Cloud Computing: Study & Scope

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ABSTRACT

Cloud computing is attracting great attention these days. The elastic nature of cloud makes it very much convenient for any kind of organization. Cloud computing is a means of providing numerous services on virtual machines allotted on top of a large physical machine pool that resides within the cloud. The boom in cloud computing over the last few years had gave us various innovative ideas and new technologies. Many people heard the name cloud computing but very few actually understand what cloud computing is and how it is going to give benefits to us. This paper will simply attempt to clarify these issues by giving a very simple definition of cloud computing and its scope. Cloud computing comes into focus only once we think about what It has always wanted : a way to extend capability or add totally different capabilities to the present setting on the fly without investing in new infrastructure, training new personnel or licensing in new software.

***Keywords*:-**cloud computing, deployment models, service models, cloud building blocks

INTRODUCTION

The National Institute of Standards and Technology defines cloud computing as follows: "*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. This cloud model promotes availability and is composed of various essential characteristics, three service models, and four deployment models*"[1].The term "cloud" is used as a metaphor for the Internet, based on the cloud drawing used in the past to represent the telephone network,[2] and later to depict the Internet in computer network diagrams as an abstraction of the underlying infrastructure it represents[3].

Cloud computing is internet based computing where resources, software's and information's are shared. Cloud based applications are accessed by web browsers; the data are stored in remote servers. Cloud application provider even gives better service and performance than if the software programs were installed locally on end-user computers. We can say It is highly scalable computing resources which provides external serves via the internet on a pay- as-you- go basis. Figure 1 shows how cloud environment works.

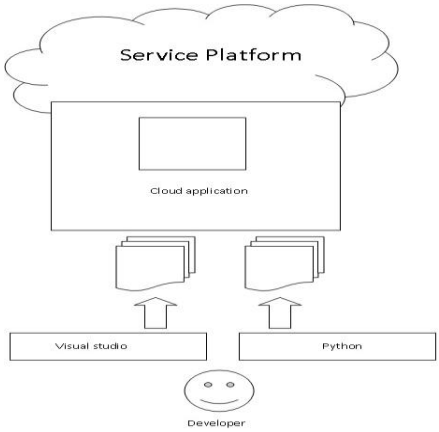

Figure1-Cloud Computing

1.1. Cloud Computing Characteristic

1. Autonomic computing — Computer systems capable of self-management [5].
2. Client–server model — *Client–server computing* refers broadly to any distributed application that distinguishes between service providers (servers) and service requesters (clients)[6].
3. Grid computing — "A form of distributed and parallel computing, whereby a 'super and virtual computer' is composed of a cluster of networked, loosely coupled computers acting in concert to perform very large tasks."
4. Mainframe computer — Powerful computers used mainly by large organizations for critical applications, typically bulk data processing such as census, industry and consumer statistics, police and secret intelligence services, enterprise resource planning, and financial transaction processing[7].
5. Utility computing — The "packaging of computing resources, such as computation and storage, as a metered service similar to a traditional public utility, such as electricity"[8][9].
6. Peer-to-peer — Distributed architecture without the need for central coordination, with participants being at the same time both suppliers and consumers of resources (in contrast to the traditional client–server model)[10].

1.2. Cloud Computing Features

Due to its various features, users want to switch from traditional computing to cloud computing. We are going to discuss some of its important features.

1) Easy to use: Cloud services are directly accessed from web browser, so no need to own, maintain hardware, software and technology. The only need is computer with internet connection.
2) Device and location independent: Cloud services are only accessed with internet, so it can be accessed from any location from any device that support web interface.
3) Economic: Because storage and other resources are used from the cloud, cost to purchase as well as maintain them is greatly reduced.
4) Flexibility and scalability: cloud can shrink and grow as per the increase or decrease of user demand. Here service tax is based on actual consumption; we only pay for what we use.
5) Helps smaller business complete: due to cloud computing now it is possible for smaller companies to compete with bigger companies. Only renting IT services instead of purchase hardware, software, and infrastructure.
6) Qos: 24/7 customer support and an immediate response when problem arise.
7) Multi-tenancy: Multi tenancy refers to a principle in software architecture where a single instance of the software runs on a server, serving multiple client organizations (tenants). for:
   - Centralization of infrastructure in locations with lower costs (such as real estate, electricity, etc.)
   - Peak-load capacity increases (users need not engineer for highest possible load- levels)
   - Utilization and efficiency improvements for systems that are often only 10–20% utilized[11].
8) Quick and easy implementation: Without the need to purchase hardware, software licences or implementation services, a company can get its cloud-computing arrangement off the ground in minutes.
9) Security could improve due to centralization of data, increased security-focused resources, etc., but concerns can persist about loss of control over certain sensitive data, and the lack of security for stored kernels[12]. Security is often as good as or better than other traditional systems, in part because providers are able to devote resources to solving security issues that many customers cannot afford[13]. However, the complexity of security is greatly increased when data is distributed over a wider area or greater number of devices and in multi-tenant systems that are being shared by unrelated users. In addition, user access to security audit logs may be difficult or possible. Private cloud installations are in part motivated by users' desire to retain control over the infrastructure and avoid losing control of information security.
10) Reliability: Multiple resources are available like computing power, Storage etc. for providing services to the users. Also the data may be stored at multiple locations by provider. This redundancy in terms of data storage and other resource enables provision for disaster recovery and achieves reliability and availability of data as well as services.

1.3. Cloud Computing Obstacles

Along with such advantages for using cloud computing applications and service, there are some obstacles that act as a barrier in its growth .These are-

1. Lock-in: It is nothing but the problem of portability and Inter-operability. Lock-in issue could be for data and vendor.

a) Data Lock-in: Due to lack of standardized API, it is very difficult to tack back data from stored cloud if a user want to change his/her cloud provider. This results in a problem of data lock-in.
b) Vendor Lock-in: If change of provider is required then APIs also has to be changed, because we know that a cloud provider gives services in terms of APIs. API made for one provider of cloud is not functional for another cloud providers . This issue is termed as vendor lock-in.

2. Service Availability: Service should be available at all time for a cloud user,. Whenever a user requests for a cloud service, provider and user has to sign Service Level Agreement. This defines the terms and conditions and specifications for cloud service. It also includes percentage of time service is available. A cloud user expects a high available service with no or minimal downtime. A cloud provider and its corresponding service are selected based on service availability and business needs.

3. Bottleneck: Data transfer bottleneck and service disturbance are some of the issues caused due to limited bandwidth.

4. Data privacy: For various organizations, concerns about security, privacy, compliance and control about their data are an obstacle in moving towards the cloud. Specific concerns include:

a) Loss of governance: A cloud provider site is located in one country and the cloud user may be using the service from another country. User data which is stored from one country is owned and is under the control of cloud provider country. The data is outside organization's direct control, its misuse may have a significant impact on privacy, security and intellectual property claims.
b) Regulatory compliance: Regulated data may reside in the cloud, the obligation for regulatory compliance may still falls with the organization that owns the data.
c) Lack of transparency: Cloud vendors do not always disclose the details of how their services work, which third-party partners they use, and exactly where data is located. The information about the user data, security measures etc. are generally not known to user.

For global businesses with offices and users in different countries, the issues are even more complex, as legal requirements vary between countries. Such obstacles as discussed above acts as a barrier in the growth of cloud computing. Among them security and privacy of data and applications are the major rising concerns [14].

2. Cloud Computing Building Blocks

Cloud computing can be visualized as a pyramid consisting of three sections:

1. Cloud Application
2. Cloud Platform
3. Cloud Infrastructure

Cloud Applications

Cloud applications are run at the top of the cloud computing and interacted with via a web browser, hosted desktop or remote client. The main characteristic of commercial cloud computing applications is that users never need to purchase expensive software and licenses themselves. Instead, the cost is included into the subscription fee. A cloud application need not to install and run on the customer's own computer, thus removing the burden of software maintenance, ongoing operation and support.

Cloud Platform

It is the middle layer of the cloud pyramid, which gives us a computing platform or framework as a

service. It is the cloud computing platform which configures, reconfigures and servers when there is increase or decrease in demand. This in reality is a distributed computing model.

Cloud Infrastructure

It is the base layer of the cloud pyramid, responsible for the delivery of IT infrastructure through virtualization.
Virtualization can be viewed as part of an overall trend in enterprise IT that includes autonomic computing, a scenario in which the IT environment will be able to manage itself based on perceived activity, and utility computing, in which computer processing power is seen as a utility that clients can pay for only as needed. The usual goal of virtualization is to centralize administrative tasks while improving scalability and overall hardware-resource utilization. With virtualization, several operating systems (OSs) can be run in parallel on a single CPU. This parallelism tends to reduce overhead costs and differs from multitasking, which involves running several programs on the same OS [4].all the three building blocks are displayed in figure 2.

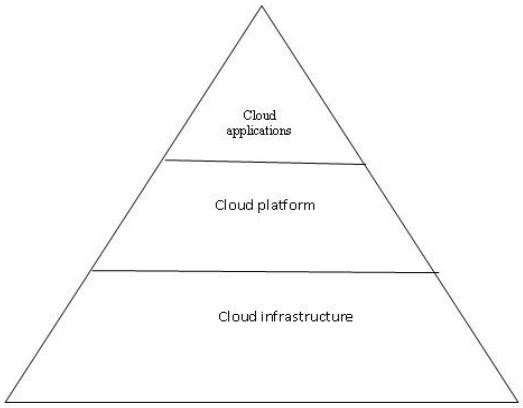

Figure 2: Cloud computing building blocks

demand access to resources (networking, servers and storage), which could be accessed via a service API. The underlying infrastructure is transparent to the end user, while s/he retains control over the platform and software running on the infrastructure. *IaaS* runs on a tenancy model, which employs a usage-based payment approach allowing users to pay for only those resources they actually use. Cloud computing service models are displayed in figure 3.

3. Cloud Computing Service Models

In cloud computing, everything is delivered *as a Service* (*XaaS*), from testing and security, to collaboration and metamodeling [15]. The cloud was rapidly becoming a fire of buzzwords "as a service". Today there are three main service models, which are agreed on and defined in the NIST document [16].

1. *Software as a Service* (*SaaS)* - It is the most widely known model of cloud computing which delivers software over the Internet.. *SaaS* has been around since early 2001 when it was commonly referred to as the Application Service Provider (ASP) Model [15]. Software as
a Service consists of software running on the provider's cloud infrastructure, delivered to multiple clients on demand via a thin client (e.g. browser) over the Internet. Typical examples are Google Docs and Salesforce.com CRM.

2. *Platform as a Service* (*PaaS*) - this gives a developer the flexibility to develop, test and deploy applications on the provider's platform (API, storage and infrastructure). *PaaS* stakeholders include the *PaaS* hoster who provides the infrastructure (servers etc), the *PaaS* provider who provides the development tools and platform and the *PaaS* user [17]. Examples of *PaaS* are Microsoft Azure and Google AppEngine.

3. *Infrastructure as a Service* (*IaaS*) - rather than buy servers and build a datacenter from ground up, and consequently having to worry about what happens when the website hits a million users, *IaaS* offers users elastic on

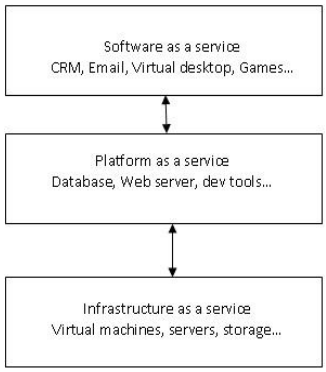

Figure 3 Service Models

4. Cloud Computing Deployment Models

Depending on infrastructure ownership, there are four deployment models of cloud computing each with its merits and demerits. This is where the security issues start.

1. *The Public Cloud* – It is also called external cloud .This is the traditional view of cloud computing in every day lingua. It is usually owned by a large organization (e.g. Amazon's EC2, Google's AppEngine and Microsoft's Azure). The owner-organization makes its infrastructure available to the general public via a multi-tenant model on a self-service basis delivered over the Internet. This is the most cost-effective model leading to substantial savings for the user, albeit with attendant privacy and security issues since the physical location of the provider's infrastructure usually traverses numerous national boundaries.
2. *The Private Cloud* – Also called private or internal cloud, refers to cloud infrastructure in a single tenant environment. It defers from the traditional datacenter in its predominant use of virtualization. It may be managed by the tenant organization or by a third party within or outside the tenant premises. A private cloud costs more than the public cloud, but it leads to more cost savings when compared with a datacenter as evidenced by Concur Technologies (est. savings of $7million in 3 years from 2009) [18]. The private cloud gives an organization greater control over its data and resources. As a result, the private cloud is more appealing to enterprises especially in mission and safety critical organizations.

3. *The Community Cloud* - according to NIST, the community cloud refers to a cloud infrastructure shared by several organizations within a specific community. It may be managed by any one of the organizations or a third party. A typical example is the Open Cirrus Cloud Computing Testbed, which is a collection of Federated data centers across six sites spanning from North America to Asia [19].

4. *The Hybrid Cloud* - comprises of a combination of any two (or all) of the three models discussed above. For example, a company could choose to use a public cloud service for general computing, but store its business-critical data within its own data centre. This may be because larger organizations are likely to have already invested heavily in the infrastructure required to provide resources in-house – or they may be concerned about the security of public clouds.

Figure 3 shows how hybrid cloud is formed using private and public network.

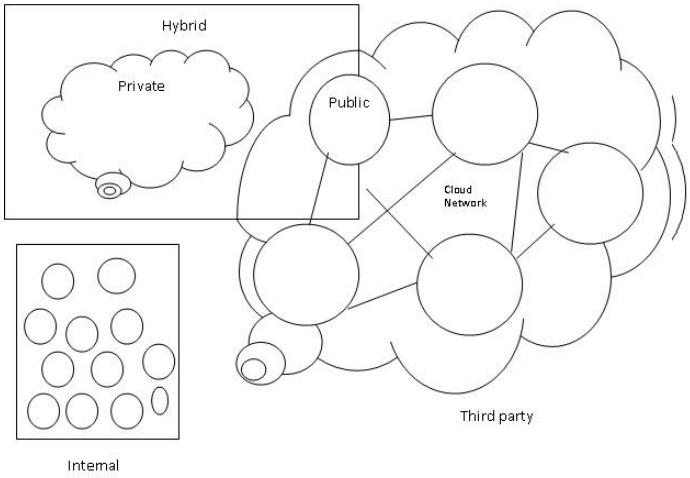

Figure 4 Cloud Computing Types

5 CONCLUSON

Cloud computing is a powerful new abstraction for large scale data processing systems which is scalable, reliable and available. In cloud computing, there are large self-managed server pools available which reduces the overhead and eliminates management headache. Cloud computing services can also grow and shrink according to need. We have presented an overview of cloud computing paradigm, as well as its main features, obstacles in cloud computing, building blocks of cloud computing, deployment models, service models. In future we will try to look related issues in cloud computing, especially security issue.

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