



CLOUD COMPUTING: AN OVERVIEW

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Abstract: Cloud computing is a relatively new term, it refers to a new way of processing and storing information this new style of processing promises to offer a huge amount of computing power to its users without requiring them to invest in expensive hardware. This paper is a brief survey based on readings on cloud computing, it will provide an overview of the basic concepts, definitions, and outlines of the general architecture of this technology.

Keywords: Cloud Computing, Grid Computing, Distributed Computing, IaaS, PaaS, SaaS

I. INTRODUCTION:

Cloud is the symbol used by network engineers to represent the internet in their network diagrams. In Cloud computing the computation is done over the internet (in the cloud), hence the name *Cloud Computing*. It is a new style of computing where the processing power, storage capacity, applications, and other computing resources are moved from user desktops to data centers on the Internet. End users can access the cloud using any internet enabled device. Cloud computing promises to offer infinite, cheap, and scalable computing resources available on demand to users over the network.

Cloud computing is considered to be the fifth generation of computing after mainframe computing, personal computing, client-server computing, and the Web. Cloud computing is the product of merging three major computing concepts: virtualization, utility computing, and grid computing.

Google Apps is one of the best examples of cloud computing where users can access software tools hosted on Google's data centers by using any connected device with a web browser or a mobile application.

II. WHAT IS CLOUD COMPUTING?

The National Institute of Standards and Technology (NIST) defines cloud computing as “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”[1].

A. *The ESSENTIAL CHARACTERISTICS of CLOUD COMPUTING:*

1) *On Demand Self-Service:*

Consumers can activate and deactivate cloud services automatically based on their needs without any human interaction by the service provider.

2) *Broad Network Access:*

Consumers can access all Cloud services by using any internet connected device.

Resources are accessed over the network by devices like desktops, laptops, PDAs, and smart phones.

3) *Resource Pooling:*

Resource pooling allows service providers to pool computing resources like: storage, processing, memory, network, bandwidth, and virtual machines together to dynamically provide service to consumers based on their level of demands.

4) *Rapid Elasticity:*

Based on their needs consumers can scale the provided service up or down, they view the resources offered by the service provider as infinite and can be purchased at any time.

5) *Measured Service:*

Consumers pay only for resources they use (pay per use), therefore they are charged on their usage of a combination of computing power, bandwidth use and storage.



B. CLOUD COMPUTING SERVICE MODELS:

1) *Infrastructure as a Service (IaaS):*

In IaaS the consumer is renting processing power, storage, networks, and other fundamental computing resources where the consumer is able to deploy and run arbitrary software, including operating systems and applications. The consumer has control over operating system, storage, deployed applications, and possibly limited control of select networking components (e.g. host firewall).

2) *Platform as a Service (PaaS):*

PaaS provides cloud infrastructure (IaaS) with an installed operating system which allows the consumer to directly deploy applications created using programming languages and tools supported by the provider. The consumer does not manage or control the underlying cloud infrastructure including network, servers, operating systems, or storage, but has control over the deployed applications and possibly application hosting environment configurations.

3) *Software as a Service (SaaS) :*

In this service model the consumer gets to use the provider's applications running on a cloud infrastructure. The applications usually accessed by web browser (e.g. web-based email). The consumer has a limited control over user specific application configuration settings only.

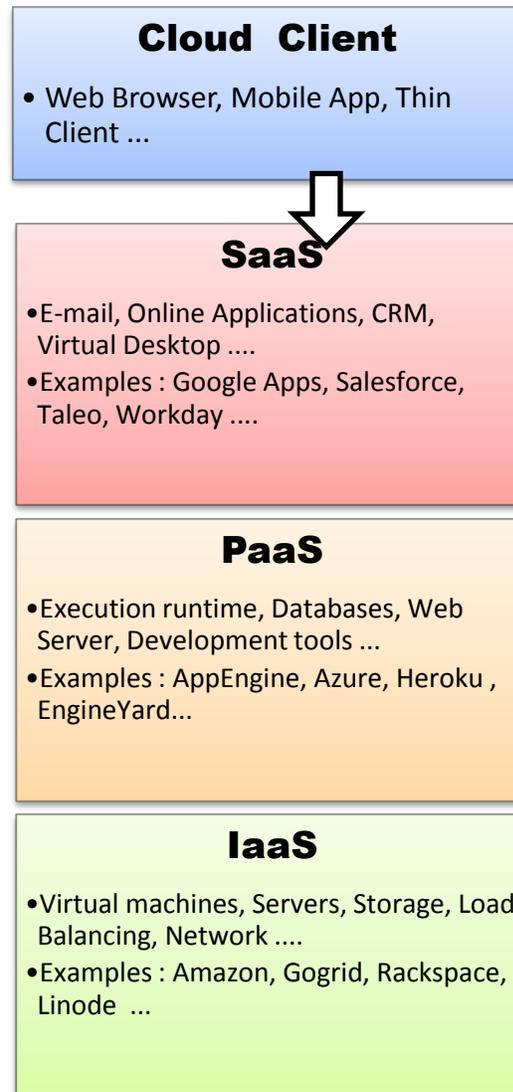


Fig. 1 Cloud Computing service models

C. CLOUD COMPUTING DEPLOYMENT MODELS:

Based on their deployment and usage cloud computing environments can be classified into 4 types *Advantages*

1) *Public clouds:*

Public or external cloud is a cloud owned and managed by a cloud service provider and can be used by the general public. A public cloud runs application from different customers sharing the infrastructure and pay for the service on pay-per-use basis.

- Public clouds allow organizations to deliver scalable and reliable applications.
- Allows organizations to develop and deploy low cost enterprise applications.

Limitations

- The main concerns of public clouds are data security and privacy.



2) *Private Clouds:*

Private or internal clouds are owned, controlled and operated by one organization. It is built by the IT staff of the organization to optimize utilization of infrastructure resources. This cloud computing environment resides within the boundaries of an organization and is used exclusively for the organization's benefits.

Advantages

- Organizations can use private clouds to improve average server utilization and provide higher efficiency from low-cost hardware.
- Reducing administrative overheads and costs with operation automation.

Limitations

- Requires initial investment by the organization in buying, building and managing the clouds.

3) *Community Clouds:*

A community cloud is a cloud owned and managed by a group of organizations that have similar requirements, they share the infrastructure to grasp some of the benefits of cloud computing. The management of the cloud maybe carried by the community or by a third party and can reside on premise or off premise.

4) *Hybrid Clouds:*

A hybrid cloud is a cloud built by combining private and public clouds. By combining the two deployment models, a consumer controls some resources (private cloud) and have the other resources managed by public cloud provider. Hybrid clouds allow organizations to maintain control over crucial applications and data while having the scalability and low costs of a public cloud.

III. THE BENEFITS OF CLOUD COMPUTING:

A. REDUCED COSTS.

Cloud computing allows consumers to rent IT infrastructure instead of purchasing it, which will reduce the cost of obtaining, supplying, and supporting required computing power. Cloud computing bills consumers based on their usage of the service which further reduce costs.

B. MOBILITY.

Cloud computing enables users to access their cloud systems using a web browser regardless of the location or type of device they use.

C. SCALABILITY.

To the consumer the cloud is infinitely scalable, this means that an organization can change and scale the level of cloud service it is receiving. Cloud computing allows IT infrastructures to be automatically and rapidly scaled up or down by consumers without requiring them to purchase expensive hardware equipment.

D. AUTOMATION.

Cloud computing reduces the load on IT staff since the administration is carried out by the cloud service provider.

E. COLLABORATION.

The cloud offers an environment where developers can publish software-based services that improve collaboration between users and simplifies information sharing.

F. FLEXIBILITY.

In the Cloud software services are offered as building blocks, consumers can pick and select the software blocks they need, organization can customize enterprise applications by just selecting those software and services which is suitable for the business.

IV. ISSUES AND CHALLENGES

The decision to adapt Cloud computing is tackled by several issues and challenges. Some of the challenges can be resolved with careful planning and design. The following are some of the notable challenges.

A. NETWORK AND SERVICE AVAILABILITY

The benefits of cloud computing can only be achieved with the availability of the cloud provider service and adequate network bandwidth. Any service or network absence will disconnect the consumers off their valuable data and applications

B. DATA MIGRATION BETWEEN NONSTANDARD ENVIRONMENTS

Most cloud service providers use proprietary cloud based applications. Those proprietary applications are not interoperable which makes it very difficult for the consumers to move their data to another cloud provider or back to their in house servers.



C. ENDLESS RESOURCE

Meeting consumer resource requirements by providing them the ability of scaling resources up or down is one of the most desired cloud computing advantages. However, this feature has to be carefully implemented to prevent service failures due to insufficient resources. To prevent service failures and control the continuous increase in the allocation of resources, scaling must be limited by agreed on threshold or scaling rate.

D. DATA SECURITY AND PRIVACY

Two of the hottest issues challenging cloud computing is related to storing and securing data. In cloud computing data has to travel between user's devices and the cloud service provider datacenters, which will make it easy target for hackers. Data security and privacy must be guaranteed whether it is traveling or still (stored in the cloud). Encryption can be used to ensure data security in cloud based storage, but it is not very useful with cloud applications because data has to be decrypted inside the cloud at some point. Cloud applications can work on encrypted data without decrypting them but it would require more time and consume more resources.

V. THE FUTURE OF CLOUD COMPUTING

The majority of technology experts expect that by 2020 most people will access software applications online and share and access information through the use of remote server networks, rather than depending on tools and information housed on their personal computers to do their work. They say that cloud computing will become more dominant than the desktop in the next decade. In other words, most users will perform most computing and communicating activities through connections to servers operated by outside firms. Among the most popular cloud services now are social networking sites (the 500 million people using Facebook are being social in the cloud), webmail services like Hotmail and Yahoo mail, micro blogging and blogging services such as Twitter, video-sharing sites like YouTube, picture-sharing sites such as Flickr, document and applications sites like Google Docs, social-bookmarking sites like Delicious, business sites like eBay, and ranking, rating and commenting sites such as Yelp and TripAdvisor. Cloud computing will continue to expand because it offers many advantages, allowing users to have easy instant and

individualized access to tools and information they need, wherever they are, locatable from any networked device. Mobile phones and other "pocket" devices will continue to be driving people to cloud-based services and applications. Control over actions on the Internet will change with mass adoption of the cloud. When people store their information and applications on their own computers as they have been up till now, a certain amount of choice and control is distributed to the edges of the network. A switch to the cloud places users' data and tools behind walls owned by others, and the people in control of cloud companies may take action that constricts individual choice and restricts openness and innovation. In the future, people will generally not be able to distinguish the difference between when they are working within their local device and when they are accessing the cloud.

VI. CONCLUSION

Cloud computing is an emerging style of computing with great promises; it is expected to change and revolutionize computing as we know. Cloud computing aims to provide scalable and inexpensive on-demand computing infrastructure, which can be offered in three different level of services *IaaS*, *PaaS*, and *SaaS* and can be implemented and deployed in one of four deployment models *Public*, *Private*, *Community*, and *Hybrid clouds*. This new paradigm offers many benefits but still facing some serious issues and challenges that need to be solved in the future.

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