

Cloud Computing: A Review of the Concepts and Roots

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Abstract— This paper presents a selected brief review of cloud computing, which describes its development, history, and definition of cloud computing. Cloud Computing is an evolution of information technology and is a major business model for distributing IT resources. With cloud computing, individual and organizations can gain access to an on-demand network in a shared pool of managed and scalable IT resources, such as servers, storage, and applications. We rely heavily on cloud services in our lives such as storing data, writing documents, managing businesses, and playing online games. Cloud Computing also provides infrastructure that has major digital trends such as mobile computing, Internet of things, Big Data and Artificial Intelligence, accelerating industry dynamics, leading to digital transformation. Cloud computing not only provides a large number of benefits and opportunities, it also comes with many challenges and concerns, for example about the security of customer's data. This paper not only covers the development, history and definition of cloud computing but also presents features, service models, deployment models, and cloud roots.

Keywords: Cloud Computing, Deployment Model, Service Model, Cloud roots

I. INTRODUCTION

In today's world every institution needs to start finding out that their business has said the need of cloud computing so that they can achieve profitability in their business field. An exceptional feature of cloud computing is that it pays one per use because the cloud user only needs to pay for the services used [1]. In summary, this paper presents a comprehensive analysis of cloud computing, interpreting its services and deployment models and identifying various features of concerns. This paper provides a literature review on the concept and deployment model of cloud computing. The structure of this paper is organized as follows. After the introduction, the development, history and definition of cloud computing will go into the next part. Then the essential features of cloud computing will be briefly explained. The service model of cloud computing will be discussed, and then the cloud computing deployment model will be reviewed. The last section of the paper discussed the roots of cloud computing, then the conclusion and finally the reference will be listed.

II. THE EVOLUTION, HISTORY AND DEFINITION OF CLOUD COMPUTING

The idea of distributing computing resources through a global network was born in the mind of J.C.R. Licklider. J.C.R. Licklider developed a network called ARPA (Advanced Research Project Agency) in 1969 to connect everyone on earth and retrieve projects and information at any site, from anywhere. Initially, it was used for military and scientific purpose, but its commercialization began in 1988 with

services such as email and telnet, which is why the internet is the foundation of all these services provided by the Cloud Service Provider (CSP). Some expert believe that cloud computing is the vision of American computer scientist John Mc Carthy of the sixties. He stated computation can be delivered as a public utility. For example a power plant is considered as a service provider which provides services distribution network as internet and households or firms as customers [2].

Cloud Computing is not really the concept of a new technology because it seems that this computer diagram is generated after a network that represents the Internet like a cloud [3]. Emerging technology has been very important in both the business environment and the educational environment [4]. It has given many definitions in various ways and researchers have observed that all these definitions are mainly focused on service and technical features. Of all the definitions responsible for cloud computing over the past few years, the most commonly used definition is the definition of NIST, which stands for the National Institute of Standard and Technology [5]. According to the NIST on the definition of cloud computing, it is a model that enables and appropriate, non-demand access network to deliver configure computing assets such as networks, storage, servers, services, and applications, with minimal management effort previously is provisioned for and released from [6]. Another author stated that cloud computing is a set of applications, hardware and system software whose purpose is to provide a good quality of services to the end user while using the internet [7].

Bohm et al [8] defined it as an IT deployment model based on virtualization in which related resources such as infrastructure, applications and data are provided over the internet as a service provided by the service provider. The service can also be extended on an individual basis as pricing can be flexible to the extent that it is on a pay-per-use basis. Another definition given by Stavinoha et al. [9] states that cloud computing is a model used to enable convenient network access based on the demand for a shared pool of computing resources that is configurable (for example network, server, storage, applications and services) and service providers can be preempted quickly with minimal management and effort as well as their respective interaction. For Rashmi et al. [10] cloud computing can be define by looking at two viewpoints such as from a user and organization point of view. Hence for the user's point of view, cloud computing provides an important for obtaining computing based services without the need to know in depth the basic technology used, and for the organization it provides services for consumers and business. The concept of cloud computing refers to a system where data center resources are shared using virtualized technology which can also provide customers with flexible, on-demand, and instant services, and customers use per pay using the method [11]. According to Olivera et al. [12], even though cloud computing is not

entirely a new concept, cloud computing encountered a lake of standardized definition.

Different definition of different researcher give cloud computing power a different perspective, but all are centered around one thing. In their respective definitions they all say that it is a form of model that makes it very specific and more emphasis is placed on the model. Before considering the model, the features of cloud computing need to be critically examined as it relates to the model.

III. CHARACTERISTICS OF CLOUD COMPUTING

Characteristics of cloud computing as explained by different researcher including Mell and Grance [6], Stovinoha [9], Dillon et al. [13] and Srinivas et al [14]. According to the definition of cloud computing are the following various characteristics.

- 1) The on-demand self-service: This is explained in terms of the user, which can provide one-way computing capabilities that are automatically required without any human supervision or interaction from any service provider. Computing capabilities can be server time or network storage.
- 2) The broad network access: Cloud computing resources can be accessed anywhere through the network from the help of mobile or workstation platform. Example of platforms may include smart phones, tablets, laptops, and workstation computer.
- 3) The resource pooling: The providers computing resources are designed to serve multiple users using multi-tenant, in which various physical and virtual resources are dynamically delegated and reassigned according to consumer demand. There is a sense of place-independence that the customer usually has no control or knowledge of the exact location of the resources provided, but may be able to specify the location at a high level of abstraction.
- 4) The rapid elasticity: In this case, computing capabilities are explained in terms of elasticity that is provided along with the issuance. The release can happen automatically in some cases to actually scale inward and outward. This scaling is used to increase customer demand. From the user's point of view, the capabilities that are provided often look as if it is unlimited which can be appropriated in terms of quantity and time
- 5) The measure service: The cloud system controls and optimizes automatic resources. All the resources used are monitored and controlled with total transparency and billed as per use. Figure 1 briefly demonstrates the essential characteristics of cloud computing-

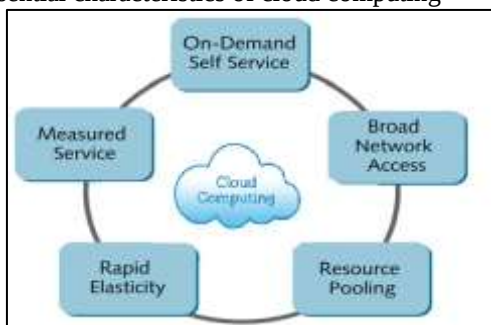


Fig. 1: Characteristics of cloud computing

IV. THE SERVICE MODELS OF CLOUD COMPUTING

According to NIST Cloud Computing, there are three principal model services, Software as a Service, Platform as a Service and Infrastructure as a Service [6]. Service models of cloud computing are based on modern-day data centers that integrate three service models that include software into a service, platforms as a service, and infrastructures as a service and consumers to pay for their usage. By providing them as utilities, data centers provide hardware in which clouds run and they form the foundation of the cloud. Data centers are usually made up of multiple interconnected servers and placed in thickly crowded bands with the least risk of natural disaster [1].

A. The Software as a Service (SaaS):

SaaS is the most common form of cloud computing for small businesses. SaaS is a distribution model that makes software applications (such as: browser) available to customers as service in the internet. The best part of SaaS is that we do not need to install, maintain and run any software application in it, because all of its software applications are run directly from the web browser. In SaaS, the data of the customer is completely safe and even if there are any faults in the system, the data is protected. SaaS applications are run in SaaS provider's servers and SaaS application are sometimes called hosted applications. Examples of SaaS application are Google apps, office365 etc.

B. The Platform as a Service (PaaS):

PaaS can be described as a crossover of both SaaS and IaaS. It is a service provider that gives the customer a platform in which they can easily create, manage and deliver software application. That is, PaaS provides a platform in which such tools are made available to the customer so that they can easily develop, customize and test the application. PaaS is also commonly called middleware because it is the service model between SaaS and IaaS. Examples of PaaS include Google App Engine, Amazon web services etc.

C. The Infrastructure as a Service (IaaS):

It is a service model in which customers are provided with hardware, networking and storage services in a cloud environment. IaaS is the lowest and most important model of cloud computing service model. In this model, it is the responsibility of the customer to update the software applications and operating systems installed by the customer. Examples of IaaS are Google compute engine, Microsoft azure.

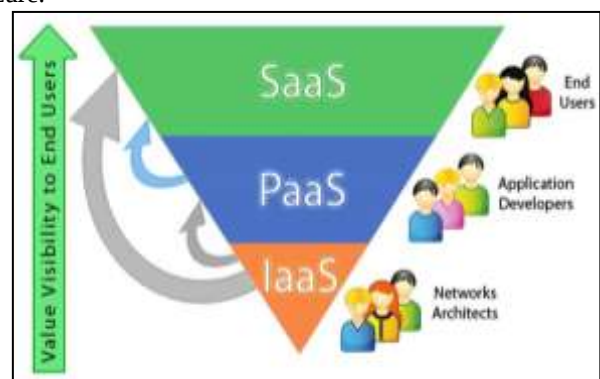


Fig. 2: Cloud computing service models

V. THE DEPLOYMENT MODELS OF CLOUD COMPUTING

Choosing the appropriate type of cloud computing to be implemented by an organization is the first important step because it promises a successful cloud computing implementation by that institution because different types of computing require diverse skills and resources. According to Chauhan et al. [15], many institutions which have failed in the implementation of their cloud computing are failing due to choosing the wrong cloud computing. Institutions should examine their data accurately, before deciding what type of cloud computing to choose so that they can avoid implementation failure. Based on previous research on cloud computing, the deployment model of cloud computing is classified as follows.

A. Public cloud model:

Public cloud is a type of cloud hosting that allows easy access to the system and its services to its clients / users. Some examples of companies providing public cloud facilities are IBM, Google, Amazon, Microsoft etc. This type of cloud computing is a true model of cloud hosting, where service providers provide services to various customers. From a technical standpoint, there is minimal difference between structural design as well as private clouds and public clouds. Only the security level depends on the type of service providers and cloud clients. Public cloud load management is better suited for business purposes. This type of cloud is economical due to the reduction in capital overheads.

B. Private cloud model:

Private cloud is also known as 'internal cloud', which allows access to systems and services within a specific range or organization. The cloud platform is implemented in a cloud-

based secure environment protected by advanced firewalls under the supervision of an IT department belonging to a particular organization. Private clouds allow only authorized users, giving organizations greater control over data and its security. Business organization that have dynamic, critical, secure, demand-based needs for management should adopt a private cloud.

C. Hybrid cloud model:

Hybrid cloud is another cloud computing type that is integrated, it can be a combination of two or more cloud servers, i.e. private, public, or community can be combined as one architecture, but individual units Persist. Non-critical tasks such as development and testing workloads can be performed using the public cloud. In contrast, critical tasks that are sensitive such as organization data handling are performed using a private cloud. Hybrid cloud hosting has the benefits of both deployment models as well as a community deployment model. Hybrid cloud uses both private cloud and public cloud. Some of the content on a site is available only to registered people and some of the content is available to the public, then such cloud is called hybrid cloud.

D. Community cloud model:

Community cloud is another type of cloud computing in which cloud setups are shared manually between different organizations that belong to the same community or region. The community cloud is only available to this group of people. Apart from this, no other outsider can access this data. For example, for a government office, only its employees can use the data available on its site or the content available on a website created by a university can only be used by students of that university.



Fig. 3: Cloud deployment models

VI. THE ROOTS OF CLOUD COMPUTING

The roots of cloud computing mean the current technologies which are collaborating in cloud computing to provide services to the end user. When discussing various cloud computing services and collaborative service delivery models, it is important to have a clear idea about the roots of cloud computing to understand the basic nature and features of cloud computing that make it different from traditional computing services [18]. It is important to know that cloud computing integrates technologies from various fields of computing and networking and it is the integration of these computing fields that makes it possible to deliver the basic services offered by cloud computing technology. Analysis of these areas is necessary to identify how cloud computing

actually performs and how it can be improved not only from a technical point of view but also from a service point of view.

Cloud computing is the development of various technologies such as hardware virtualization, distributed computing, Internet-based technology and system management. Most importantly, virtualization, also known as the backbone of cloud computing, is a part of hardware technology that improves resource utilization. Distributed computing is another technology that uses grids, utilities, etc. to share resources at a very low cost. Advances in Internet technology drive the growth of cloud computing and make them available to the user anytime and anywhere. Finally, system management takes the responsibility of the entire cloud setup to avoid any mistake and keep them updated with the latest technologies [19]

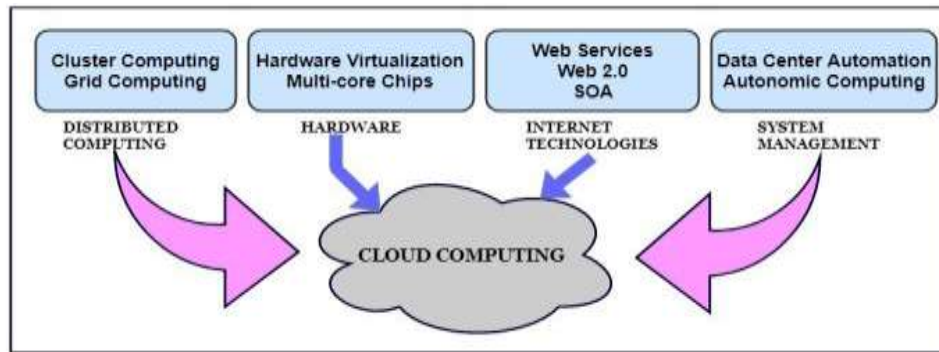


Fig. 4. Roots of cloud computing

VII. CONCLUSION AND FUTURE SCOPE

Cloud computing market will continue to be driven by migration from traditional data center to cloud. Many businesses are taking advantage of the power of data processing such as big data cloud. Computing has made it easier for organizations to collaborate globally as data can be shared and accessed from anywhere around the world and hence increasing the productivity of organizations. We studied that distributed, utility and grid computing are the basic building blocks of cloud computing and virtualization technology is the backbone of the cloud. In this paper, we discussed the concept of cloud development and history and explained various definitions of cloud computing. Apart from this, their features, service models and deployment models were also discussed. This task will be helpful in improving the quality and availability of services in the future that drive users towards cloud adoption.

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