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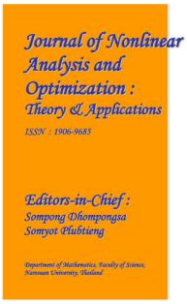

CLOUD COMPUTING AND ITS FUNDAMENTALS

Mr.S.Balasubramani, Assistant Professor, Department of Data Science, Sri Krishna Adithya College of Arts and Science, Coimbatore.
Mr. S. Vishnudev, Ms. N. Ramya, Department of Data Science, Sri Krishna Adithya College of Arts and Science, Coimbatore.

ABSTRACT:
Cloud computing has emerged as a pivotal role in modern computing, offering a scalable, flexible, and Cost – effective approach to managing IT resources. By delivering on – demand access to computational power, storage, and applications over the internet, cloud computing transforms traditional IT infrastructure management. This paper explores the types of cloud models, Core service (IaaS), platform as a service (PaaS), and software as a service (SaaS) – and their roles in enabling organizations to optimize performance, reduce costs, and enhance agility and so on.

INTRODUCTION:

Cloud computing is the delivery of computing services over the internet. Computing services include common IT infrastructure such as virtual machines, storage, databases, and networking. Cloud services also expand the traditional IT offerings to include things like Internet of Things (I0T), machine learning (ML), and artificial intelligence (AI).

Because cloud computing uses the internet to deliver these services, it doesn't have to be constrained by physical infrastructure the same way that a traditional data center is. That means if you need to increase your IT infrastructure rapidly, you don't have to wait to build a new data centre – you can use the cloud to rapidly expand your IT footprint.

1. CLOUD MODEL:

It is a model that enable convenient and on -demand network access to a shared pool of resources, The four types of cloud models are:

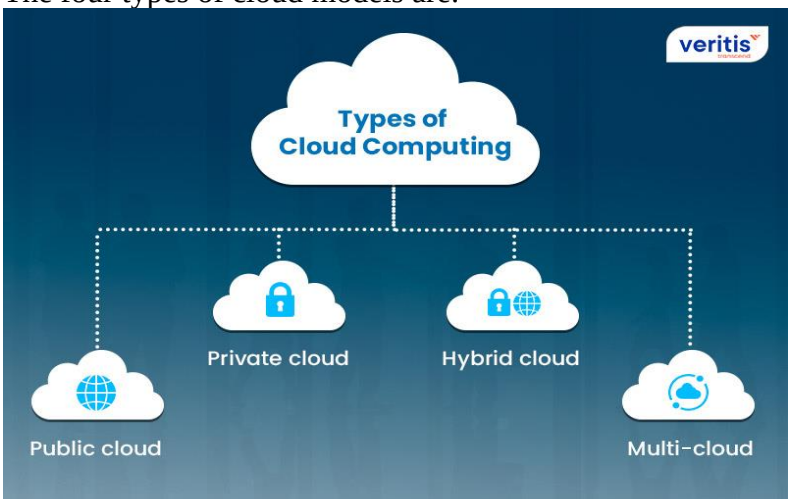

Figure. 1 Types of Cloud Computing

- **PRIVATE CLOUD**:

A Private cloud is, in some ways, the natural evolution from a corporate data center. It is a cloud that's used by a single entity and it provides much greater control for the company and its IT department. But it also comes with greater cost and fewer of the benefits of a public cloud deployment. It may be hosted in a dedicated data center and also be hosted in a data center offsite, potentially even by a third party that has dedicated that data center to your company.

- **PUBLIC CLOUD:**

A Public cloud is built, controlled, and maintained by a third – party cloud provider. With a Public cloud, anyone can purchase the cloud services and use the resources. The general public availability is a key difference between public and private clouds.

- **HYBRID CLOUD:**

A Hybrid cloud is a computing environment that uses both public and private clouds in an inter – connected environment. A hybrid cloud environment can be used to allow a private cloud to surge for increased, temporary demand by deploying public cloud resources. Hybrid clouds can be used to provide an extra layer of security. For example, users can flexibly choose which services to keep in the public cloud and which to deploy to their private cloud infrastructure.

- **MULTI CLOUD:**

In a Multi – cloud you use multiple public cloud providers and different features from different cloud providers or you can start your cloud journey with one provider and in the process of migrating to a different provider. Regardless, in a multi – cloud environment you deal with two or more public cloud providers and manage resources and security in both environments.

2. HIGH AVAILABILITY:

Cloud providers often use multiple servers, storage, and network devices, so if one component fails, others are available to take over. They are designed to automatically switch to a backup system in case of failure, ensuring uninterrupted service. Traffic is distributed across multiple servers, ensuring that no single server becomes a bottleneck or point of failure. Many cloud providers distribute resources across different regions and availability zones. This ensures that if one geographic area experiences an issue, services in other areas remain unaffected.

3. SCALABILITY:

It refers to the ability of a system, network, or application to handle the increasing workloads or demand by automatically adjusting resources. It is one of the core benefits of cloud computing, allowing businesses to efficiently meet changing performance requirements without over provisioning or wasting resources.

3.1. TYPES OF SCALABILITY:

- VERTICAL SCALABILITY:

It involves adding more power to an existing server, such as increasing CPU, RAM, or Storage capacity as it enhances the performance of a single resource or instance without changing its fundamental architecture.

- HORIZONTAL SCALABILITY:

It involves adding more servers or instances to distribute the workload across multiple resources. Instead of upgrading a single server, more machines or cloud instances are added to the system. This is particularly effective for load balancing, where requests are spread across multiple servers.

4. RELIABILITY:

It is the ability of the system to recover from its failures and continue its function. The cloud has its decentralized design that naturally supports a reliable and resilient infrastructure. With a decentralized design, the cloud enables you to have resources deployed in regions around the world. With this global scale, even if one region has a catastrophic event other regions are still up and running. In some cases, your cloud environment itself will automatically shift to a different region for you, with no action needed on your part.

5. CLOUD SERVICE MODELS:

It defines the way cloud services are delivered and managed by a cloud provider. It specifies the level of control and responsibility the user has over the infrastructure, platform, and applications.

TYPES OF CLOUD SERVICES ARE:

1. Infrastructure as a Service (IaaS)

2. Platform as a Service (PaaS)
3. Software as a Service (SaaS)

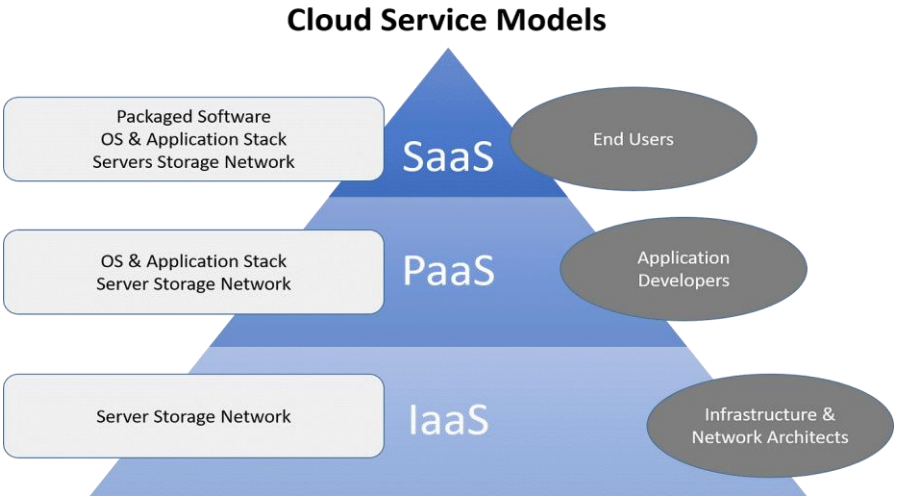

Figure.2 Cloud Service Models

➢ **INFRASTRUCTURE AS A SERVICE (IaaS):**

It is the most flexible category of cloud services, as it provides you the maximum amount of control for your cloud resources. In an IaaS model, the cloud provider is responsible for maintaining the hardware, network connectivity and physical security. You're responsible for operating system installation, configuration, and maintenance; infrastructure network configuration; database and storage configuration; and so on.

Examples:
Amazon Web Services (AWS)
Google Cloud Compute Engine
IBM Cloud

➢ **PLATFORM AS A SERVICE (PaaS):**

It gives a platform allowing the customers to develop, run, and manage the applications without worrying about the underlying. It offers a framework for developers to build applications, providing tools like operating systems, databases, middleware, development frameworks, and more. The platform automatically handles scaling of resources based on the application's needs. The cloud provider manages servers, storage, networking, and security.

Examples:
Google App Engine
Heroku
IBM Cloud Foundry

➢ **SOFTWARE AS A SERVICE (SaaS):**

It is a model where software applications are delivered over the internet as a service, rather than installed and maintained on local devices. Users can access these applications via a web browser, eliminating the need for complex software installation, maintenance, and hardware management. It is typically offered on a subscription basis, which can be monthly or yearly, with usage -based pricing models in some cases. The service provider manages the updates, patches, and security, ensuring that the software is always up to date and it is easily scalable to accommodate more users or additional features as the business grows. A single instance of the software serves multiple users while maintaining the data isolation.

Examples:
Google Workspace
Microsoft
Dropbox

6. CLOUD SECURITY:

It involves the practices, technologies, and policies used to safeguard the data, applications, and services hosted in cloud environments. It operates on a shared responsibility model where cloud providers manage the security of the infrastructure, while customers are responsible for securing their data, applications, and access controls. Key elements include encryption, Identity and Access Management (IAM), network security, compliance with regulations, and continuous monitoring for threats. Effective cloud security ensures data protection, privacy, and business continuity while addressing challenges like multi-cloud complexity and third-party risks.

7. NETWORKING:

It refers to the system of virtualized network resources and services that facilitate communication and transfer the data between various cloud components and external systems. Key aspects are:

- **Virtual Networks:** They are logically isolated networks within the cloud environment that allow users to deploy and manage their resources, such as virtual machines and databases, securely.
- **Subnets:** It is a Segment of a virtual network that organizes and isolates different types of resources, providing better security and performance management.
- **IP Addressing:** Cloud resources are assigned IP addresses to facilitate communication. This can be both public (accessible from the internet) and private (accessible only within the cloud network).
- **Load Balancing:** It is used to distribute the network traffic across multiple servers to ensure availability and optimize performance.
- **Firewalls and Security Groups:** Tools that define rules for controlling incoming and outgoing traffic, enhancing security by regulating which traffic can access cloud resources.
- **VPNs and Direct Connect:** They provide secure and direct connections between on – promises networks and cloud environments.

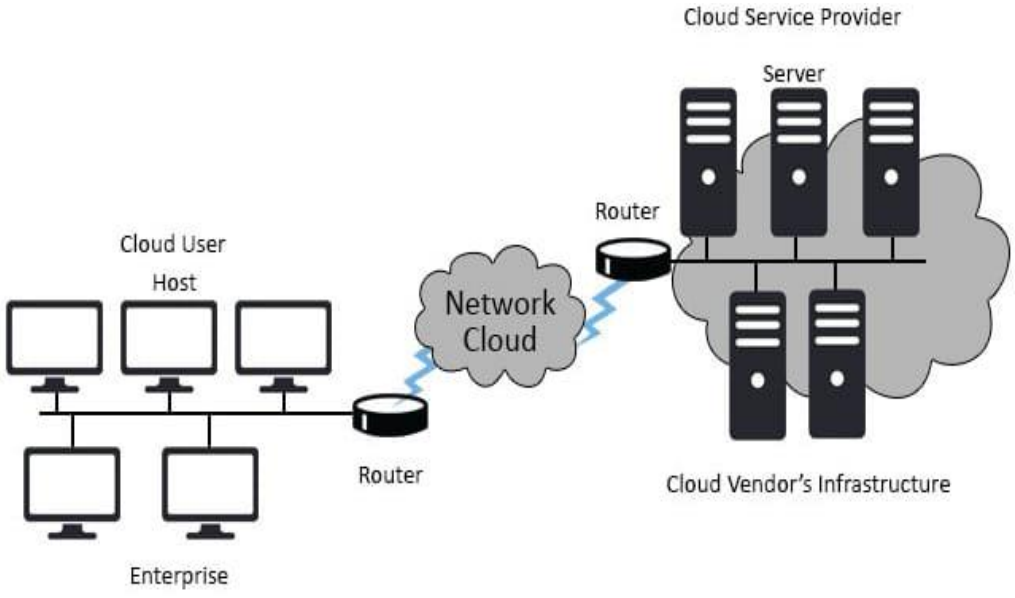

Figure.3 Networking

8.CONCLUSION:

Cloud computing has revolutionized the way we approach data management, computing power, and IT services. By leveraging key fundamentals such as virtualization, scalability, and on-demand resource provisioning, cloud computing enables organizations to achieve greater flexibility, cost-efficiency, and operational agility. The core models—Infrastructure as a Service (IaaS), Platform as a Service (PaaS), and Software as a Service (SaaS)—each offer unique advantages, driving innovation and enhancing productivity across various sectors. As technology continues to evolve, understanding

these fundamentals is essential for harnessing the full potential of cloud computing and addressing emerging challenges.

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