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Cloud Computing: Paving the Way for the Future of IT

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ABSTRACT

Cloud computing is a new technology that is becoming more and more important in the internet field right now. Every day, more and more people are interested in it. It's one of the tools that has grown the fastest over the past year. It's still in the process of being made. Because of this, it is important to know about the past and current state of cloud computing. This will help with future study and development. The main goal of this paper is to give an in-depth look at cloud computing. This essay talks about a variety of topics, including the normal meaning, the history of cloud computing, and five important features of cloud computing. This study also talks about deployment models, service models, and some problems that might come up.

Keywords: Definition, Evolution, Components, Characteristics, Deployment Models, Services Models.

I. INTRODUCTION

The idea behind cloud computing is that it's a cheap way to offer computing services, storage, and other services to customers who ask for them through certain apps that work over the internet. This model is based on the pay-as-you-go model. This means that the fee will change based on the resources and data you used, which are measured immediately.

The National Institute of Standard and Technology (NIST) defines the cloud computing in following manner: "Cloud computing is a model for enabling 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."

Fig 1. Cloud computing

This paper goes like this: in Section 2, we have some short information about how cloud computing has changed over time. In Section 3, we talk about the parts, and in Section 4, we list the five most important things about cloud computing. In Section 5, you can read about the four main release models. In Section 6, you can read about service models, and in Section 7, you can read about some problems that come up with them. Finally, part 8 is where this paper comes to an end.

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II. EVOLUTION OF CLOUD COMPUTING

It is thought that Joseph Carl Robnett Licklider came up with the idea of cloud computing while working on ARPANET in the 1960s. This network let people and data join from anywhere at any time. People who used CompuServe in 1983 were given a small amount of disc space that they could use to store any files they uploaded. At that point, in 1994, AT&T launched PersonalLink Services, an online service for business and personal contact.

The drastic development in cloud computing starts after Amazon Web Services introduced their cloud storage service AWS S3 in the year 2006 and has gained popularity and adopted as storage supplier to popular services such as SmugMug, Dropbox and Pinterest.

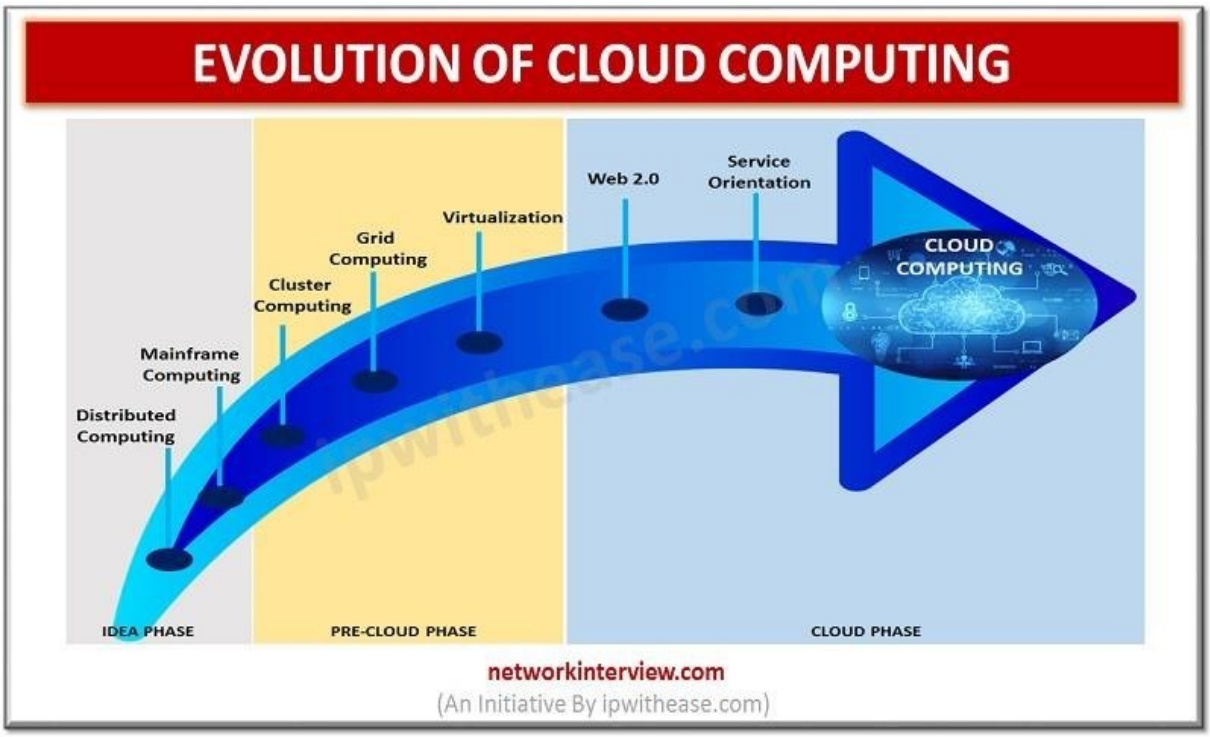

Fig 2. Evolution of cloud computing

The model of cloud computing started out as distributed computing, then moved on to mainframe, cluster, grid, and so on, as shown in fig.2. Finally, it ended up as cloud computing as we know it today.

When parts of a program system are shared between several computers, this is called distributed computing. To complete a job, the systems on different networked computers talk to each other and work together by sending messages back and forth. Mainframe computing is the way that mainframe computers are used, and big businesses use them for important tasks like processing large amounts of data for things like censuses, industry and consumer statistics, police and secret intelligence services, enterprise resource planning, and processing financial transactions. Cluster computing is when a lot of computers are linked together on a network and work together to do one thing. A "node" is a computer that is linked to the network. It can help you solve hard problems by making computing faster and protecting data more securely. Grid computing is a type of distributed and parallel computing in which a supercomputer and virtual information processing system are made up of a group of computers that are only lightly connected to each other and work together to complete very large jobs.

III. CLOUD COMPUTING COMPONENTS

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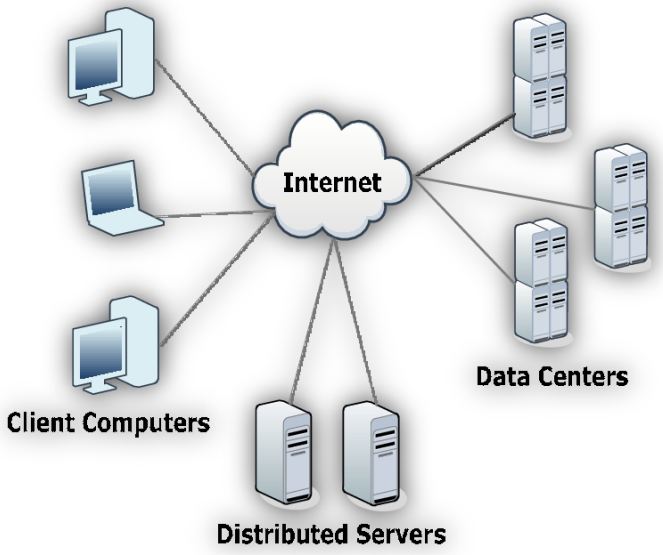
Cloud computing is a huge paradigm that is bounded by three basic (main) components as shown in the given fig 3.

These three basic components are client, Data Center and distributed server. All these components combined together to form the giant network which we are popularly known as cloud computing. These components have



their own identity and inevitable role in this model. To be more specific about components, they are discussed below:

Fig 3. Components of cloud computing

Clients: These are the things that end users use to control their cloud services. They could be a desktop computer, laptop, smartphone, iPad, or something else. This thin client only needs to be able to run a web browser, like Google Chrome, Firefox, or something else. It doesn't need a fast engine or a lot of storage space. There are three different types of clients: thin clients, mobile clients, and thick clients. The client's main job is to make a way to the resources over the internet so that those resources can be reached.

Data centre: This is where all the resources are located and where the needed data is stored and accessed. The apps that people who use cloud computing access are stored on many computers, which could be a building or a room that isn't in your house but can be reached through the internet. A host is a real computer that can run more than one virtual machine (VM). The number of VM that can run at the same time depends on the host's speed, the type of applications that run on the VM, and the host's size.

Since the computers are spread out, the cloud's services are not limited to one place. Because of this, it needs spread computers that are placed in certain areas of the world and are in charge of distributing resources in those areas. The computers in the cloud are spread out in different parts of the world. In the event that one server fails, the other server will take over. On the other hand, if more servers are needed, they will just be added to the ones that are already there on purpose.

IV. CLOUD COMPUTING CHARACTERISTICS

Here are the five most important things about cloud computing that show how it is similar to and different from traditional computing: Self-service on demand: An individual can easily set up computer resources, like server time and network storage, as needed without having to talk to each service provider directly. The word "Self-service" means giving the services without any help from a

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person, while "On-demand" means the request. This means that cloud computing offers its services when a client asks for them without any help from a person.

Broad network access: The main goal of cloud computing is to make computing services available to as many people as possible so that they can do their work more efficiently. Many people need to be able to receive the services, so it needs to have wide network access. It could be reached through standard support for a variety of thin or thick client platforms' use. For instance, cell phones, tablets, computers, and workstations.

Using shared resources: The cloud computer approach is made to serve a lot of people at the same time. It means that a lot of people are using the cloud servers at the same time. Using a multi-tenant model, the provider's computer resources are shared among many customers. Depending on what each customer needs, different real and virtual resources are given and changed. The user doesn't know the exact spot of where the needed info is saved (where the resources are kept). Storage, processing, memory, and network capacity are all examples of resources.

Rapid elasticity: The cloud computing model needs to show that it can be expanded instantly when the load on a program goes up or down. It helps by giving its customers infinite resources, which makes the services more useful because the customers can use the resources whenever they want and in any amount.

Measured service: The cloud is a very large network that needs strong systems and resources that cost a lot. That's why it's not possible to give people free services. As a result, this model offers limitless resources at a low cost through paid services, which is good for both the company and the client. You only pay for what you use, and it is measured instantly.

V. VARIOUS CLOUD COMPUTING DEPLOYMENT MODELS

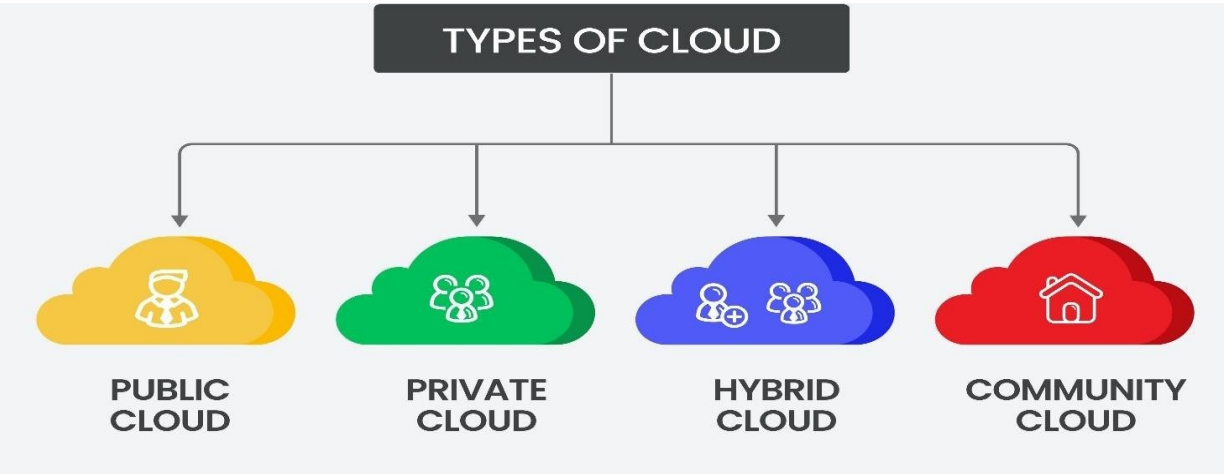

Fig 4. Deployment models of cloud computing

It allows the company to identify the environment that will house IT infrastructure based on ownership, accessibility, scale and cloud's nature and purpose of the cloud. There are mainly four types of deployment models of cloud computing which are discussed below:

Private model: The cloud infrastructure that is own by a single entity for the personal application is called private cloud model. It is only accessible to the owner or related person and is under direct control of the owner. The services provided as per the owner.

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Community model: "Community" refers to the specific group of people. So, the cloud infrastructure which is designed for large number of people of specific group to serve various purposes is called community model. It is accessible only to the specific group or the member of that particular community.

Public cloud: The cloud infrastructure which is owned by any company or organization and providing services to any people across the globe with paid services is called public cloud. As it is meant to provide the services to the public, it is accessible by the public according to their needs.

Hybrid cloud: As its name suggests "Hybrid" means combination of two entity. So, the cloud infrastructure that combines any two or more cloud model to serve the specialized service to any organization or people is called hybrid cloud model

VI. SERVICE MODELS OF CLOUD COMPUTING

It is the software distribution model where the applications are hosted by a cloud service provider and publicized to the customers over the internet. A cloud computing system can provide access to the software application such as email or office productivity tools (the Software as a Service, or SaaS, service model), or can provide an environment for customers to use to build and operate their own software (the Platform as a Service, or PaaS, service model), or can provide network access to traditional computing resources such as processing power and storage (the Infrastructure as a Service, or IaaS, service model). The different service models have different strengths and are suitable for different customers and business objectives. The three service models are discussed below:

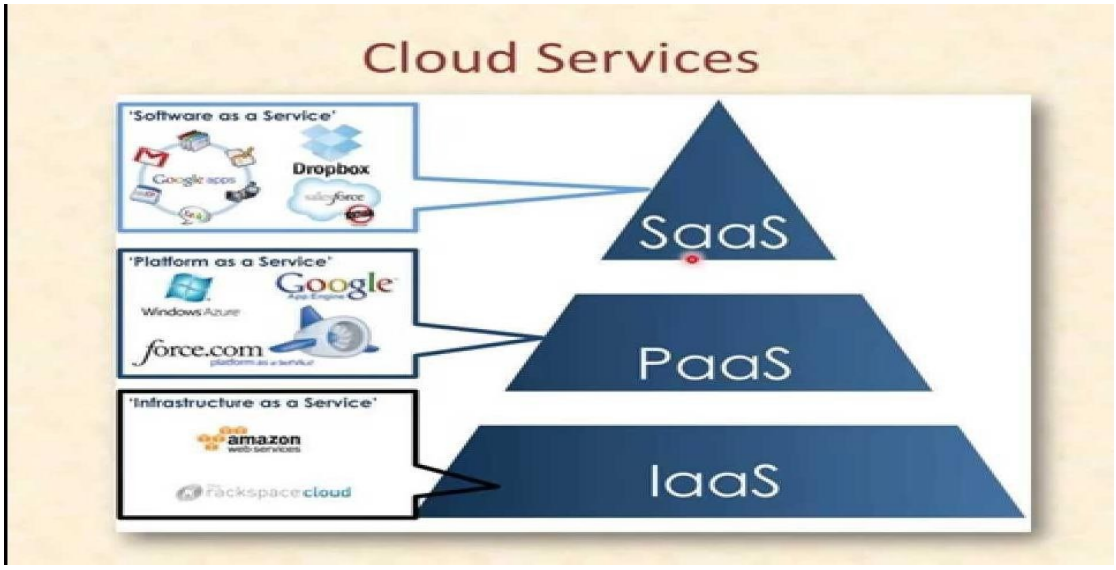

Fig 5. Cloud service models

Infrastructure as a Service (IaaS): As the name refers, it is providing the infrastructure as a service to clients, IT service or data centre usage will be measured according to the usage time of CPU per hour, Storage usage and Data transfer per gigabyte. Cloud consumers can directly use IT infrastructures (processing, storage, networks, and other fundamental computing resources) provided in the IaaS cloud. IaaS cloud provides "Virtualization" in order to integrate/decompose physical resources in an ad-hoc manner to meet growing or shrinking resource demand from cloud consumers. An example of IaaS is Amazon's EC2.

Advantages:

- The most flexible and dynamic model
- Cost-effective due to pay-as-you-go pricing
- Easy to use due to the automated deployment hardware
- Management tasks are virtualized, so employees have more free time for other tasks.

Disadvantages:

- Data security issues due to multi-tenant architecture
- Vendor outages make customers unable to access their data for while.
- The need for the team training to learn how to manage new infrastructure.

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Platform as a Service (PaaS): PaaS provides a development platform that supports the full "Software Lifecycle" which allows cloud consumers to develop their cloud services and applications directly on the PaaS cloud. It is used by the clients who are interested to develop the application because the providers are providing the development environment and toolkit. It allows the developer to develop the application without taking care of the processor's ability and the size of the memory which is going to be used by the application. Examples Google App Engine, Amazon AWS, etc.

Advantages:

- PaaS-built software is highly scalable, available and multi-tenant, as it is cloud based
- The development process is quickened and simplified
- Reduced expenses for creating, testing and launching apps
- Automated company policy
- Reduced amount of coding required
- Allows for easy migrating to the hybrid cloud

Disadvantages:

- Data security issues
- Compatibility of existing infrastructure (not every element can be cloud-enabled)
- Dependency on vendor's speed, reliability and support

Software-As-a-Service (SaaS): The provider allows the user to use provider's software, the software reacts with the user's interface. By using cloud technology, client only has to rent the software via the internet connection, every client in the cloud which using the same software feel that it independently belongs to him only but in the fact it is shared on the same infrastructures. By the technology of cloud, the user can use the software by either participation way or pay per use model. Examples of SaaS are SalesForce.com, Google Docs, and Google Mail.

Advantages:

- No hardware and no initial setup costs
- Automated upgrades
- Cross-device compatibility
- Accessible from any location
- Pay-as-you-go model
- Scalability and easy customization

Disadvantages

- Loss of control
- Limited range of solutions
- Connectivity is a must

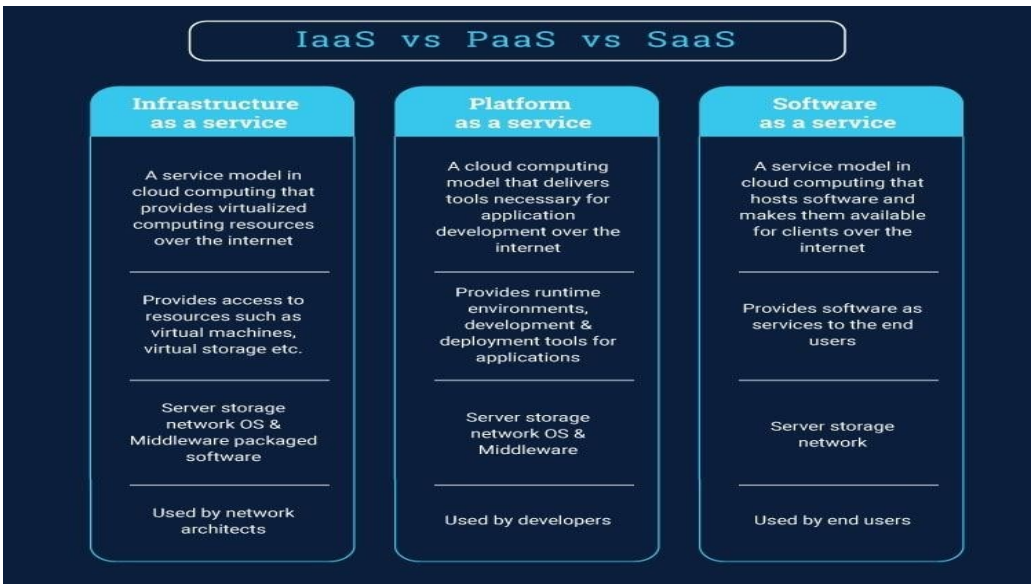

Fig 6. Comparison between various service models

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VII. CHALLANGES IN PRESENT SERVICE MODELS

As we know that the cloud computing is a gigantic model that helps in data and information handling. During this process it has to face many challenges to provide highest rate of efficiency in services with more reliability.

Fig 7. Challenges in cloud computing

Out of many challenges, some are given below:

- Security and challenges: Because of its huge network, it is very difficult to provide the best security and privacy to the each and every client. It is the biggest challenge to the present existing cloud computing service models. There is always risk of data leak. This issue can be overcome by employing encryption, security hardware and security applications.
- Portability: It is another challenge to the cloud service models that applications should easily be migrated from one cloud provider to another. There must not be vendor lock-in. However, it is not yet made possible because each of cloud provider uses different standard languages for their platform. Therefore, it may be possible in near future if all the cloud providers collaborate in near future.
- Interoperability: It means the application on one platform should be able to incorporate services from the other platforms. It is made possible via web services, but developing such web services is very complex and is another challenge.
- Computing performance: While running the business application through cloud it productivity depends upon the performance of the cloud model provided to you. To provide a high efficient platform is also the challenge to the cloud model as there are many obstacles that reduces the performance of the service model.
- Reliability and availability: Cloud is used by many people to store their useful data so that they can easily access it from anywhere and at any time. It is necessary for cloud system to be reliable and robust because most of the businesses are now becoming dependent on services provided by third-party.

VIII. CONCLUSION

Cloud computing is a new technology that is becoming more famous and has already taken up most of the room in modern technology. It's going to bring a new era of technology that is much better than the one we have now. It was for this study that we looked at cloud computing and how it has changed over time. We also talked about the four main distribution models (private model, community model, public model, and mixed model) and the important traits that each one must have. The service types

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we have now (IaaS, PaaS, and SaaS) are they were also listed, along with their pros, cons, and current problems with cloud computing. This will help with future study and development in this area.

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