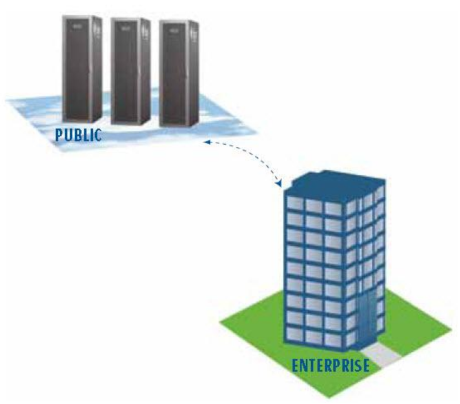

Figure 3 . Public Clouds

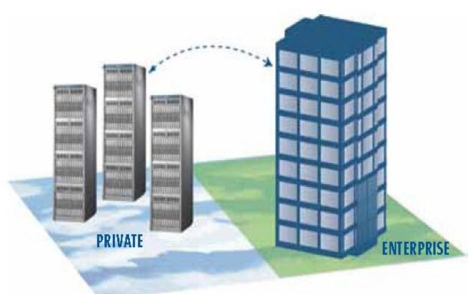

Figure 4 . Private Clouds

Figure 5 . Hybrid Clouds

Hybrid clouds combine both public and private cloud models, and they can be particularly effective when both types of cloud are located in the same facility

Cloud Computing Deployment Models		
Deployment Model	**Description of Cloud Infrastructure**	**To Be Considered**
Private cloud	• Operated solely for an organization • May be managed by the organization or a third party • May exist on-premise or off-premise	• Cloud services with minimum risk • May not provide the scalability and agility of public cloud services
Public cloud	• Made available to the general public or a large industry group • Owned by an organization selling cloud services	• Same as private cloud, plus: • Data may be stored with the data of competitors. • Data may be stored in unknown locations and may not be easily retrievable.
Hybrid cloud	A composition of two or more clouds (private or public) that remain unique entities but are bound together by standardized or proprietary technology that enables data and application portability (e.g., cloud bursting for load balancing between clouds)	• Aggregate risk of merging different deployment models • Classification and labelling of data will be beneficial to the security manager to ensure that data are assigned to the correct cloud type.

Cloud Computing Service Models		
Service Model	**Definition**	**To Be Considered**
Infrastructure as a Service (IaaS)	Capability to provision processing, storage, networks and other fundamental computing resources, offering the customer the ability to deploy and run arbitrary software,which can include operating systems and applications. IaaS puts these IT operations into the hands of a third party.	Options to minimize the impact if the cloud provider has a service interruption
Platform as a Service (PaaS)	Capability to deploy onto the cloud infrastructure customer-created or acquired applications created using programming languages and tools supported by the provider	• Availability • Confidentiality • Privacy and legal liability in the event of a security breach (as databases housing sensitive information will now be hosted offsite) • Data ownership • Concerns around e-discovery
Software as a Service (SaaS)	Capability to use the provider's applications running on cloud infrastructure. The applications are accessible from various client devices through a thin client interface such as a web browser (e.g., web-based e-mail).	• Who owns the applications? •Where do the applications reside?

Table 3: Cloud Computing Service Models Considerations

	Amazon Web Services	Microsoft Azure	Google AppEngine
Computation model (VM)	• x86 Instruction Set Architecture (ISA) via Xen VM. • Computation elasticity Allows scalability, but developer must build the machinery, or third party VAR such as RightScale must provide it.	• Microsoft Common Language Runtime (CLR) VM; common intermediate form executed in managed environment. • Machines are provisioned based on declarative descriptions (e.g. which "roles" can be replicated); automatic load balancing.	• Predefined application structure and framework; programmer-provided "handlers" written in Python, all persistent state stored in MegaStore (outside Python code). • Automatic scaling up and down of computation and storage;network and server failover; all consistent with 3-tier Web app structure
Storage model	• Range of models from block store (EBS) to augmented key/blob store (SimpleDB). • Automatic scaling varies from no scaling or sharing (EBS) to fully automatic (SimpleDB, S3), depending on which model used. • Consistency guarantees vary widely depending on which model used. • APIs vary from standardized (EBS) to proprietary.	• SQL Data Services (restricted view of SQL Server). • Azure storage service.	• Megastore/Big Table
Networking Model	• Declarative specification of IPlevel topology; internal placement details concealed. • Security Groups enable restricting which nodes may communicate. • Availability zones provide abstraction of independent network failure. • Elastic IP addresses provide persistently routable network name.	• Automatic based on programmer's declarative descriptions of app components (roles).	• Fixed topology to accommodate 3-tier Web app Structure. • Scaling up and down is automatic and programmer-invisible.

Table 4: Examples of Cloud Computing vendors and how each provides virtualized resources (computation, storage, networking) and ensures scalability and high availability of the resources[11]

3. Objective

The main purpose of our paper is to present a basic framework and determine benefits from Cloud Computing as an alternative to conventional IT infrastructure, such as privately owned and managed IT hardware. Our effort is motivated by the rise of Cloud Computing providers and the question when it is profitable for a business to use hardware resources in the Cloud". More and more companies already embrace Cloud Computing services as part of their IT infrastructure. With our work we want to give an overview of economic and technical aspects of Cloud Computing that must be taken into the consideration while switching to Cloud. With this paper we have tried to find out the security issues and obstacles in the cloud and appropriate solutions for obstacles. Our purpose to this paper is to represent the Challenges and issues to be considered when switching to virtual cloud in IT industry.

4. Challenges

4.1. Current View

Critics argue that cloud computing is not secure enough because data leaves companies' local area networks. It is up to the clients to decide the vendors, depending on how willing they are to implement secure policies and be subject to 3rd party verifications. Salesforce, Amazon and Google are currently providing such services, charging clients using an on-demand policy.

[5]References statistics that suggest one third of breaches are due to laptops falling in the wrong hands and about 16% due to stolen items by employees. Storing the data in the cloud can prevent these issues altogether.

Moreover, vendors can update application/OS/middleware security patches faster because of higher availability of staff and resources.

According to cloud vendors, most thefts occur when users with authorized access do not handle data appropriately. Upon a logout from the cloud session, the browser may be configured to delete data automatically and log files on the vendor side indicate which user accessed what data. This approach may be deemed safer that storing data on the client side.

There are some applications for which cloud computing is the best option. One example is the New York Times using Amazon's cloud service to generate PDF documents of several-decade old articles. The estimated time for doing the task on the Times' servers was 14 years, whereas the cloud provided the answer in one day for a couple hundred dollars. [6] However, the profile of the companies that currently use the cloud technology includes Web 2.0 start-ups that want to minimize material cost, application developers that want to enable their software as a service or enterprises that are exploring the cloud with trivial applications.

The fact that cloud computing is not used for all of its potential is due to a variety of concerns.

4.2. Cloud Computing Deployment Challenges

Challenges that cloud computing currently faces in being deployed on a large enterprise scale:[26]

Self-healing
SLA-driven
Multi-tenancy
Service-oriented
Virtualized
Linearly scalable
Data management

4.3. Cloud Computing Security Issues

It's identified seven issues that need to be addressed before enterprises consider switching to the cloud computing model. They are as follows:[26]

- *Privileged user access*
- *Regulatory compliance*
- *Data location*
- *Data segregation*
- *Recovery*
- *Investigative support*
- *Long-term viability*

5. Potential Benefits of Cloud Computing

While the promise of financial savings is a very attractive enticement for cloud computing, quite possibly the cloud's best opportunity is for enterprises to streamline processes and increase innovation. It enables increasing productivity and transforming business processes through means that were prohibitively expensive before the cloud. Organizations can focus on their core business, rather than be concerned about scalability of infrastructure. Solving peak business demands for performance can be readily met by using cloud computing—translating into more reliable backup, more satisfied customers, increased scalability and even higher margins.

Some of the key business benefits offered by the cloud include:

- **Cost containment**.
- **Immediacy**
- **Availability**
- **Scalability**
- **Efficiency**
- **Resiliency**

6. References

[1]http://en.wikipedia.org/wiki/Distributed_computing
[2]http://www.usenix.org/event/hotcloud10/tech/full_papers/WangH.pdf
[3]www.thbs.com/pdfs/Cloud-Computing-Overview.pdf
[4] Buyya R., Yeo C.S., Venugopal S.; Market-Oriented Cloud Computing: Vision, Hype, and Reality for Delivering IT Services as Computing Utilities, Keynote Paper, Proceedings of the 10th IEEE International Conference on High Performance Computing and Communications, Sept. 25-27, 2008, Dalian, China.
[5]Elinor Mills, "Cloud Computing Security Forecast: Clear Skies", 2009 http://news.zdnet.com/2100-9595_22-264312.html
[6]Neil Wienberg, "Cloudy picture for cloud computing",2008 http://www.networkworld.com/news/2008/043008-interop-cloud-computing.html?ap1=rcb
[7] Boss G., Malladi P., Quan D., Legregni L., Hall H.; IBM on Cloud Computing; High Performance On-Demand Solutions, IBM;
[8] Armbrust M., Fox A. et al; Above the Clouds: A Berkeley View of Cloud Computing; http://radlab.cs.berkeley.edu/;
[9] http://www.sun.com/cloud/.
[10] http://en.wikipedia.org/wiki/Cloud_computing
[11]http://www.eecs.berkeley.edu/Pubs/TechRpts/2009/EECS-2009-28.pdf
[12]http://computer.howstuffworks.com/cloud-computing/cloud-computing2.htm
[13]STERN, A. Update From Amazon Regarding Friday's S3 Downtime. CenterNetworks (February 2008). Available from: http://www.centernetworks.com/amazon-s3-downtime-update.
[14] THE AMAZON S3 TEAM. Amazon S3 Availability Event: July 20, 2008 [online]. July 2008. Available from: http://status.aws.amazon.com/s3-20080720.html.
[15] WILSON, S. AppEngine Outage. CIO Weblog (June 2008). Available from: http://www.cio-weblog.com/50226711/appengine_outage.php.
[16] JACKSON, T. We feel your pain, and we're sorry [online]. August 2008. Available from: http://gmailblog.blogspot.com/2008/08/we-feel-your-pain-and-were-sorry.html.
[17] PAXSON, V. private communication, December 2008.
[18] BRODKIN, J. Loss of customer data spurs closure of online storage service 'The Linkup'. Network World (August 2008).

[19] TC3 Health Case Study: Amazon Web Services [online]. Available from: http://aws.amazon.com/solutions/case-studies/tc3-health/.
[20] GRAY, J., AND PATTERSON, D. ACM Queue 1, 4 (2003), 8–17.
[21] GARFINKEL, S. An Evaluation of Amazon's Grid Computing Services: EC2, S3 and SQS. Tech. Rep. TR-08-07, Harvard University, August 2007.
[22] MCCALPIN, J. Memory bandwidth and machine balance in current high performance computers. IEEE Technical Committee on Computer Architecture Newsletter (1995), 19–25.
[23] An ISACA Emerging Technology White Paper October 2009 on Cloud Computing: Business Benefits With Security, Governance and Assurance Perspectives.
[24] http://cloudcomputing.sys-con.com/node/1764445
[25] http://www.amazon.com/Success-Stories-AWS-home-page/b/ref=sc_fe_l_1?ie=UTF8&node=182241011&no=3440661
[26] http://www.cs.wustl.edu/~jain/cse571-09/ftp/cloud.pdf
[27] http://www.coderun.com