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# Cloud Computing: The Technology for Next Generation

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## ABSTRACT

Cloud computing is increasingly becoming popular model for the next generation internet in which computational resources are made available online to the user on demand. Cloud computing is based on the concept of sharing computer resources online without worrying about owning the infrastructure, software or the service. The users can access anything from anywhere with the power of cloud internet. The cloud infrastructure uses the concept of virtualization and delivery of IT capabilities "as a service" to the needed clients. The virtualization makes an abstraction of the physical infrastructure and it appears as it's available as a software component for network users. The existence of rich data centre's and powerful servers has benefited small enterprises in becoming large organizations. The cloud network is the successor of GRID computing and peer-to-peer computing. However despite the fact that cloud presents huge amount of scalability and performance, the technology is still in its infancy. A lot of research is being done in this field in order to improve state-of-the-art infrastructure, better security and performance metrics. The paper makes a comprehensive study of the motivational factors for embracing cloud architecture and reviews various cloud deployment and service models. The paper also addresses issues related to availability, security and privacy in deploying this type of architecture.

**Keywords:** Cloud Computing, Data Centre's, Virtualization, Servers, GRID computing

## 1. INTRODUCTION

The term cloud is used as a metaphor for "the internet"; therefore cloud computing usually refers to internet based computing. In recent years of technological development, there has been increase in the amount of computing and networking resources. Cloud computing is the new technological wave implemented to facilitate large scale, on demand flexible computing infrastructures, software, data access and storage. Cloud provides an inexpensive means of accessing remote resources. Many universities LMS (learning management system) is based on cloud technologies especially for SaaS (software as a service).The idea is to expand functionality to infrastructure and platform (IaaS and PaaS).The internet is growing rapidly with constant pace as new computing applications are coming into the market. Since the idea of internet is "sharing of information", but today it's also used as a medium for sharing of computing resources. The next generation internet should be robust enough to overcome the scalability, flexibility, resilience and security bottlenecks of current network and service architectures, so that there is a provision for large opportunities and services, which can be adapted by business organizations for the utilization of IT resources [1].A number of computing environments and paradigms have emerged in the last decade, exploiting technological advances in networked computing environments e.g. Peer to Peer Networks, GRID computing and now most recently cloud computing[2].

Figure-1 below shows the evolution of cloud computing from various computing technologies

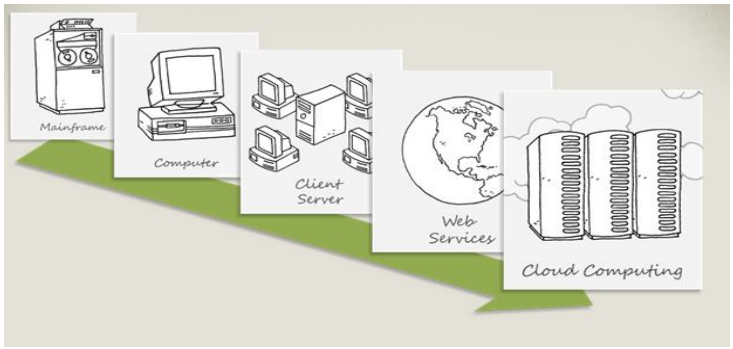


**Figure 1**: Evolution of Cloud Computing

Cloud computing is a new infrastructure deployment environment[3],[4],[5] that delivers the promise of supporting on demand services like computation, software package and knowledge access in an exceedingly versatile manner by scheduling bandwidth, storage and computing resources on the fly without requiring end user knowledge of physical location and system configuration that delivers the service. According to the definition put forward by NIST (National Institute of Standards and Technology) [6], "*Cloud computing is a model for enabling convenient, on demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction*". Cloud computing is based on virtualized computation of

power and storage delivered via platform unknown infrastructures of abstract hardware and software and accessed over the internet.
The creation of virtual environment (virtualization), i.e. abstraction of hardware, software, a storage device or network resources paves a way for reducing energy and hardware costs through server consolidation. Adding to it, virtualization can also optimize resource sharing among various applications hosted on different virtual machines.

## 2. CLOUD ARCHITECTURE

Cloud architecture refers to the combination of components and subcomponents required for cloud computing [7].These usually consists of front end user interface (mobile devices, PDA's, Thin and Fat clients), back end players (servers, storage devices), a cloud based delivery system and a network. The cloud offers number of services that are provided to the user over a network on a leased basis and with the ability to improvise or scale down their service requirements. Usually cloud computing services are delivered by a third party organization that owns the whole infrastructure. Below are discussed the two basic cloud models

- Cloud Service Model
- Cloud Deployment Model

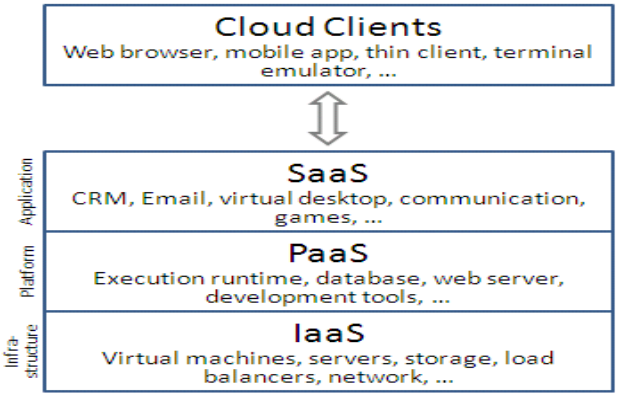


**Figure 2** : Cloud Service Models [7]

### 2.1 Cloud Service Model

In the service model, cloud architecture is viewed as medium for delivery of computing services across the internet to number of external clients [9].Cloud computing[10] provides different infrastructure levels which include three services: "IaaS","SaaS","PaaS" as shown in figure 2 above:

1) IaaS (Infrastructure as a service) model:

The idea behind this model is the creation of virtual environment where the user has a virtual desktop or virtual machine and consumes resources like network storage, load balancers, server time, routers, firewalls and network bandwidth etc.The resource usage fees are calculated as per hour basis for CPU utilization, data stored, network bandwidth consumed, infrastructure usage and other value added services. Examples: Storage services provided by AmazonS3, Amazon EBS, Google Compute Engine (GCE), Computation services: AmazonEC2, Layered tech etc.

2) PaaS (Platform as a service) model:

It plays the role of providing the runtime environment, a framework for software deployment, a programming language execution environment, a database or a web server or program development tools to enable direct deployment of applications over the web. PaaS provides a platform where generally, software can be developed, tested and then possibly deployed. The entire software development life cycle is carried on PaaS. This cloud service model is dedicated to application developers, software testers and all those people involved in the software development process. Examples: Google App Engine (GAE), Microsoft Azure, IBM Smart Cloud, Force.com, Engine Yard, Mendix, Open Shift, Amazon EC2, salesforce.com and jelastic.com.

3) SaaS (Software as a Service) model:

It's a service model in which users are provided access to application software and databases and consume these services directly over the network on demand basis. In this model, the providers of the cloud have installed applications and operate application software in the cloud only and cloud users access that software from that cloud. The Cloud users are unaware of the cloud infrastructure and they do not manage the platform where the application runs. The users need not to install and run the application on their own computers which simplify maintenance and support. Example: Gmail-a mail application provided by Google implements cloud's SaaS model, Google docs, Google apps, Microsoft office 365 etc.

### 2.2 Cloud deployment Model

The cloud deployment models are categorized into four types as shown in figure 3 below[7]:

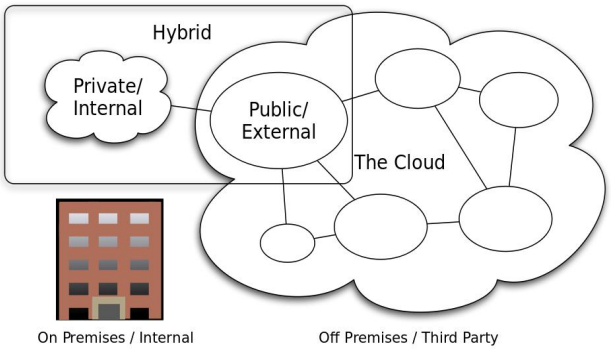


**Figure 3**: Cloud Deployment Model [7]

1) Public/External Cloud:

This model allows the cloud infrastructure to be made available to the public and is open to access. It is generally owned by the organization offering cloud services.

2) Private/Internal Cloud

This cloud infrastructure is solely meant for the organization's own use. Its build to provide services within the organization. It may be owned by the organization or a third party that offers services to the organization.

3) Hybrid Cloud/Virtual Private Cloud

This model is a combination of private and public clouds where the computing environment and infrastructure is hosted and managed by third party but some resources are privately used within the organization itself.

4) Community Cloud

It is a computing environment which is managed by number of related organizations with similar motives and goals

## 3. MOTIVATING FACTORS AND ISSUES IN CLOUD COMPUTING

In cloud computing the role of service providers is divided into infrastructure providers who lease resources and manage cloud platforms and service providers who use rented resources from one or many infrastructure providers to serve number of end users [12]. The growth and development of cloud has tremendous impact on technology industry and many companies like Google, IBM and Amazon have already embraced this platform. In fact cloud computing provides features that are compelling to business owners. Participation of various factors for encouraging the adoption of cloud computing are listed below:

***Scalability/On demand self service:*** Cloud computing can scale up or shrink down according to the size of business level. For example, a service infrastructure provider can easily enlarge its service to larger dimensions in order to handle rapid increase in service demands (e.g., flash-crowd effect). This model is sometimes called surge computing [14]. There is only a need to pay for the module we use. There is a large pool of resources from data centres available for a user.

***No up-front investment*:** Cloud computing is based on pay-per-use pricing model. A service provider doesn't need to invest in the infrastructure but simply rents resources from the cloud according to its own needs and pay for the usage.

***Lowering the operating cost*:** Resources in a cloud environment can be rapidly allocated and de-allocated on demand. Hence, a service provider no longer needs to keep provision capacities according to the peak load. This provides huge savings since resources can be released to save on operating costs when service demand is low.

***Easy access*:** Services hosted in the cloud are generally web-based applications. Therefore, they can be easily accessed through a variety of devices with Internet connections. These not only include desktop and laptop computers, but also cell phones and PDAs.

***Reducing business risks and maintenance expenses*:** By outsourcing the service infrastructure to the clouds, a service provider shifts its business risks (such as hardware failures) to infrastructure providers, who often have better expertise and are better equipped for managing these risks.

As we know, adopting cloud computing has numerous motivating factors but there is still long way for cloud computing to prove itself according to the organization's trust level. There are various reasons that warns us for the adoption of cloud computing.

***Security***

Security issue has played a pivotal role in embracing Cloud computing architecture. Various security issues, possible in cloud computing are: data availability, data integrity, confidentiality, data access, data segregation, privacy policies, recovery, accountability, multi-tenancy issues and so on. The Solution to varied cloud security problems vary through cryptographic techniques particularly public key infrastructure (PKI), use of multiple cloud service providers, standardization of APIs, enhancing virtual machines and legal support.

***Difficult to migrate***

It's not quite easy to shift the applications from an enterprise to cloud computing environment or even within different cloud computing platforms because different cloud service providers support different application architectures which are also dissimilar from enterprise application architectures.

***Internet dependency – performance and availability***

Cloud services depend fully on the availability, bandwidth, speed, quality and performance of internet as it works as carrier in between consumer and service provider.

***Downtime and service level***

The business world is marked with downtime and is common concern because every minute of application downtime is minute in which important business application can't be performed which degrades the performance of organization as well its repute also. Scalability is the best solution to increasing and maintaining application performance in cloud computing environments. But one of the main technical challenge of cloud environment is vertical scalability (Scale

up) because in cloud environment elastic scalability is not only currently restricted to horizontal scaling (Scale out), but its also inefficient as it tends to resource over usage due to limited scale down capabilities and full replication of instances rather than only of essential parts. Horizontal scaling is implemented through the addition of more machines or devices to the computing platform to handle the increased load. Vertical Scaling is ability to scale the size of a server i.e. in this scaling the size of server is scaled either by resizing the server or by replacing that server to bigger one. Vertical scaling can handle most sudden peaks in application demand on cloud infrastructures. Traditionally, most businesses have best served by using vertical scaling methods as long as possible and then scaling individual parts of application horizontally but in Cloud environment the scenario is changed and most businesses firstly served by using horizontally because the most common operating systems do not support on-the-fly (without rebooting) changes on the available CPU or memory to support this ―vertical scaling. Vertical scaling typically involves making significant changes to a server's core configuration. Therefore, it's better to perform such changes manually and when try to set up scalable server arrays for (horizontal) auto scaling purposes, and then cannot change an existing server's configuration. When horizontal scaling is combined together with vertical scaling, it ends up with an infrastructure that makes the most efficient use of computing resources.

## 4. CONCLUSION

Cloud computing have several benefits over non- cloud environment and has capability to handle most sudden peaks in application demand on cloud infrastructures. Virtualization technology provides smart support to attain aim of cloud computing like higher resource utilization, elasticity, reducing IT capital expenditure to handle temporary loads as well as cloud computing offers flexible service and versatile deployment models which is also one of the main issue of adopting this paradigm. Virtualization ideas have open shared nature that is liable for the violation of security polices and laws as well as degrades their computing repute and performance. So there is need to target on privacy and on solutions of varied security issues to take care of the trust level of organization for deploying the cloud computing without any hesitation and additionally need of technical support for elastic measurability to serve by vertical scaling approach that is currently restricted to solely horizontal scaling.

## REFERENCES


[1]. Onur, E., et al."Intelligent end-to-end resource virtualization using service oriented architecture" *Proceedings of IEEE GLOBECOM workshops*. 2009.

[2]. Buyya, Rajkumar. "Market-oriented cloud computing: Vision, hype, and reality of delivering computing as the 5th utility." *ChinaGrid Annual Conference, 2009. ChinaGrid'09. Fourth*. IEEE, 2009.

[3]. Knorr, Eric, and Galen Gruman. "What cloud computing really means."*InfoWorld* 7 (2008).

[4]. Buyya, Rajkumar, et al. "Cloud computing and emerging IT platforms: Vision, hype, and reality for delivering computing as the 5th utility." *Future Generation computer systems* 25.6 (2009): 599-616.

[5]. Braun, C., et al. "Cloud Computing, Web-based Dynamic IT-Services." (2010).

[6]. Peter Mell and Tim Grance,The NIST Definition of Cloud Computing, NIST Report, July 2009.

[7]. http://en.wikipedia.org/wiki/Cloud_computing_architecture

[8]. http://computer.howstuffworks.com/cloud-computing/cloud-computing1.htm

[9]. Thepparat, Theera, Amnart Harnprasarnkit, Douanghatai Thippayawong, Veera Boonjing, and Pisit Chanvarasuth."A Virtualization Approach to Auto-Scaling Problem." In *ITNG*, pp. 169-173. 2011.

[10]. Zhang, Liang-Jie, Carl K. Chang, Ephraim Feig, and Robert Grossman. "Business Cloud: Bringing The Power of SOA and Cloud Computing." In *IEEE International Conference on Services Computing (SCC 2008)*. 2008.

[11]. Jangra, Ajay, and Renu Bala. "Spectrum Of Cloud Computing Architecture: Adoption And Avoidance Issues." *International Journal of Computing and Business Research* 2 (2011).

[12]. Zhang, Qi, Lu Cheng, and Raouf Boutaba. "Cloud computing: state-of-the-art and research challenges." *Journal of Internet Services and Applications* 1.1 (2010): 7-18.

[13]. Buyya, Rajkumar, James Broberg, and Andrzej M. Goscinski, eds. *Cloud computing: Principles and paradigms*. Vol. 87. John Wiley & Sons, 2010.

[14]. Armbrust M et al (2009) Above the clouds: a Berkeley view of cloud computing. UC Berkeley Technical Report