iJRASET
International Journal For Research in Applied Science and Engineering Technology



INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 7 **Issue:** VI **Month of publication:** June 2019

DOI: http://doi.org/10.22214/ijraset.2019.6325

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International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.177
Volume 7 Issue VI, June 2019- Available at www.ijraset.com

Cloud Computing: A Study of the Cloud Computing Services

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Abstract: ***Cloud computing now easily tops any list of topics in computer science because of its far reaching involvements in many areas in computing, especially Big Data. Moreover, It is a one of the most emerging technology due to the provision of various computing infrastructure and services. Cloud computing has evolved through a number of phases that include mainframe computing, cluster computing, and grid computing, parallel computing, distributed computing and utility computing. Cloud computing is often considered the successor of grid, cluster and, mainframe computing. Cloud computing is the delivery of many services through the Internet. These resources include tools and applications like databases, infrastructure, platforms, data storage, servers, networking, and software. Many people and businesses use cloud for a number of reasons including cost savings, increased productivity, speed, efficiency, high performance, scalability, high computing power and security. This paper presents the definition of cloud computing, its characteristics, different cloud services and various platforms that are used in cloud computing.***

Keywords: Cloud computing, Evolution, Service models and cloud computing platforms.

I. INTRODUCTION

Many people believe that the term cloud computing is just another buzzword, but the term cloud computing has been used over the years to mean a number of technologies, including: grid computing, utility computing, Internet-based applications, software-as-a service (SaaS), peer-to-peer computing and remote processing. In cloud computing, the word "cloud" is used as a symbol of the most popular computer network means "*the Internet,*" so the phrase *cloud computing* means a type of Internet-based medium, in which different services —including servers, storage and applications — are delivered and made accessible to an organization through the Internet [1][3].

Cloud computing is the on-demand delivery of networking, computing power, database, storage, applications, and other IT resources via the internet with a pay-as-you-go pricing. It states that the cloud computing purpose is storing and accessing the data and programs over the internet rather than the computer's hard disk. The data can be videos, music, files, images, documents, and many more. Furthermore, Cloud computing allowing access to virtual resources to its user over the Internet. Many of the daily things you do that made possible through the cloud—like email, file storage and backup, social media, Google drive, drop box, online shopping and banking. Rather than keeping files on a hard drive or local storage device, cloud-based storage makes it possible to save them to a remote service provider. Moreover, an electronic device has access to the web; it has access to the data and the software programs to run it. The cloud computing technology has become in demand because it provides benefits to people, consumers and businesses alike, including lower costs, easier access, reduced management cost, free provision of services and higher reliability. Cloud service examples are Google Drive, Apple iCloud, Amazon Cloud Drive, Microsoft One Drive and Oracle Cloud. The concept of cloud computing is based on the Everything-as-a-Service, mostly referred as XaaS [2], where the Fig. 1 shows the different components of a system— Software-as-a-Services(i.e. SaaS services are End-user applications, Scientific applications, Office automation, photo editing, CRM, and social networking), Platforms-as-a-Services (i.e. PaaS mainly focusing on the runtime environment for applications, development and data processing platforms and Infrastructure-as-a-Services(i.e. IaaS provides services like hardware, virtualized servers, storage and networking). The Cloud provides four deployment models for consumers that are Public, Private, Hybrid and Community models.



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Fig. 1 Cloud Computing Services & Deployment Models

II. HISTORY AND OTHER DEFINITION OF CLOUD COMPUTING

The Cloud Computing concept came into the spotlight in the year 1950 with access via thin/static clients and the implementation of mainframe computers. Then in 1961, John McCarthy delivered a speech at MIT in which he suggested that computing services will be readily available on demand service [4], just as other utility services such as water, electricity, telephone, and gas that computing can be sold like a utility. In the 21st century, this model has been referred to as utility computing or as cloud computing. Using cloud computing you can go with Pay-per-use or Pay-As-u-go Model. In 1999, Salesforce.com became the 1st company to enter the cloud arena, excelling the concept of providing enterprise-level applications to end users through the Internet. Then in 2002, Amazon came up with Amazon Web Services, providing services like computation, storage, and even human intelligence. *In 2009,* Google Apps, Hadoop, Salesforce.com, Manjra soft Aneka and Microsoft's Windows Azure also started to provide cloud computing enterprise applications. Other companies like HP and Oracle also joined the stream of cloud computing, for fulfilling the need for greater data storage.

Many definitions have been introduced for the last years to define exactly what "cloud Computing" are: According to Buyya et al. [5] have defined it as follows: "Cloud is a parallel and distributed computing system consisting of a collection of interconnected and virtualized computers that are dynamically provisioned and presented as one or more unified computing resources based on service-level agreements (SLA) established through negotiation between the service provider and consumers." The National Institute of Standards and Technology (NIST) [6] characterizes cloud computing as "a pay-per-use model for enabling available, convenient, on-demand network access to a shared pool of configurable computing resources (e.g. networks, servers, storage, applications, services) that can be rapidly provisioned and released with minimal management effort or service provider interaction." Vaquero et al. [7] have stated "clouds are a large pool of easily usable and accessible virtualized resources (such as hardware, development platforms and/or services). These resources can be dynamically reconfigured to adjust to a variable load (scale), allowing also for an optimum resource utilization. This pool of resources is typically exploited by a pay-per-use model in which guarantees are offered by the Infrastructure Provider by means of customized Service Level Agreements." definition proposed by the U.S. National Institute of Standards and Technology (NIST)[6]:"Cloud computing is a model for enabling ubiquitous, 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".

III. EXISTING TECHNOLOGY

1) *Mainframes:* Mainframes were powerful, highly reliable computers specialized for large data movement and massive input/output (I/O) operations. They are mostly used by large organizations for bulk data processing tasks such as online transactions, enterprise resource planning, and other operations involving the processing of significant amounts of data. The main application of mainframes is Batch Processing. The evolved version of application which are still use for transaction processing i.e. airline ticket booking, online banking, government services and supermarkets.
2) *Clusters:* This technology is faster, more powerful, high availability of resources, high performance and cheap cost than mainframe computers[8].High performance or cluster computing is form by large number of groups that are connected through a LAN so that is act as a single machine. Due to its faster processing speed, better integrity it solve the complex problems more efficiently. It is used for critical applications some are Earthquake Simulation, Weather Forecasting, Google search engine etc.
3) *Grid:* Grid computing is evolution of the cluster computing [9]. It aggregates the geographically dispersed clusters with a internet to solve a particular task. These clusters belonged to heterogeneous computing nodes, and arrangements are made among them to share the computational power, data storage and memory.

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IV. CHARACTERISTICS OF CLOUD COMPUTING

A. On demand access
B. No up-front commitments
C. Pay-per-use model
D. Nice Pricing
E. Efficient resource allocation
F. 24/7 hours available
G. Easily manageable, flexible and scalable
H. Energy efficiency
I. Increased agility
J. Service orientation
K. Security
L. High performance and reliability
M. Accessible from anywhere

V. MAJOR CATEGORIES OF CLOUD COMPUTING SERVICES

The cloud computing is the capability to deliver, on demand, a variety of IT services to users over the internet. Cloud computing service offerings into three major categories: Infrastructure-as-a-Service (IaaS),Platform-as-a-Service (PaaS), and Software-as-a-Service (SaaS)[10].

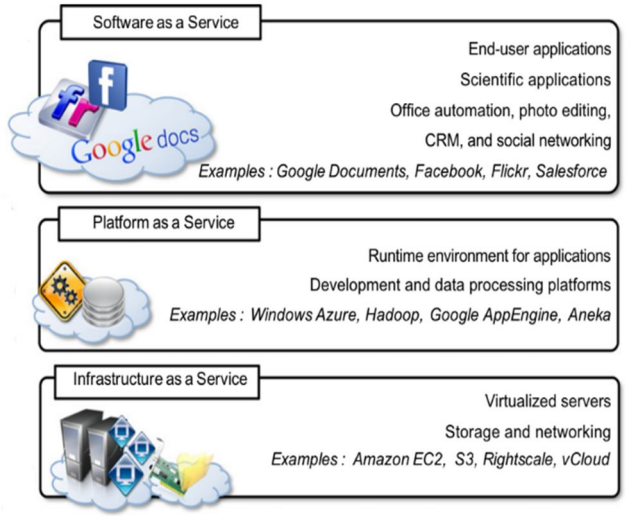


Fig. 2 Cloud Computing Services

A. Infrastructure as a Service: Hardware as a Service or Iaas is a bottom layer which delivers infrastructure on demand in the form of virtual storage, networking, virtual machines, hardware and other resources. They deliver customizable infrastructure on user request to Iaas provider. Then provider creates one or more virtual machines on the demand of the client. The user can able to deploy and run the software stack in the virtual machine. Iaas help the consumer to reduced the cost of purchasing and managing their storage, networking and physical servers. The cloud service provider hosts the IaaS infrastructure services in which the users access these computing resources in a virtualized environment and priced according to the specific resource of the virtual hardware, memory, number of processors, disk storage etc. Iaas service providers are Amazon EC2 and S3,GoGrid etc. Besides the virtual machine management capabilities, additional services can be provided by Iaas that generally including the SLA(Service Level Aggrement) resource-based allocation, workload management, support for infrastructure design through advanced Web interfaces, and the ability to integrate third-party[11].Iaas services provides by public clouds vendors such as Amazon, GoGrid, Joyent, Rightscale, Terremark, Rackspace, ElasticHosts, and Flexiscale, which has their own large datacenters and give access to their computing infrastructures as a renting bases.

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Fig. 3 Iaas Services

B. Platform as a Service: Paas providers commonly provides a development and deployment environment that allow users to create and run their applications on cloud with little or no trouble to low-level details of the platform. It is the responsibility of the Paas service provider to offer scalability and to manage fault tolerance, while users are requested to focus on the logic of the application developed by the provider's APIs, programming tools and libraries [11]. Client design their applications and are not concerned with hardware that may be physical or virtual, server, storage, operating systems and other low-level services. The core middleware or hypervisor is in charge of managing the resources and scaling and descending applications on demand or automatically, according to the commitments made with users in SLA. This approach increases the level of abstraction at which cloud computing take advantage but also some restrictions for the user. The user works under a more controlled environment.
PaaS providers usually support multiple programming languages in platforms include Python and Java (e.g., Google AppEngine), .NET languages (e.g., Microsoft Azure), and Ruby (e.g. Heroku), force.com or Saleforce.com has made its own programming language (Apex) and an Excel-like query language, which provide higher levels of abstraction to key platform functionalities [12]. The most popular is Microsoft Windows Azure [11], which provides a comprehensive framework for building service-oriented cloud applications on top of the .NET technology, hosted on Microsoft's data centers.



Fig. 4 Paas Services

C. Software as a Service: Saas is top most layer of the cloud computing service. In this model, consumers neither need install anything on their personal computer, nor have to pay considerable up-front costs to purchase the software and the required licenses. They simply access the application website, enter their credentials and billing details, and can instantly use the application, which, in most of the cases, can be further customized for their needs. On the provider side, the specific details and features of each customer's application are maintained in the infrastructure and made available on demand. Software-as-a-Service is a software distribution model in which applications are hosted by a vendor and made available to customers over a network, typically the Internet. The common features of desktop applications—such as office automation, document management, photo editing, and customer relationship management (CRM) software—are duplicates on the provider's infrastructure and made more scalable and accessible through a web browser on demand and billing done through renting weekly, monthly, yearly and pay-per -use. These applications are shared across multiple users whose interaction is isolated from the other users. Examples are Google drive, social networking site, gmail, etc.

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Fig. 5 Saas Services

VI. CLOUD COMPUTING PLATFORMS

1) *Amazon web Services (AWS):* AWS is mostly known for its compute and storage-on-demand services, namely Elastic Compute Cloud (EC2) and Simple Storage Service (S3). EC2 provides users with customizable virtual hardware that can be used as the base infrastructure for deploying computing systems on the cloud[13]. AWS offers cloud IaaS services ranging from virtual compute, storage, and networking to complete computing stacks. EC2 also provides the capability to save a specific running instance, as an image, thus allowing users to create their own templates for deploying systems.
2) *Google App Engine:* Google App Engine is a scalable runtime environment, mostly developed to executing Web applications and dynamically scale as user demand varies over the time [15]. App Engine provides services include in-memory caching, scalable data store, job queues, messaging, secure execution environment and a collection of services that simplify the development of scalable and high-performance Web applications. Developers can build and test applications on their own machines using the AppEngine software development kit (SDK), which replicates the production runtime environment and helps test and profile applications.
3) *Hadoop:* Apache Hadoop is an open-source framework that is suited for processing large data sets on commodity hardware. Hadoop is an implementation of Map Reduce, an application programming model developed by Google, which provides two fundamental operations for data processing: map and reduce. The former transforms and synthesizes the input data provided by the user; the latter aggregates the output obtained by the map operations. Hadoop provides the runtime environment, and developers need only provide the input data and specifies the map and reduce functions that need to be executed[15].Hadoop is an integral part of the Yahoo! Cloud infrastructure and supports several business processes of the company. Currently, Yahoo! manages the largest Hadoop cluster in the world.
4) *Microsoft Azure:* Microsoft Azure is a cloud operating system and a platform for developing applications in the cloud. It provides a scalable runtime environment for Web applications and distributed applications in general. Applications on Azure are organized around the concept of roles, which identify a distribution unit for applications and embody the application's logic. There are three types of role: *Web role, worker role, and virtual machine role.* The Web's role is designed to host a Web application, the worker role is a more generic container of applications and can be used to perform workload processing, and the virtual machine role provides a virtual environment in which the computing stack can be fully customized, including the operating systems.
5) *Force.com and Salesforce.com:* Force.com is a cloud computing platform for developing social enterprise applications. The platform is the basis for SalesForce.com, a Software-as-a-Service solution for customer relationship management. Force.com allows developers to create applications by composing ready-to-use blocks; a complete set of components supporting all the activities of an enterprise is available [11]. It is also possible to develop your own components or integrate those available in AppExchange into your applications.
6) *Manjrasoft Aneka:* It is a cloud application platform for rapid creation of scalable applications and their deployment of various types of clouds in a seamless and elastic manner. It supports a collection of programming abstractions for developing applications and a distributed runtime environment that can be deployed on heterogeneous hardware (clusters, networked desktop computers, and cloud resources). Developers can choose different abstractions to design their application: tasks, distributed threads, and map-reduce. These applications are then executed in the distributed service-oriented runtime environment, which can dynamically integrate additional resource on demand[11].
7) *Rackspace Cloud Servers:* Rackspace Cloud Servers are an IaaS solution that provides fixed size instances in the cloud. Cloud Servers offer a range of Linux-based pre-made images. A user can request different-sized images, where the size is measured by requesting RAM, not CPU.

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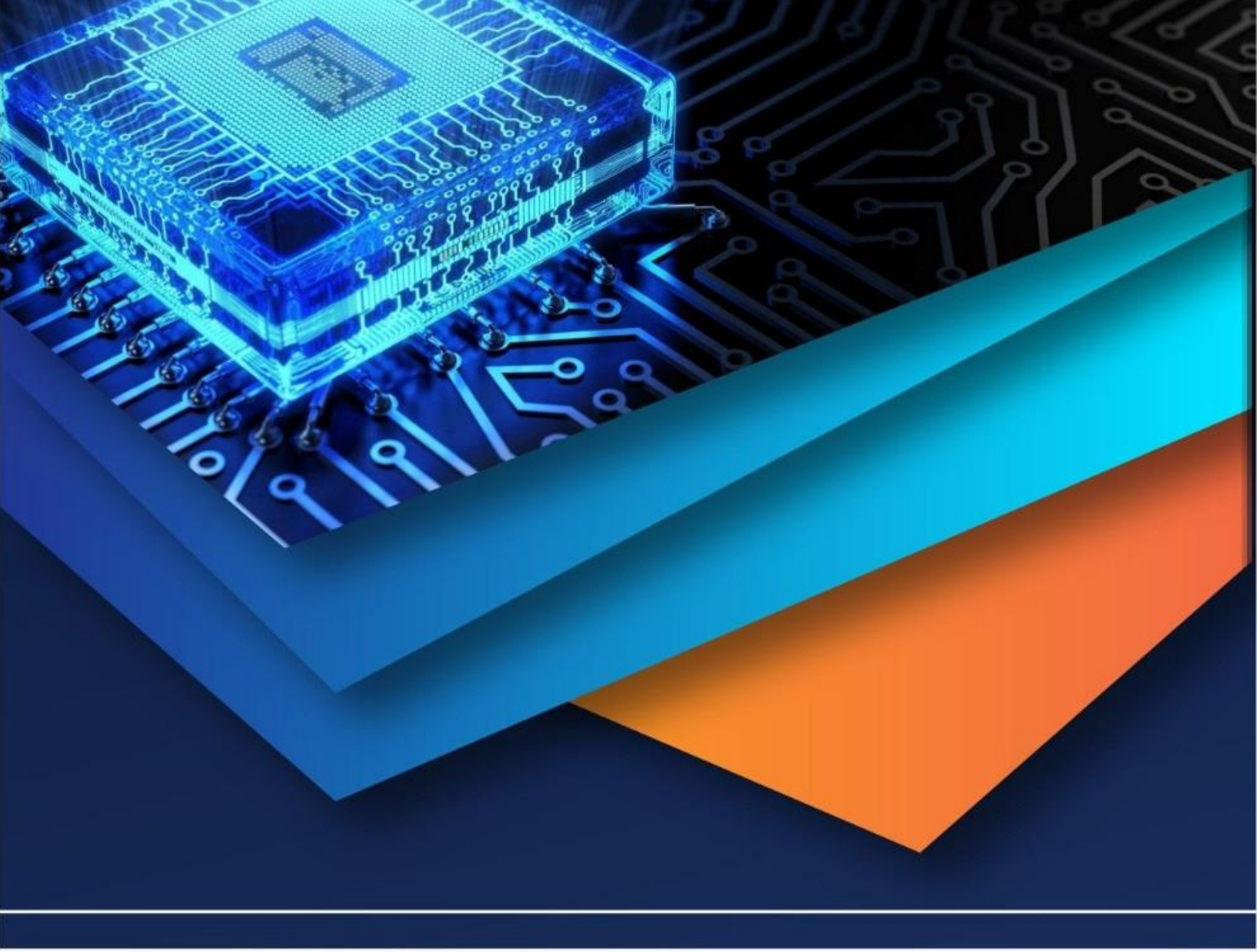
VII. CONCLUSION

Cloud computing is a one of the most emerging technology and its popularity increasing very rapidly. Many companies providing the various services to the consumer on rent bases like Google, Amazon Services, Oracle, Microsoft etc. Today, IT companies shift their business over the cloud based architecture because it provides physical infrastructure to build an application, the developer deploy their application on virtual environment and user run many software without installing on their personal computers. Moreover, user can store their personal data on cloud as per their requirement. This paper discussed the history, cloud computing services and its various technologies which recently used by IT industries. This technology changes the view point of many companies and they attract towards this technology. Cloud computing received lot of interest from various enterprises and IT professionals.

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