Cloud Computing - An Overview & Evolution

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ABSTRACT

The term Cloud refers to a network or Internet. Cloud is something which is present at remote location. Cloud can provide services over network i.e. on public networks or on private networks. Cloud is a huge collection of effortlessly approachable imaginary like utilities that can be used and accessed from anywhere, these operating environments and applications could be alterably re-designed to acclimate to a varying burden, permitting likewise for best environment utilization. This paper highlights the fundamentals of cloud computing in detail.

Keywords : Cloud computing, Virtualization, VMM, Cloud services, Multi-tenancy and DDoS.

I. INTRODUCTION

Cloud computing is considered to be the fifth generation of architecture in the IT world [2]. It follows-up the following architectures in the chronological order of their appearance: Mainframes (1970), Client-server (1980), Web (1990), SOA (2000) and Cloud (2010). Cloud computing known to be the revolution in computing field with implications for greater flexibility and availability with reduced cost, this being the reason cloud computing has turned out to be a giant forte and view of attention. Source of service would be, economies of scale achieved through extreme use of resources, specialization, and other efficiencies [1].

Cloud computing is definitely a very common term these days amongst emerging and developing technologies. Cloud Computing has been evolved by NIST [3] as a model designed to access network on-demand, in order to share the collection (i) of configurable computing resources that can (ii) be drastically utilized and dismissed with minimal management or service provider interaction.

Gartner's cited definition as: Cloud computing is a style of computing where adaptable and versatile information technology-empowered capacities are given as an administration to numerous outside clients utilizing Internet advances.
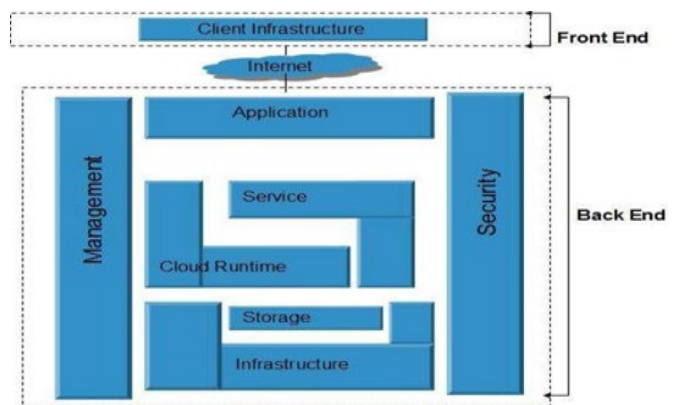

Figure 1. Basic Cloud Architecture

Cloud computing architecture as shown in figure1 comprises of many cloud components, which are loosely coupled. The cloud architecture broadly can be divided into two parts [4]:

- ✓ Front End
- ✓ Back End

Each of the ends is connected through a network, usually Internet. Front End refers to the client part of cloud computing system. It consists of interfaces and applications that are required to access the cloud computing platforms. E.g. Web Browser. Back End refers to the cloud itself. It consists of all the

resources required to provide cloud computing services. It comprises of huge data storage, virtual machines, security mechanism, services, deployment models, servers etc.

Cloud infrastructure consists of servers, storage, network, management software, and deployment software and platform virtualization. Hypervisor is a firmware or low level program that acts as a Virtual Machine Manager [6]. It allows sharing the single physical instance of cloud resources between several tenants. Management Software helps to maintain and configure the infrastructure.

Deployment software helps to deploy and integrate the application on the cloud. Network is the key component of cloud infrastructure. It allows connecting cloud services over the internet. It is also possible to deliver network as a utility over the internet i.e. the consumer can customize the network route and protocol.

Server helps to compute the resource sharing and offer other services such as resource allocation and de allocation, monitoring resources, security etc. Storage is the vital element in the cloud computing, cloud uses distributed file system for storage purpose. If one of the storage resources fails then it can be extracted from another one, which makes cloud computing more reliable.

The next section describes about the virtualization and vulnerabilities involved with cloud computing and section III explains the evolution of cloud computing in detail.

II. RESEARCH BACKGROUND

The main object-oriented principle involved with cloud computing is abstraction and this is a process in which specific details are hidden, it helps to simplify the generalization process. For example, data can be stored in an unknown location in the cloud network. It really does not matter where it actually stored on particular server. The server could be located in the next office or halfway around the world.

Cloud computing with the use of virtualization, offers several VMs (Virtual Machines) to support multi-tenancy which is one of the important features of cloud, and those VMs are controlled & managed by VMM (Virtual Machine Monitor). But at the same time virtualization poses various security challenges to the users. Thus, virtualization offers both opportunities and challenges to the cloud users [7].

Multi-tenancy in VM-based cloud infrastructures, together with the subtleties in the way physical resources are shared between guest VMs, can give rise to new sources of threats. The most serious threat is that malicious code can escape the confines of its VMM and interfere with the hypervisor or other guest VMs.

The following are the vulnerabilities in the cloud computing.

Vulnerabilities	Effects
Vulnerabilities in virtualization	Bypassing the security barriers can allow access to underlying hypervisor.
Vulnerabilities in Internet protocol	Allow network attacks like ARP spoofing, DoS/DDoS etc
Unauthorized access to management interface	An intruder can gain access control and can take advantage of services to harbor attacks. Access to administrative interface can be more critical.
Injection vulnerabilities	Unauthorized disclosure of private data behind applications.
Vulnerabilities in browsers and	Allow unauthorized service access

Vulnerabilities	Effects
APIs	

DDoS (Distributed Denial of Service) is one of the major security attacks based on virtualization. The main objective of DDoS attack is to consume large amount of server resources and avoid the server access to genuine users. It is the main threat to the availability of cloud services.

III. EVOLUTION OF CLOUD

In 1970s, IBM came out with an operating system (OS) named VM. This allowed for simultaneous operation of more than one OS. Guest Operating Systems could be run on every VM, with their own memory and other infrastructure, making it possible to share these resources [5]. This is evolved as the concept of virtualization in computing which was become popular.

In the 1990s, telecom operators implemented the virtualized private network connections, which were offered very good quality of service with point-to-point (dedicated) services at very lesser cost. This technology was helped the telecom companies to offer shared services to many users with a single physical infrastructure.

This virtualization in turn to Grid computing, which allowed major issues to be addressed via parallel computing; utility computing facilitated computing resources to be offered as a metered service and SaaS allowed subscriptions. After addressing the issues with Grid computing, Cloud computing has been emerged with these factors [5].

The three prominent types of cloud computing for businesses are Software-as-a-Service (SaaS), which requires a company to subscribe and access services over the Internet. Infrastructure-as-a-Service (IaaS), which is a solution provided by the large cloud computing companies to deliver virtual infrastructure. Platform-as-a-Service (PaaS), which enables the customers to develop the custom applications and it will be accessible across their company.

Cloud networks are classified into four types: public, private, community, and hybrid. Through public cloud, a provider can offer services with storage and applications to any user via Internet [6]. They can be provided freely or charged on a pay-per-usage method.

Public cloud services are easier to install and less expensive, as costs for application, hardware and bandwidth are borne by the provider. They are scalable, and the users avail only those services that they use.

A private cloud is referred to as also internal cloud or corporate cloud, and it called so as it offers a proprietary computing architecture through which hosted services can be provided to a restricted number of users protected by a firewall. A private cloud is used by businesses that want to wield more control over their data.

As far as the community cloud is concerned, it is a resource shared by more than one organization whose cloud needs having common requirements.

A combination of two or more clouds is a hybrid cloud. Here, the clouds used are a combination of private, public, or community.

Cloud computing is now being adopted by mobile phone users too, although there are limitations, such as storage capacity, life of battery and restricted processing power.

Some of the most popular cloud applications are Amazon Web Services (AWS), Google Compute Engine, Rackspace, Salesforce.com, IBM Cloud Managed Services. Cloud services have made it possible for small and medium businesses (SMBs) to be on par with large companies [7].

Mobile cloud computing is being harnessed by bringing into existence a new infrastructure, which is made possible by getting together mobile devices and cloud computing [5]. This infrastructure allows the cloud to execute massive tasks and store huge data, as processing of data and its storage do not take place within mobile devices.

The emergence of 4G, Worldwide Interoperability for Microwave Access (Wimax), among others, is also scaling up the connectivity of mobile devices. In addition, new technologies for mobile, such as, CSS3, Hypertext Markup Language (HTML5) hypervisor for mobile devices, Web 4.0, etc. will only power the adoption of mobile cloud computing.

Salesforce.com, started force.com in 2007. That stage as an administration let associations' engineers construct, retailer and run the sum of the applications and sites they required running their business in the cloud. Google Apps started in 2009, permitting individuals to make and store paperwork truly in the genuine cloud.

In 2010 Salesforce.com started the cloud-based database at Database.com planned for engineers, denoting the advancement of could computing administrations that might be utilized on any unit, run on practically any stage and composed in diverse modifying dialect.

IV. CONCLUSION

The main benefits of using cloud computing by companies are that they need not buy any infrastructure, thus lowering their maintenance costs. They can do away with the services used when their business demands have been met. It also gives firms comfort that they have huge resources are readily available if they suddenly acquire a major project.

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