Evolution of Cloud Computing

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***Abstract* — Enterprises are striving for lower costs, greater availability, agility, and risk management, all of which are being accelerated by Cloud Computing. The cloud is not a specific product, but rather a method of offering IT services that are consumable on demand, elastic enough to scale up and down as needed, and adhere to a pay-for-usage paradigm. Infrastructure as a Service (IaaS) is one of three major types of cloud computing service models. It is a service model that delivers servers, processing power, network bandwidth, and storage capacity as a service to their subscribers. Cloud can refer to many things, but none of the other applications are conceivable without the essential storage parts, which are given as a service, called Cloud storage. This paper introduces Cloud Storage, covering the key technologies in cloud computing and Cloud Storage, management insights about cloud computing, different types of cloud services, driving forces of cloud computing and cloud storage, advantages and challenges of cloud storage, and concludes by identifying a few challenges that cloud storage providers must address.**

Keywords — Cloud Computing, Mainframe computing, distributed computing, open source software, Benefits, Challenges, Applications.

I. INTRODUCTION

Cloud computing changes the way existing company IT infrastructure is built and managed by delivering consumable services such as infrastructure, platform, and applications. It will transition the IT infrastructure from a "manufacturing" concept to a "supply chain" approach. It is a computing model that enables simple, on-demand access to pools of highly elastic computer resources. These materials are made available as a service across a network, most often the Internet. Cloud computing allows users to conceive of computing as practically infinite, low-cost, and dependable, without having to worry about how it is built, how it works, who operates it, or where it is situated.

The rise of cloud computing over the years has resulted in a paradigm shift in which consumers are increasingly interested in how to harness the capacity of a technology rather than being involved in its technical know-how. It has also resulted in a new paradigm in which the consumer attempts to decrease the initial cost of installation by choosing for the more viable and easy pay-as-you-go pricing.

The internet allows remote access to the data. To assist consumers, the Cloud offers a variety of services such as infrastructure as a service (IaaS), platform as a service (PaaS), and software as a service (SaaS). All of these services are utilised by small, medium, and big businesses. These services enable customers to remotely store and retrieve data. The cloud's adoption in industries is determined by its benefits and drawbacks. The study's main goal is to paint a picture of cloud usage in IT industries.

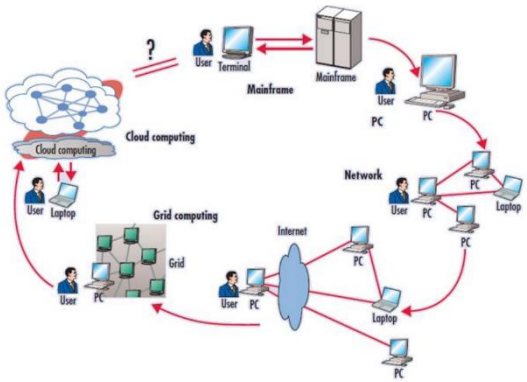
The purpose of cloud computing is to enable consumers to benefit from all of these technologies without requiring extensive knowledge or skill in any of them. The cloud seeks to reduce expenses and allow customers to focus on their main business rather than being hampered by IT hurdles. We will be further looking at the evolution of cloud computing in the paper.

In reality, the burden is managed by computer networks that comprise the cloud. As a result, user demand for hardware and software falls. Hence, all that is necessary to see the cloud computing programme on a computer is a web browser such as Opera, Google Chrome, Mozilla Firefox, and so on. Cloud computing features include on-demand self-service, measurement of services, a large network area, quick elasticity, reduced pooling, multi-tenacity, and shared infrastructure.

II. EVOULTION OF CLOUD COMPUTING

The most recent technologies, including virtualization, utility computing, grid computing, and distributed computing environments with web-based platforms, have led to the evolution of cloud computing. When mainframe computers were introduced in 1950 and made accessible by thin/static clients, the idea of cloud computing was born. With the introduction of the grid computing concept in the late 1980s, cloud computing technology began to emerge. A new method of processing and organizing data was produced by cloud computing as a result of businesses changing their management style. Before cloud computing, employees had to go through a certain department where a lot of files were arranged in order to access data. Because they will require a person to organize and handle their data, this type of process typically takes a long time and is expensive.

According to Armbrust et al., "Cloud Computing refers to both the hardware and systems software in the datacenters and the applications offered as services over the Internet."
which offer those services. Long-standing terminology for the services is "Software as a Service" (SaaS). We'll refer to the hardware and software in datacenters as a cloud. We refer to a Cloud as a Public Cloud when it is made available to the general public on a pay-as-you-go basis; the service being offered is Utility Computing. The internal datacenters of a company or other organization that are closed off to the broader public are referred to as private clouds. Therefore, SaaS and Utility Computing together make up Cloud Computing, but Private Clouds are excluded. Cloud computing is the fifth generation of computing, after mainframe, personal computer, client-server, and the internet.



A. Mainframe Computing:

In the past, mainframes were used by businesses to power their information infrastructure. This big, powerful computer held all the data and performed all the software programmes in one physical place (a building or an office). Even though many programmes could be supported by a single mainframe with reasonable ease, programmers were constrained by batch files, which required operators to operate complicated computer hardware made up of power-hungry mechanical relays, transistors, and vacuum electronic I/O devices once entire jobs were submitted on punch cards.

To efficiently utilise different system resources, multi-programmed, batch systems were developed. These systems then evolved into time-sharing systems, in which a single CPU conducts numerous tasks for a number of users while switching between them. The processing of enormous amounts of data necessary for resource planning, census data, industrial and consumer statistics, and significant financial transactions are all applications of mainframe computers. The IBM System/360TM was introduced on April 7, 1964, which is when the mainframes we use today were first introduced. A breakthrough development in computer development was System/360.

B. Personal Computing:

These systems are considerably small and are cheaper than Mainframe Systems and more suitable for typical office environments and necessary for every personal executive.In personal computing, interactivity was centred on the lone user interacting with the computer to do a variety of activities. Due to the popularity of personal computers at home, firms now need to supply them in the workplace as well. Open source software like Linux, which is not only free but also effective, is beginning to challenge Microsoft Windows' dominance of the personal computer.

C. Client - Server Computing:

When personal computers and laptops became more affordable, businesses began switching from mainframe terminals to PCs connected to a network. A server, which might be a mainframe or a powerful PC, is at the centre of the network of PCs (clients). It holds some of the data, application software, and other instructions that the network users require in order to interact and conduct network transactions. Different types of servers facilitate different types of needs like a web server provides web pages to users, an application server assigns specific tasks to other servers to enable a faster more efficient response to client requests than a single mainframe trying to do everything.

The computer community has recognised the numerous unique benefits of client/server systems as they have become more durable. The ease with which programmes fit into a client/server architecture is arguably its most significant benefit. A system for an electronic phonebook is a common illustration of this. It makes logical to build this part of the application as a server because the data is largely static and the data repository must be able to react to requests. A thin client makes sense given that it is challenging to update each user's phone book, the best search algorithm is subject to change at any moment, and the amount of space needed for the volume of data processed is prohibitive for many users' workstations. P2P computing provides an alternative to the traditional client/server architecture. P2P computing can be used in ecommerce, gaming, search engine, virus protection, etc.

Client Server Computing has certain limitations too such as those with remote network computers and mobile network computers who want to communicate over the network at a reasonable pace will be impacted by commercial network availability.

D. Internet Computing:

The Internet is the massive network of networks connects millions of computers together worldwide, forming a network in which any computer can communicate with any other computer provided that they are both connected to the Internet. The foundation of the WWW are its files, also known as pages or Web pages, which contain data and links to online resources, both textual and multimedia. Internet protocols are a collection of guidelines that permit machine-to-machine communication. Hypertext is sent over networks using HTTP (Hyper Text Transfer Protocol), a web protocol. The disadvantages of grid computing include

1. The software of the grid is still in the involution stage.
2. A super fast interconnect between computer resources is the need of hour.

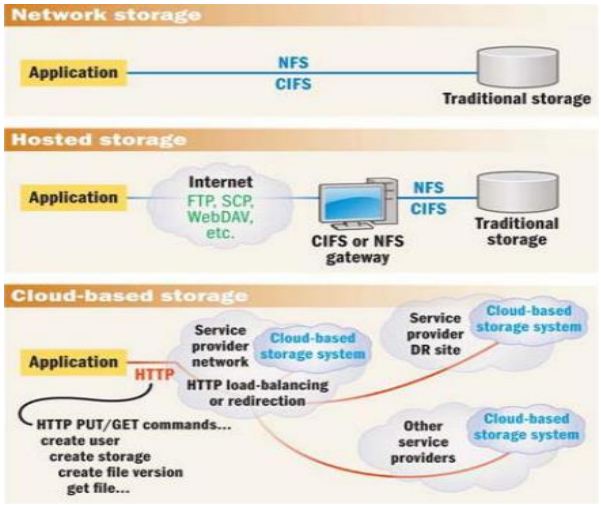
E. Applications of Cloud Computing:

Data may be accessed quickly on the internet using cloud computing, and nobody would be barred unless it is confidential. With the advent of cloud computing, e-commerce has reached a new age. Starting an online store is now much more affordable because there is no longer a need for a company to invest in a data centre, monitor website traffic, or hire a skilled provider. Data may be accessed quickly on the internet using cloud computing, and nobody would be barred unless it is confidential.

As a replacement for traditional learning and teaching in terms of knowledge transfer and knowledge sharing, the cloud offers tremendous help in knowledge management. In addition, cloud computing offers cost-effective benefits for both healthcare and education. Due to the long-term availability of low cost computing and bandwidth, today's factor that contributes to the rise of cloud computing enables cloud hosting providers like EarthLink Cloud to offer reliable cloud services that aid businesses in saving money.

Cloud computing can be considered a new computing paradigm that allows users to temporarily employ computer

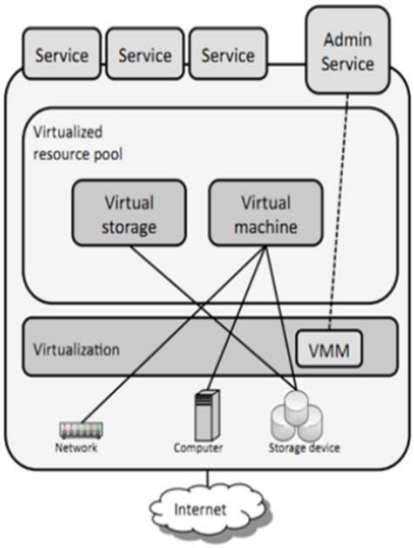
infrastructure through the network, offered as a service by the cloud-provider at possibly one or more layers of abstraction," claim Youseff et al. One service provided by cloud computing is cloud storage. Fig. 7 depicts the development of cloud storage using hosted storage and conventional network storage. Data access from anywhere is a benefit of cloud storage. Little amounts of data up to an organization's whole warehouse can be stored by cloud storage services. The amount of use and data transferred to the cloud storage can be paid for by the subscriber directly to the cloud storage provider.



III. Approach of Cloud Computing

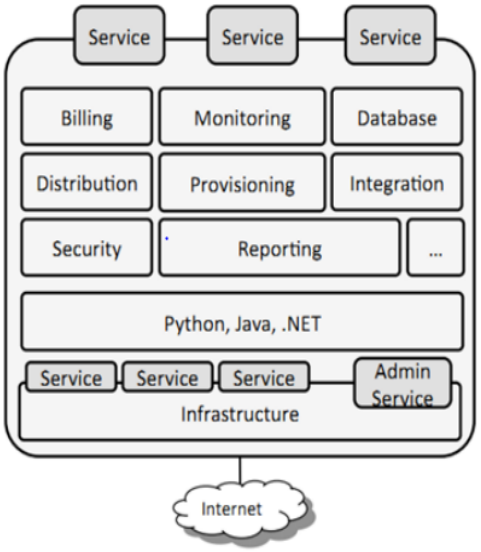
1. Infrastructure as a Service (IaaS)

In this model, the service provider's responsibility is to offer the essential infrastructure required to host cloud applications. The processing, storage, and platform-related decisions are under the subscriber's discretion. This is the most fundamental type of the majority of the resources are still under the end user's control in cloud computing. This model works effectively for applications when the end user just need cloud infrastructure resources. Common examples can be: Rackspace Cloud, Amazon Cloud formation.



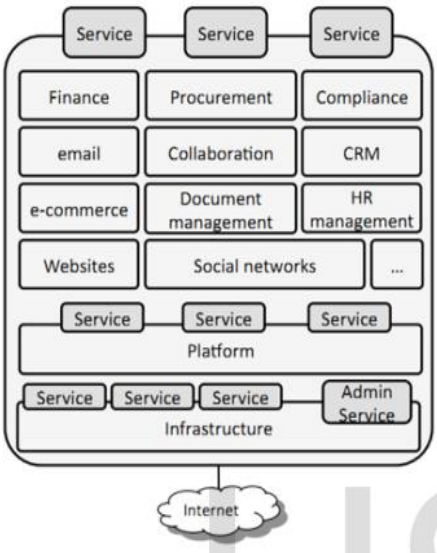
2. Platform as a Service (PaaS)

In this model, the consumer seeks related to infrastructure as well as operating system and storage from the service provider. The consumer uses these resources for deploying consumer created or acquired applications. This model puts the consumer in control of only the application without having to worry about the platform and the infrastructure that is being used for deployment of the application. Examples include: Amazon Engine, Windows Azure, etc.



3. Software as a Service (SaaS)

This model is what can be described as leveraging cloud potential to capacity. In this model, the consumer uses the application provided by the service provider. The consumer does not control infrastructure, platform or the software. The consumer only uses the software as an end product and pays as per the usage. Examples are Microsoft Office 365, Google Apps, and Salesforce.com.



IV. Benefits of Cloud Computing

1. Scale: Cloud computing provides flexibility in terms of scale. Initially, when IT resources are purchased,

they are as per the demand. When the demand increases, more resources are pur- chased. When the demand goes down, there is no way to re- duce these resources. Therefore, there is an observed underuti- lization of the resources. With cloud, when the demand becomes lean, the services can be scaled down. Conversely, it can also be scaled up as and when required.

2. Audit and Compliance: Audit and compliance is probably one of the biggest burdens on any IT organisation. Cloud vendors' service level agreements (SLAs) ensure that all audits and compliance activities are logged, monitored satisfactorily.

3. Business Continuity Planning (BCP): BCP truly showcases one of the many benefits of cloud and how it can serve as an extension of IT and your business. BCP enables:
   - Disaster recovery with cold or hot backup.
   - Disaster recovery with high-failover or high- redundancy.
   - Data duplication and backup

V. Issues with Cloud Computing

Although cloud storage offers reduction in the capital investment cost, customers has to face some of the technical, integration, security and organisational issues at various levels.

1. Control over the Data: Since the data is residing outside the enterprise's infrastructure, it is perceived that the enterprise may lose the control over data. Although the concerns are largely hypothetical and psychological rather than actual.
2. Privacy: The user data can be accessed by the host company with or without permission. The service provider may access the data that is on the cloud at any point in time.
3. Interoperability & Control: Each vendor has different access methods, nonstandard APIs that make integrating applications, such as archiving or file shares with cloud storage, difficult and costly. Some vendors provide software clients that implement common network file sharing protocols such as Network File System (NFS).
4. Security: Cloud-based services involve third-party storage and security. Can one assume that a cloud-based company will protect and secure one's data?

VI. Future Scope of Cloud Computing

India is growing at a faster pace in the information technology sector thereby showing a great potential for the cloud computing services. Predictive technology and software will soon make this more robust and accurate. Companies will be able to foresee disaster and avert it, mitigating damage to their systems. This will prevent downtime and make the company safer.

In the future, cloud security systems will be able to validate identities through a "centralised trust." Identity-based security is thought to be more secure than current forms of security.

Uptime assurance with low-power processors, data centres will become more affordable, allowing companies to acquire seven to ten data centres around the world in different time zones and thereby allowing them to guarantee 99.9 percent uptime.

VII. Conclusion

Cloud storage techniques and service models are still in their infancy. Standardisation of service provider service levels, pricing plans, data access methods, operational and security processes, emergency plans for data migration if the enterprise wishes to change vendors sooner or later, and improving performance by using better load balancing methodologies are some of the thrust areas where future cloud storage work can be focused.

We talked about cloud computing, its properties, development, and a comparison with grid computing. Next we spoke about alternative approaches to cloud computing and some of its benefits. When we investigated cloud computing and its methodologies, we discovered that the study of this issue is extensive, and the variety of application fields will continue to expand. As a result, we recognize that cloud computing has a significant influence on society and the commercial industry.

Cloud computing is a significant advancement in information technology. Cloud computing is a catch-all phrase for anything involving the delivery of hosted services through the Internet. We have offered a simple overview of Cloud Computing Technology and its progress and development over time in this paper. This work also contains Cloud Computing characteristics, and it may be utilised for future cloud computing advances.

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