7th National Conference on
"Role of Engineers in Nation Building" organized by VIVA Institute of Technology, Mumbai
(1st and 2nd March 2019)
International Journal of Engineering Research & Science (IJOER)
ISBN: [978-93-5321-411-1] ISSN: [2395-6992] [Vol-5, Issue-3, March- 2019]

Cloud Computing and Its Challenges

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Abstract *— **Cloud** computing is defined as the development of parallel computing, distributed computing, grid computing, cluster computing and virtualization technologies. This paper explored the concept of architectural components of the cloud and also explain how cloud computing differ from grid computing. It also explained the applications of cloud computing platforms, challenges and issues of cloud computing identified. This paper also explores the comparison of different cloud service models. Security and privacy issues present a strong obstacle for users to put up cloud computing systems.*

Keywords—Architectural components, Cloud computing, cloud platforms, Deployment models, issues and challenges.

I. INTRODUCTION

The term cloud refers to servers, storage and software development platforms over the internet. Cloud computing is a method used for retrieving resources, data or information stored over the internet through web-based tools and applications. Cloud computing allow us to store the data in the cloud rather than keeping in the hard drive or local storage device. The information or data being accessed is found in "the cloud" and does not limit a user to be in a specific place to access it. Cloud computing provides services such as computing, databases, storages, servers, machine intelligence, analytics, and virtual machines. Nowadays, organizations are moving towards cloud computing technologies due to the following reasons:

1.1 Cost efficient

Earlier organization has to spend a huge amount on maintaining confidential information. Cloud computing eliminates the capital expenditure of the organization of buying hardware and software's, installation or setting up servers.

1.2 Speed

Most of the services are self-service and on demand, typically, by just a few mouse clicks, the user can access the data. It gives a lot of Flexibility and takes pressure off capacity planning of businesses.

1.3 Productivity

Cloud computing removes the need for On-site Datacentres, which require a lot of 'racking and stacking' Hardware setup, software patching or installation and other IT management chores which are time-consuming. Hence, IT teams in an organization started using cloud technology in order to achieve more business goals.

1.4 Device and Location Independence

It enables users to access data using web browsers regardless of the location and the device they use, e.g. Desktop, Laptop or Mobile.

II. ARCHITECTURAL COMPONENTS

Cloud computing architecture comprises two models as follows: Service models and Deployment models. Service models are defined as types of services provided by the cloud and Deployment models are defined on the basis of how and by whom the cloud services are used.

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2.1 Service models are classified into three types:

Fig. 1 Service Models

2.1.1 IaaS (Infrastructure as a Service)

IaaS is a method of delivering cloud computing infrastructures like storage, network, server, and operating system. IaaS is also known as the Internet as an on-demand service. IaaS was earlier known as Hardware as a Service (PaaS), Cloud computing platform-based model. IaaS is the easiest and lowest level cloud service model. IaaS gives an advantage to enterprise customers to create lucrative and easily scalable IT solutions. Popular examples of IaaS are Amazon EC2, IBM Soft Layer and Google's Compute Engine (GCE).

2.1.2 PaaS (Platform as a Service)

PaaS is the type of service model which gives the users with application platforms and databases. It also provides development and deployment tools which are essential for developing applications. It has a characteristic of point-and-click tools that helps non-developers to create web applications. Due to this service model, it is easy for developers to log on the websites and use the built-in-API to create web-based applications. It lowers the administrative overhead cost because there is no need to buy expensive hardware, servers, power and data storage. PaaS provides built-in security, web service interfaces and built-in tools for defining workflow and business rules.Examples of PaaS offering vendors are App Engine of Google and Force.com

2.1.3 SaaS (Software as a Service)

SaaS model provides software application as a service to the end users. It refers to software that is distributed on a host service and is accessible via the Internet. SaaS helps the developer to develop customized application through API (Application Programming Interface). SaaS makes software accessible over the Internet and is cost effective since they do not require any maintenance. They are available on demand and can be scaled up or down and are automatically upgraded. SaaS helps the cloud customers to achieve economies of scale, optimization in terms of speed, security, availability, disaster recovery, and maintenance. Examples of Saas are Google Mail, SalesForce.com, and Google Docs.

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2.2 Deployment models are classified into four types:

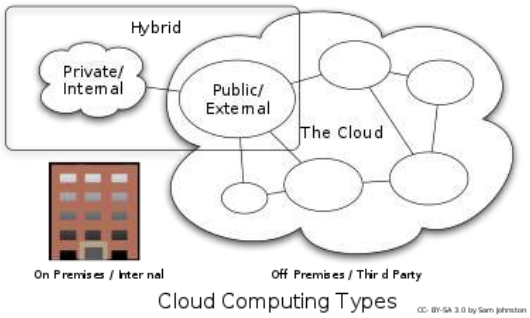

Fig. 2 Deployment Models

2.2.1 Public cloud

This model is operated solely for a single organization, whether managed and hosted either internally or externally or by the third party. General publican easily accesses systems and services through a public cloud. The big IT giants such as Google, Amazon, and Microsoft provide cloud services through the internet. There are huge benefits to using the public cloud as follows: cost-effective, reliable, flexible, and highly scalable. Public cloud services can be accessed from anywhere via the Internet, ensuring location independence. It is also based on the pay-per-use model.

2.2.2 Private cloud

Private cloud allows systems and services to be accessible by the users within an organization. It is operated and managed only within a single organization internally by the organization itself or by third-party. Private cloud operations are not accessible by the general public, ensuring high security and privacy. It has more control over its resources and hardware because it is accessed within an organization only.

2.2.3 Community cloud

Group of organizations can access systems and services with the help of a community cloud. It may be managed and operated by organizations or by the third party and shares the infrastructure by various organizations from a specific community with common concerns like security, compliance, jurisdiction, etc. It has some advantages as that of private cloud at low cost. It is comparatively more secure than public cloud but less secure than the private cloud.

2.2.4 Hybrid cloud

Hybrid cloud is a mixture of two or more clouds (private, public or community) which remain distinct entities but are bound together, providing the benefits of multiple clouds services. Public cloud is used for performing non-critical activities while the private cloud is used for performing critical activities. It allows one to stretch either the capacity or the capability by aggregation, integration or customization with another cloud service. It is benefitted to an organization due to the feature of public cloud scalability and private cloud scalability. It ensures a higher degree of security. Choosing a hybrid cloud model depends on various factors such as data security and compliance requirements, level of control needed over data and the applications an organization uses. It organizations use public cloud computing resources to meet temporary capacity needs that cannot be met by the private cloud.

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III. ANALYSIS TABLE

Table 1
Comparison of the types of cloud storage services

Characteristic	Public cloud	Private cloud	Hybrid cloud
scalability	high	limited	High
security	good, depending on the security offered by the service provider	well protected, all data available only within the network	very high, integrated options allow to turn on additional layers of security
performance	average	very good	good, depends on the performance of the server on which the service was launched
reliability	average, depending on Internet connection and the availability of the service on the service provider side	high, limited to the performance of the internal network	average, depends on the possibility of use of cache memory for frequently used data and the availability of an Internet connection
cost	low, because user usually pay only for extra space for data or increase of data transfer	average, because it requires additional expenses related to hardware and costs of electricity	average, because it allows to transfer part of data to an external hosting

IV. COMPARISON BETWEEN CLOUD COMPUTING AND GRID COMPUTING

Cloud computing focus on the applications which are business specific such as web-based application. Which are used by thin clients or for handheld devices? Grid computing focusses on research-based applications that work together for solving larger computing problem. The cloud computing infrastructure is centralized, whereas grid computing focusses on the decentralized management system. The cloud computed has to pay as they use whereas user does not have to pay as he/she releases the recourses the resources. Cloud computing services are highly flexible and real-time whereas grid computing services are low flexible. There is a management pool of resources In cloud computing whereas the resources are limited in grid computing.

V. POPULAR CLOUD COMPUTING PLATEFORMS

4.1 AbiCloud

Abicloud is a cloud computing platform, It can be utilized to frame, combine and manage public as well as a private cloud in the homogeneous environments. Using Abicloud, the user can efficiently and automatically deploy and manage the server, storage system, network, virtual devices and applications and so on. Abicloud is a powerful web-based management function as compared to other cloud computing platforms. The main advantage of Abicloud is its core encapsulation manner. Abicloud helps the user to finish deploying a new service by just dragging a virtual machine with a mouse. Abicloud can be used to expand and implement private cloud as well as hybrid cloud according to the cloud providers' demand and configuration. It is very much helpful for the transformation of the working environment and will make the cloud deployment process easy and flexible.

4.2 Eucalyptus

Eucalyptus (Elastic Utility Computing Architecture for Linking Your Programs to Useful Systems) is used to build open-source private cloud platform. Eucalyptus is an elastic computing structure that can be utilized for connecting the users' programs to the user systems. Currently, Eucalyptus is compatible with EC2 from Amazon and may support more other kinds of clients with minimum alteration and extension.

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4.3 Nimbus

Nimbus is an open toolset and IaaS, a cloud computing solution providing. It authorizes users to lease remote resources and build the required computing environment through the deployment of virtual machines.

4.4 OpenNebula

OpenNebula is an open source cloud service framework which allows the user to deploy and manage virtual machines on physical resources. The main dissimilarity between OpenNebula and Nimbus is that nimbus implements a remote interface based on EC2 or WSRF through which user can process all security-related issues. OpenNebula is also an open and flexible virtual infrastructure management tool, which can be utilized for synchronizing the storage, network and virtual Techniques.

VI. CLOUD COMPUTING APPLICATIONS

The Cloud computing Applications are as follows:

- Provides dependable and secure data storage center.
- Cloud computing can comprehend data sharing between different types of equipment.
- The cloud provides nearly boundless possibility for users to use the internet.
- Cloud computing does not require high-quality equipment for the user and it is simple and easy to use.

VII. ISSUES IN CLOUD COMPUTING

Enormous information on individuals and companies is placed in the cloud; the main concern is beginning to grow about just how safe an environment it is? Issues of cloud computing are summarized as follows:

7.1 Privacy

Cloud computing uses the virtual computing technology, users' personal data may be distributed in variousvirtual data centers rather than stay in the same physical location, users may expose hidden information when they are accessed cloud computing services. Attackers can examine the critical task depend on the computing task acknowledged by the users.

7.2 Reliability

The cloud servers also experience downtimes and slowdowns like our local server.

7.3 Legal Issues

Anxiety stick with safety measures and confidentiality of individual all the way through legislative levels

7.4 Compliance

Numerous regulations related to the storage and need of data requires daily reporting and audit trails.

7.5 Freedom

Cloud computing denies users to physically acquire the storage of the data, leaving the data storage and control in the hands of cloud providers.

VIII. CHALLENGES OF CLOUD COMPUTING

8.1 Security

Familiar security issues such as data loss, phishing, botnet (running remotely on a collection of machines) pose severe threats to an organization's data and software. The multi-tenancy model and the pooled computing resources on cloud computing has

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popularized new security challenges such as shared resources (hard disk, data, VM) on an identical physical machine invites unexpected side channels between a malicious resource and a regular resource. And, the issue of "reputation fate-sharing" will harshly damage the reputation of many good Cloud "citizens" who happen to, unfortunately, share the computing resources with their companion tenant – an errant user with a criminal mind. Since they may share the same network address, any atrocious handling will be attributed to all the users without differentiating real subverters from normal users.

8.2 Service Level Agreement

It is very important for consumers to obtain guarantees from providers on service delivery.Typically, it is provided through Service Level Agreements (SLAs) negotiated between the providers and consumers.

8.3 Data integrity

In the cloud system means to protect information integrity (i.e. not lost or modified by unauthorized users).

8.4 Control

In the cloud system means to regulate the use of the system, which includes the applications, its infrastructure, and the data.

IX. CONCLUSION

This paper discussed about the advantages of Cloud computing and importance of cloud computing in today's era. This paper also describes about the services provided by cloud computing, the architectural components of cloud computing which is subdivided into Service Models (such as SaaS, PaaS, IaaS) and Deployment models (such as Public cloud, Private cloud, Community cloud and Hybrid cloud). Further in this paper, it is also describe how Grid computing differ with Cloud computing. Cloud computing applications are also been explained in order to know about the benefits of cloud computing technique for businesses, companies and organizations.

Despite of so many benefits and importance of cloud computing, there are also networking issues and challenges faced by the organization. Rightly said every coin has two sides, viz, negative and positive prospect. Hence, Challenges and issues of cloud computing are also addressed. In spite of so many limitations and the need for better methodologies processes, cloud computing is becoming a very attractive paradigm, especially for large organizations.

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