**What is Cloud Computing?**

**Cloud computing** is the **on-demand delivery** of computing resources such as **servers, storage, databases, networking, software, and more** over the **internet**. Instead of maintaining physical data centers and servers, businesses can rent computing power from cloud providers like **Google Cloud (GCP), Amazon Web Services (AWS), Microsoft Azure, etc.**

✅ **Example**:

* Imagine you need a **computer** to run a Java application. Instead of buying a physical server, you can "rent" a virtual server from **GCP Compute Engine** or **AWS EC2** and start using it instantly.

**Cloud Deployment Models**

Organizations can choose where to deploy their applications:

☁️ **Public Cloud** – Services are hosted by cloud providers like GCP, AWS. (Most common)  
🏢 **Private Cloud** – Dedicated cloud resources for a single organization.  
🔄 **Hybrid Cloud** – Combination of public and private cloud.  
🌍 **Multi-Cloud** – Using services from multiple cloud providers.

✅ **Example**:

* A bank may keep sensitive customer data in a **private cloud** but use a **public cloud** for customer-facing applications.

**Public Cloud (Default Model for GCP & AWS)**

🔹 Resources are hosted in **shared data centers**, and multiple customers (tenants) use the same infrastructure.  
🔹 **Fully managed** by GCP or AWS, and organizations rent resources on a pay-as-you-go model.

✅ **Example**:

* When you create a **Compute Engine (GCP)** or **EC2 instance (AWS)**, you are using the **Public Cloud** because your VM runs on shared cloud infrastructure.

**👉 This is the most common model used today.**

* Owned and operated by third-party providers.
* Accessible over the internet.
* Pay-as-you-go pricing model.
* Best for startups, enterprises, and individuals who don’t want to manage infrastructure.

**Private Cloud (Dedicated Resources for One Organization)**

🔹 Cloud resources are **dedicated exclusively to a single organization** (not shared with others).  
🔹 Can be hosted **on-premises or in a cloud provider’s dedicated environment**.  
🔹 Organizations have **more control over security, compliance, and performance**.

* More security and control but higher cost.
* Best for government agencies, banking, or sensitive data workloads.

**Hybrid Cloud (Combination of Private + Public Cloud)**

🔹 Some workloads run on **on-premises private cloud**, while others run on **public cloud (GCP/AWS)**.  
🔹 Ensures **data security** while allowing **scalability using the public cloud**.

* Some resources run on a private cloud, while others use a public cloud.
* Example: A company stores confidential customer data in a private cloud but runs their application on a public cloud.

**💡 Which Cloud Deployment Model is Best?**

✔️ **Public Cloud** – Best for most applications (**cost-effective, scalable, fully managed**).  
✔️ **Private Cloud** – Best for **high-security** industries (**banking, healthcare, government**).  
✔️ **Hybrid Cloud** – Best when **some applications need to stay on-prem** while using cloud benefits.  
✔️ **Multi-Cloud** – Best for **avoiding vendor lock-in** and using **best features from different clouds**.

**Types of Cloud Computing (Flavors of Cloud)**

Cloud computing services come in different models:

**☁️ 1. Infrastructure as a Service (IaaS) – Virtual Machines**

🔹 Cloud provider **rents out servers, storage, and networking**.  
🔹 Users install and manage their own OS, applications, and software.

✅ **Example**:

* GCP **Compute Engine** or AWS **EC2** allows you to run a Java application on a Linux VM, just like a physical server.

**Use Case: If you need full control over the OS, networking, and applications, but don’t want to maintain physical hardware.**

**2. Platform as a Service (PaaS) – Managed Environments**

🔹 Cloud provider **manages everything except your application code**.  
🔹 Developers only focus on writing code; cloud handles deployment, scaling, and maintenance.

✅ **Example**:

* GCP **App Engine** or AWS **Elastic Beanstalk** allows you to deploy a Java app without worrying about the infrastructure.

**🔹 Use Case: If you’re a developer and only want to focus on coding while the cloud provider manages infrastructure and scaling.**

**3.Software as a Service (SaaS) – Ready-to-Use Applications**

🔹 Fully managed cloud applications that users access directly via a browser.

✅ **Example**:

* Gmail, Google Drive, and Zoom are SaaS applications where users don’t manage infrastructure.

**Use Case: End-users who need ready-to-use applications without managing backend services.**

Advantages of Cloud Computing

✅ Cost-Effective – Pay only for what you use.  
✅ Scalability – Easily increase or decrease resources.  
✅ Reliability – Cloud providers offer high availability and disaster recovery.  
✅ Security – Cloud providers have strong security policies, but security is a shared responsibility.  
✅ Faster Deployment – Deploy apps in minutes instead of weeks.

How to Explain Cloud to Beginners?

🎯 Analogy 1: Electricity Grid

* Instead of buying a power generator, we use electricity from a provider (just like using cloud services instead of maintaining our own data center).

🎯 Analogy 2: Renting an Apartment

* Instead of building your own house (data center), you rent an apartment (cloud service) where maintenance is handled by the owner.

**Region and Zone**