International Journal of Advance Research in Science and Engineering
Volume No.07, Special Issue No.08, March 2018
www.ijarse.com
IJARSE
ISSN: 2319-8354

A REVIEW ON CLOUD COMPUTING: ITS ARCHITECTURE AND SECURITY ISSUES

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ABSTRACT

Cloud computing is a buzzword that means different things to different people. Cloud Computing is the delivery of computing as service rather than a product, whereby shared resources, software and information are provided to computers and other devices as a metered service over a network. Cloud Computing works on the concept of resource sharing, this model has to main advantage such as ease to use and cost effectiveness. The cloud is a large sized server on which different data and services are stored and users access all those according to their needs. The data and services that users access does not exist on their computing instead it is on server. This paper explores the basic concept of cloud computing with its service models, architecture, benefits and security issues in cloud computing.

Keywords: Cloud Computing, IaaS, PaaS, SaaS, Public Cloud, Private Cloud, Hybrid Cloud, Benefits and Security.

1. Introduction

"Cloud computing is a model for enabling convenient, on demand network access to a shared pool of configurable computing resources which includes networks, servers, storage, applications, and services that may be rapidly provisioned and released with minimum management attempt or service provider interaction [1]. Cloud computing is a subscription-based service in which you may acquire networked storage area and computer resources. Servers inside the cloud may be physical machines or virtual machines. Advanced clouds generally consist of different computing resources which include storage area networks (SANs), network system, firewall and other security devices. Cloud computing [2] additionally describes programs which are extended to be available through the internet. These cloud programs use huge information centers and powerful servers that host internet programs and internet services. anybody with a appropriate internet connection and a standard browser can get entry to a cloud application.

"To the users, cloud computing is a Pay-per-Use-On-demand mode that may easily access shared IT resources via the internet. Where the IT resources consist of server, storage, network, application, service and so on and they may be deployed with much fast and smooth way and less management and also offer interactions with service providers. Cloud computing can much enhance the availability of IT resources and owns many advantages over different computing techniques.

Cloud computing has emerged as a popular way to offer reasonably-priced and smooth access to externalized IT resources. An increasing number of organizations benefit from Cloud computing to host their applications. via virtualization, Cloud computing is capable of deal with with the same physical infrastructure a large client base with distinct computational needs [3]–[6]. In recent years, Cloud Computing has come to be an emerging era that gains huge impact on IT systems. Fig. 1. describes the concept cloud computing. So we can say that cloud computing is a better way because it is the responsibility of an experienced supplier including Amazon net services or salesforce.com[7].

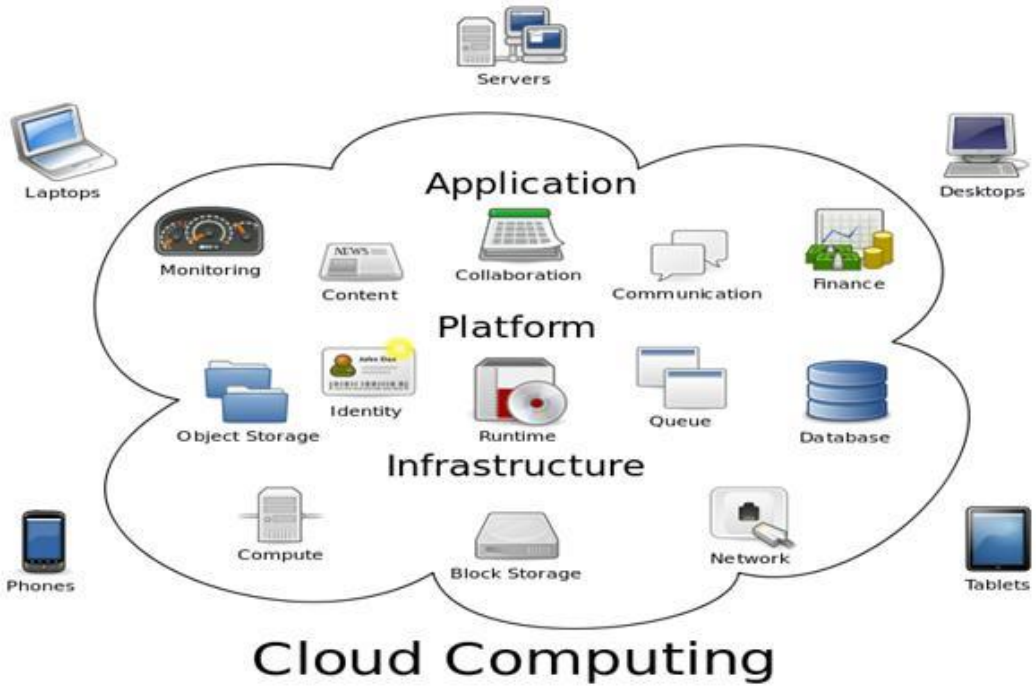

Fig. 1. Cloud Computing

2. Characteristics Of Cloud Computing

Cloud computing has five essential characteristics that distinguish it from other ways of building and operating IT infrastructures:

2.1. On-Demand Service

It confers the ability to provision, monitor, and manage computing resources as needed without the help of human administrators.

2.2. Broad Network Access

It enables computing services to be delivered over standard, ubiquitous networks and heterogeneous devices.

2.3. Rapid Elasticity

It makes it possible to quickly and automatically scale out and scale in IT resources as needed.

2.4. Resource Pooling

It means IT resources can be shared in non-dedicated ways across multiple applications and/or tenants.

2.5. Measured Services

It means IT resource utilization can be tracked in terms of each application and/or tenant, generally for purposes of billing or chargeback.

3. Types of Clouds

There are four types of cloud computing models listed by NIST (2009): Public cloud, Private cloud, Community cloud and Hybrid cloud[8].

3.1. Public Cloud

In simple terms, public cloud services are characterized as being available to clients from a third party service provider via the Internet. The term "public" does not always mean free, even though it can be free or fairly inexpensive to use. A public cloud does not mean that a user's data is publicly visible; public cloud vendors typically provide an access control mechanism for their users. Public clouds provide an elastic, cost effective means to deploy solutions.

3.2. Private Cloud

A private cloud offers many of the benefits of a public cloud computing environment, such as being elastic and service based. The difference between a private cloud and a public cloud is that in a private cloud-based service, data and processes are managed within the organization without the restrictions of network bandwidth, security exposures and legal requirements that using public cloud services might entail. In addition, private cloud services offer the provider and the user greater control of the cloud infrastructure, improving security because user access and the networks used are restricted and designated.

3.3. Community Cloud

A community cloud is controlled and used by a group of Organizations that have shared interests, such as specific security requirements or a common mission. The members of the community share access to the data and applications in the cloud.

3.4. Hybrid Cloud

A hybrid cloud is a combination of a public and private cloud that interoperates. In this model users typically outsource non business-critical information and processing to the public cloud, while keeping business-critical services and data in their control.

4. Cloud Computing Service Models

This section of the paper describes the various cloud service models. Cloud can be delivered in 3 models namely SaaS, PaaS, and IaaS, Fig. 2 describes Service Model used in cloud computing.

4.1. Software As A Service (SaaS)

Software as a service features a complete application offered as a service on demand. A single instance of the software runs on the cloud and services multiple end users or client organizations. The most widely known example of SaaS is salesforce.com, though many other examples have come to market, including the Google Apps offering of basic business services including email and word processing. Although salesforce.com preceded the definition of cloud computing by a few years, it now operates by leveraging its companion force.com, which can be defined as a platform as a service.

4.1.1. Characteristics of SaaS

- Centralized web based access to company and commercial software.
- Entire business process shifting to cloud giving superior services to client.
- No hassle of software upgrades and patches as they are managed by Service provider.
- Application Programming Interfaces (APIs) allow integration with different applications.

4.2. Platform As A Service (PaaS)

Platform as a service encapsulates a layer of software and provides it as a service that can be used to build higher-level services. There are at least two perspectives on PaaS depending on the perspective of the producer or consumer of the services. One is, someone producing PaaS might produce a platform by integrating an OS, middleware, application software, and even a development environment that is then provided to a customer as a service. stack and support for additional programming languages such as Perl or Ruby. Other is, Someone using PaaS would see an encapsulated service that is presented to them through an API. The customer interacts with the platform through the API, and the platform does what is necessary to manage and scale itself to provide a given level of service. Virtual appliances can be classified as instances of PaaS. PaaS offerings can provide for every phase of software development and testing, or they can be specialized around a particular area such as content management. Commercial examples of PaaS include the Google Apps Engine, which serves applications on Google's infrastructure.

4.2.1. Basic Characteristics of PaaS

- Single environment to develop, test, deploy, host and maintain applications.
- Multi-tenant architecture facilitating concurrent users.
- Load balancing, security and failover capabilities for application to be deployed.
- Operating System and Cloud programming APIs to create new apps for cloud
- Tools to handle billing and subscription.

4.3. Infrastructure As A Service (IaaS)

Infrastructure as a service delivers basic storage and compute capabilities as standardized services over the network. Servers, storage systems, switches, routers, and other systems are pooled and made available to handle workloads that range from application components to high-performance computing applications. Commercial

examples of IaaS include Joyent, whose main product is a line of virtualized servers that provide a highly available on-demand infrastructure.

4.3.1. Basic Characteristics of IaaS

- Resources distributed as a service.
- Dynamic, on-demand scaling of resources.
- Utility based pricing model.
- Concurrent users on a single piece of hardware.

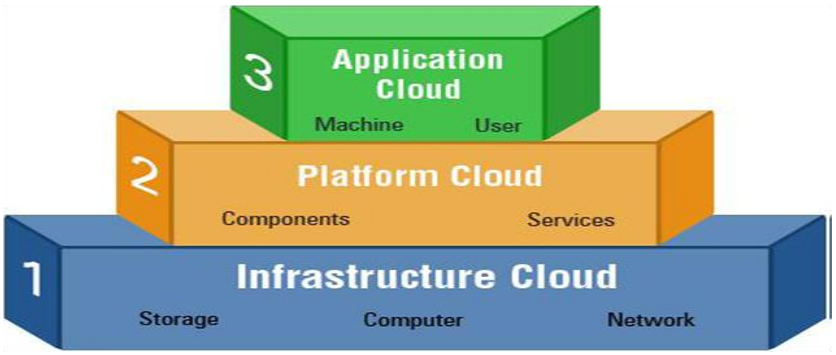

Fig. 2. Cloud Computing Service Models

5. Architecture

Cloud computing system[9], is the system which is divided it into two sections: the front end and the back end. They connect to each other through a network, usually the Internet. The front end is the side the computer user, or client, sees. The back end is the "cloud" section of the system. The front end includes the client's computer and the application required to access the cloud computing system. Not all cloud computing systems have the same user interface. Services like Web-based e-mail programs leverage existing Web browsers like Internet Explorer or Firefox. Other systems have unique applications that provide network access to clients. On the back end of the system are the various computers, servers and data storage systems that create the "cloud" of computing services. In theory, a cloud computing system could include practically any computer program you can imagine, from data processing to video games. Usually, each application will have its own dedicated server. A central server administers the system, monitoring traffic and client demands to ensure everything runs smoothly. It follows a set of rules called protocols and uses a special kind of software called middleware. Middleware allows networked computers to communicate with each other. Most of the time, servers don't run at full capacity. That means there's unused processing power going to waste. It's possible to fool a physical server into thinking it's actually multiple servers, each running with its own independent operating system. The technique is called server virtualization. By maximizing the output of individual servers, server virtualization reduces the need for more physical machines. If a cloud computing company has a lot of clients, there's likely to be a high demand for a lot of storage space. Some companies require hundreds of digital storage devices. Cloud

computing systems need at least twice the number of storage devices it requires to keep all its clients' information stored. That's because these devices, like all computers, occasionally break down. A cloud computing system must make a copy of all its clients' information and store it on other devices. The copies enable the central server to access backup machines to retrieve data that otherwise would be unreachable. Making copies of data as a backup is called redundancy. Fig. 3 describes cloud computing architecture.

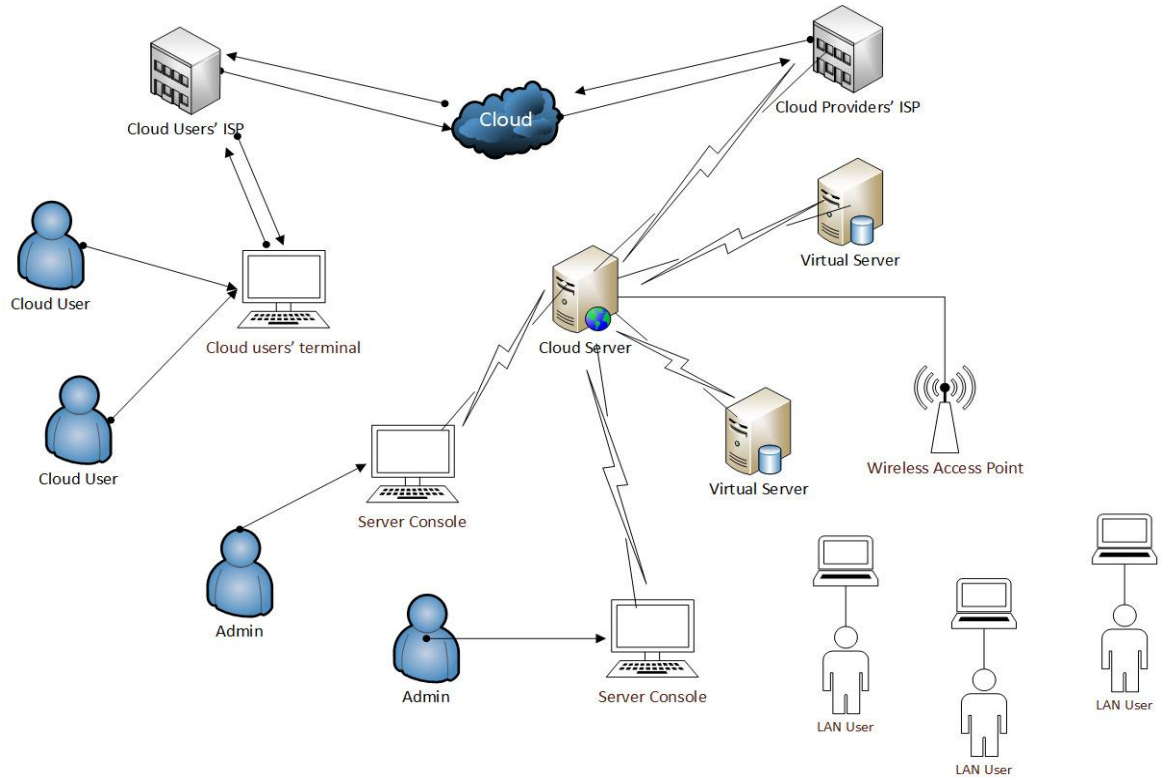

Fig. 3. Cloud Computing Architecture

6. Security Issues In Cloud Computing

Based on the study, we found that there are many issues in cloud computing but security is the major issue which is associated with cloud computing.

6.1. Misuse And Reprehensible Use Of Cloud Computing

Hackers, spammers and other criminals take advantage of the suitable registration, simple procedures and comparatively unspecified access to cloud services to launch various attacks like key cracking or password.

6.2. Insecure Application Programming Interfaces (API)

Customers handle and interact with cloud services through interfaces or API's. Providers must ensure that security is integrated into their service models, while users must be aware of security risks.

6.3. Wicked Insiders

Malicious insiders create a larger threat in cloud computing environment, since consumers do not have a clear sight of provider policies and procedures. Malicious insiders can gain unauthorized access into organization and their assets.

6.4. Shared Technology Issues/Multi-Tenancy Nature

This is based on shared infrastructure, which is not designed to accommodate a multi-tenant architecture.

6.5. Data Crash

Comprised data may include; deleted or altered data without making a backup; unlinking a record from a larger environment; loss of an encoding key; and illegal access of sensitive data.

6.6. Account, Service & Traffic Hijacking

Account or service hijacking is usually carried out with stolen credentials. Such attacks include phishing, fraud and exploitation of software vulnerabilities. Attackers can access critical areas of cloud computing services like confidentiality, integrity and availability of services.

6.7. Unidentified Risk Report

Cloud services means that organizations are less involved with software and hardware, so organizations should not be aware with these issues such as internal security, security compliance, auditing and logging may be overlooked.

7. Benefits of Cloud Computing

As cloud computing are booming in market, several major benefits have become evident. The following are some of the benefits for those who offer cloud computing-based services and applications [10].

7.1. Cost Savings

The cloud promises to cut the cost of acquiring, delivering, and maintain computing power, a benefit of particular importance in times of economic uncertainty. By enabling SME to purchase only the computing services needed, instead of investing in complex and expensive IT infrastructures, SME can cut down the costs of developing, testing, and maintaining new and existing systems.

7.2. Collaboration

Collaboration is a term where a group of people can work together through online. By using cloud computing environment online, collaboration is easier than before a good example is Google docs.

7.3. Scalability and Capacity

Cloud Computing main benefit is scalability and capacity. By using of public cloud we can scale up and won as per our requirement and the capacity also. But in private it‟s not possible. Traditional computing also doesn‟t support scalability.

7.4. Customization

Cloud computing is a platform where we can modify to our needs with being redevelopment. It offers a platform for creating and amending applications to address a diversity of tasks and challenges.

7.5. Mobile Access

The cloud computing enables to access high-powered computing and storage resources for anyone with a network access device. Capabilities of cloud computing helps to facilitate Tele-network initiatives, as well as bolster an agency's continuity of operations (COOP) demands.

7.6. Resource Maximization

Cloud computing has reduce burden of IT resources to many companies and agencies by maximizing the resources from cloud computing pool.

8. Conclusion

The growing interest in Cloud computing has led to new approaches for allocating financial resources and leveraging IT infrastructure and services. Cloud computing provides concrete opportunity for making a flexible use of IT by turning it into a utility. Cloud adoption is becoming a standard practice in many business sectors to scale IT infrastructure on demand. Despite this, the development of elastic and scalable applications is a complex task. Cloud application development platforms offer huge cost savings by reducing the cost of software engineering and enabling intelligent use of Cloud infrastructures. A wide range of applications scenarios from financial services, to entertainment and media, or manufacturing and engineering, demonstrates how Cloud technology can help increasing technology efficiency and adoption.

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