CLOUD COMPUTING: AN OVERVIEW

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ABSTRACT

This overview gives the basic concept, defines the terms used in the industry, and outlines the general architecture and applications of Cloud computing. It gives a summary of Cloud Computing and provides a good foundation for understanding.

Keywords: *Grid, Cloud, Computing*

1. INTRODUCTION

Cloud Computing," to put it simply, means "Internet Computing." The Internet is commonly visualized as clouds; hence the term "cloud computing" for computation done through the Internet. With Cloud Computing users can access database resources via the Internet from anywhere, for as long as they need, without worrying about any maintenance or management of actual resources. Besides, databases in cloud are very dynamic and scalable.

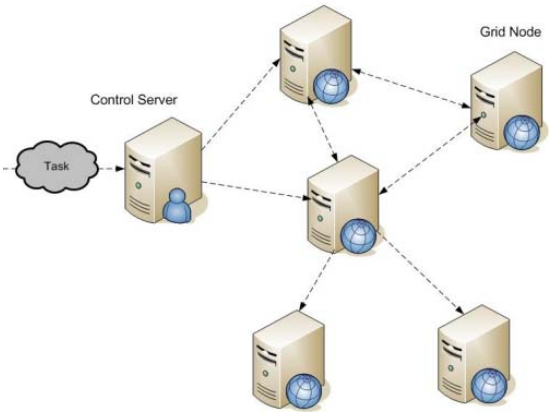
Cloud computing is unlike grid computing, utility computing, or autonomic computing. In fact, it is a very independent platform in terms of computing. The best example of cloud computing is Google Apps where any application can be accessed using a browser and it can be deployed on thousands of computer through the Internet.

2. WHAT IS CLOUD COMPUTING?

Cloud computing provides the facility to access shared resources and common infrastructure, offering services on demand over the network to perform operations that meet changing business needs. The location of physical resources and devices being accessed are typically not known to the end user. It also provides facilities for users to develop, deploy and manage their applications 'on the cloud', which entails

virtualization of resources that maintains and manages itself.

Grid Computing



Cloud Computing

Some generic examples include:

- Amazon's Elastic Computing Cloud (EC2) offering computational services that enable people to use CPU cycles without buying more computers
- Storage services such as those provided by Amazon's Simple Storage Service (S3)
- Companies like Nirvanix allowing organizations to store data and documents without adding a single on-site server
- SaaS companies like Salesforce.com delivering CRM services, so clients can manage customer information without installing specialized software

3. SOFTWARE AS A SERVICE(SAAS)

SaaS is a model of software deployment where an application is hosted as a service provided to customers across the Internet. Saas is generally used to refer to business software rather than consumer software, which falls under Web 2.0. By removing the need to install and run an application on a user's own computer it is seen as a way for businesses to get the same benefits as commercial software with smaller cost outlay. SaaS can alleviate the burden of software maintenance and support but users relinquish control over software versions and requirements. Other terms that are used in this sphere include *Platform as a Service* (PaaS) and *Infrastructure as a Service* (IaaS).

4. CLOUD STORAGE

Over time many big Internet based companies (Amazon, Google…) have come to realise that only a small amount of their data storage capacity is being used. This has led to the renting

out of space and the storage of information on remote servers or "clouds". Information is then temporarily cached on desktop computers, mobile phones or other internet-linked devices. Amazon's Amazon Elastic Compute Cloud (EC2) and Simple Storage Solution (S3) are the current best known facilities.

Data Cloud

Along with services the cloud will host data. There has been some discussion of this being a potentially useful notion possibly aligned with the Semantic Web, though it could result in data becoming undifferentiated .

5. CLOUD COMPUTING ARCHITECTURE

Cloud computing architecture, just like any other system, is categorized into two main sections: Front End and Back End. Front End can be end user or client or any application (i.e. web browser etc.) which is using cloud services. Back End is the network of servers with any computer program and data storage system. It is usually assumed that cloud contains infinite storage capacity for any software available in market. Cloud has different applications that are hosted on their own dedicated server farms.

Cloud has centralized server administration system. Centralized server administers the system, balances client supply, adjusts demands, monitors traffic and avoids congestion. This server follows protocols, commonly known as middleware. Middleware controls the communication of cloud network among them.

Cloud Architecture runs on a very important assumption, which is mostly true. The assumption is that the demand for resources is not always consistent from client to cloud. Because of this reason the servers of cloud are unable to run at their full capacity. To avoid this scenario, server virtualization technique is applied. In sever virtualization, all physical servers are virtualized and they run multiple servers with either same or different application. As one physical server acts as multiple physical servers, it curtails the need for more physical machines.

As a matter of fact, data is the most important part of cloud computing; thus, data security is the top most priority in all the data operations of cloud. Here, all the data are backed up at multiple locations. This astoundingly increases the data storage to multiple times in cloud compared with a regular system. Redundancy of data is crucial, which is a must-have attribute of cloud computing

6. CHARACTERISTICS OF CLOUD COMPUTING

Cloud computing, typically entails:

- **High scalability**

  Cloud environments enable servicing of business requirements for larger audiences, through high scalability

- **Agility**

  The cloud works in the 'distributed mode' environment. It shares resources among users and tasks, while improving efficiency and agility (responsiveness)

- **High availability and reliability**

  Availability of servers is high and more reliable as the chances of infrastructure failure are minimal

- **Multi-sharing**

  With the cloud working in a distributed and shared mode, multiple users and applications can work more efficiently with cost reductions by sharing common infrastructure

- **Services in pay-per-use mode**
  - SLAs between the provider and the user must be defined when offering services in pay per use mode. This may be based on the complexity of services offered
  - Application Programming Interfaces (APIs) may be offered to the users so they can access services on the cloud by using these APIs

- **Support for all service oriented applications**

7. COMPARISON WITH RELATED TECHNOLOGIES

Several technologies are related to cloud computing, and the cloud has emerged as a convergence of several computing trends. It seeks to address certain key aspects that may have been lacking in each of these trends, individually. The features of each of these related technologies and how they compare with cloud computing has been outlined in the table.

Types of cloud computing environments

The cloud computing environment can consist of multiple types of clouds based on their deployment and usage.

Public clouds

This environment can be used by the general public. This includes individuals, corporations and other types of organizations. Typically, public clouds are administrated by third parties or vendors over the Internet, and services are offered on pay-per-use basis. These are also called provider clouds.

Business models like SaaS (Software-as-a-Service) and public clouds complement each other and enable companies to leverage shared IT resources and services.

- **Example**

  New York Times archive project which used 100 Amazon EC2 instances and 5.5TB of S3 storage to generate PDFs of 11 million articles for the paper's archives, at a small fraction of traditional costs

- **Advantages**
  - Public clouds are widely used in the development, deployment and management of enterprise applications, at affordable costs
  - Allows organizations to deliver highly scalable and reliable applications rapidly and at more affordable costs

- **Limitations**

  Security is a significant concern in public clouds

Private clouds

This cloud computing environment resides within the boundaries of an organization and is used exclusively for the organization's benefits. These are also called internal clouds. They are built primarily by IT departments within enterprises who seek to optimize utilization of infrastructure resources within the enterprise by provisioning the infrastructure with applications using the concepts of grid and virtualization.

- **Advantages**
  - They improve average server utilization, allow usage of low-cost servers and hardware while providing higher efficiencies; thus reducing the costs that a greater number of servers would otherwise entail
  - High levels of automation, reducing operations costs and administrative overheads

- **Limitations**

  IT teams in the organization may have to invest in buying, building and managing the clouds independently

External clouds

This cloud computing environment is outside of the boundaries of the organization, though it is not necessarily a public cloud. Some external clouds make their cloud infrastructure available to specific other organizations, but not to the general public.

Hybrid clouds

This is a combination of both private (internal) and public (external) cloud computing environments.

Variations of clouds

Clouds can be classified as:

- Infrastructures
- Platforms
- Applications

8. **INFRASTRUCTURES**

- **Salient features**
  - Known also as IaaS (Infrastructure-as-a-Service), acknowledged as the most potent cloud
  - Provides access to shared resources on need basis, without revealing details like location and hardware to clients
  - Provides details like server images on demand, storage, queuing, and information about other resources, among others
  - Vendors who provide this type of service enable cloud platforms and cloud applications. Some may even leverage others within the space to provide competitive viability as well
  - Offers full control of server infrastructure, not limited specifically to applications, instances and containers
- **Example**

  Amazon's EC2, through which users can request Linux Virtual Machine instances that are created on the fly and billed based on actual usage
- **Limitations**
  - Service providers may demand higher prices for services offered
  - Issues pertaining to resource and server down time

Platforms:

- **Salient features**
  - Known also as PaaS (Platform-as-a-Service)
  - Empowers developers to deploy, deliver and manage their applications. They can build applications, upload (deploy) the same into the cloud platform and simply run and test them
  - Developers can also leverage additional benefits like authentication and data access provided by the platform
  - This cloud takes away the concept of servers, while providing an application centric environment
  - While creating this kind of cloud computing platform, a vendor "builds a cloud platform first and then develops applications that run on it" (OR) "develops a hostable application and then plugs it into the cloud". But considering the advantages and disadvantages, the latter would be the better approach
- **Limitations**

  Significant dependency on cloud infrastructure providers

Applications:

- **Salient features**

  Companies host applications on the Internet and users sign up and use them, without concerning themselves about its

maintenance and whereabouts. This is also called as SaaS (Software-as-a-Service)

- **Advantages**

  Mostly free, very easy to use, feature-rich, easy to access and promises good consumer adoption

- **Limitations**

  User can only use the application and would not know the technology leveraged to develop the application; thereby user has little control over application development

9. CONCLUSION

After so many years, Cloud Computing today is the beginning of "network based computing" over Internet in force. It is the technology of the decade and is the enabling element of two totally new computing models, the Client-Cloud computing and the Terminal-Cloud computing. These new models would create whole generations of applications and business. Our prediction is that it is the beginning to the end of the dominance of desktop computing such as that with the Windows. It is also the beginning of **a new Internet based service economy**: the Internet centric, Web based, on demand, Cloud applications and computing economy.

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