**Cloud computing** is the delivery of computing services over the internet. Instead of buying and managing physical servers or software, you use resources (servers, storage, databases, etc.) from a cloud provider like **AWS**, **Azure**, or **Google Cloud**.

**🔑 Key Benefits:**

* **On-demand** resources
* **Scalable** and flexible
* **Pay-as-you-go** model
* **Accessible** from anywhere

**Cloud Computing Platform**

**A cloud computing platform is a model for delivering computing services over the internet, where resources such as servers, storage, databases, software, and applications are provided as a service to users on-demand. Cloud computing platforms allow users to access and utilize these resources on a pay-as-you-go basis, eliminating the need for upfront capital expenditures and reducing the complexity of managing IT infrastructure.**

**Key Characteristics**

**1. On-Demand Self-Service: Users can provision and de-provision resources as needed, without requiring human intervention.**

**2. Broad Network Access: Resources are accessible over the internet or a private network, from any device, anywhere in the world.**

**3. Resource Pooling: Resources are pooled together to provide a multi-tenant environment, where resources can be dynamically allocated and re-allocated based on demand.**

**4. Rapid Elasticity: Resources can be quickly scaled up or down to match changing workload demands.**

**5. Measured Service: Users are billed only for the resources they use, reducing costs and increasing efficiency.**

**Types of Cloud Computing Platforms**

**1. Public Cloud: A public cloud is a multi-tenant cloud environment where resources are shared among multiple users. Examples include Amazon Web Services (AWS), Microsoft Azure, and Google Cloud Platform (GCP).**

**2. Private Cloud: A private cloud is a single-tenant cloud environment where resources are dedicated to a single organization. Examples include VMware and OpenStack.**

**3. Hybrid Cloud: A hybrid cloud combines public and private cloud environments, allowing users to leverage the benefits of both.**

**Benefits**

**1. Scalability: Cloud computing platforms provide scalable infrastructure that can grow or shrink to match changing workload demands.**

**2. Flexibility: Cloud computing platforms offer a wide range of services and programming languages, allowing developers to choose the best tools for their applications.**

**3. Cost-Effectiveness: Cloud computing platforms provide a pay-as-you-go pricing model, reducing upfront capital expenditures and increasing efficiency.**

**4. Reliability: Cloud computing platforms provide high availability and durability, with built-in redundancy and failover capabilities.**

**5. Security: Cloud computing platforms provide robust security features and compliance certifications, ensuring the protection of sensitive data.**

**Use Cases**

**1. Web Applications: Cloud computing platforms are ideal for building and deploying web applications, including e-commerce platforms, social media, and content delivery networks.**

**2. Big Data and Analytics: Cloud computing platforms provide a platform for big data processing, analytics, and machine learning, enabling businesses to gain insights from large datasets.**

**3. Mobile Applications: Cloud computing platforms offer services for building, deploying, and managing mobile applications, including mobile backend services and push notifications.**

**4. Enterprise IT: Cloud computing platforms are used by enterprises for migrating on-premises infrastructure to the cloud, as well as for building new cloud-native applications.**

**🧱 Cloud Service Models**

**1. IaaS (Infrastructure as a Service) 🧰**

You manage : your app, runtime, OS  
Cloud manages: servers, storage, networking

* You rent **infrastructure** (virtual servers, storage, networks).
* **You install and manage** everything else.

📌 Example: AWS EC2, Google Compute Engine, Azure Virtual Machines  
✅ Best for: developers who want full control over their environment

**2. PaaS (Platform as a Service) 🏗️**

You manage: your app  
Cloud manages: everything else (runtime, OS, infra)

* You deploy your app, and the platform handles the rest.
* No need to manage servers, scaling, or updates.

📌 Example: AWS Elastic Beanstalk, Heroku, Google App Engine  
✅ Best for: rapid development without worrying about infrastructure

**3. SaaS (Software as a Service) 💻**

You just use the software, nothing to manage

* Fully managed software, available via web or API.
* No setup, no servers, just log in and use.

📌 Example: Gmail, Dropbox, Zoom, Microsoft 365, Salesforce  
✅ Best for: end-users or businesses who just want to use software

**🌐 Cloud Deployment Models**

**1. Public Cloud ☁️**

* Resources (servers, storage) are owned and managed by a third party (e.g., AWS, Azure).
* Multiple customers share the same infrastructure.

📌 Example: AWS, Google Cloud, Azure  
✅ Best for: most businesses, startups, scalable apps

**2. Private Cloud 🏢**

* Used **exclusively by one organization**
* Hosted on-premises or by a provider, but **dedicated to you**

📌 Example: VMware private cloud, OpenStack  
✅ Best for: companies with strict compliance/security needs (banks, government)

**3. Hybrid Cloud 🔄**

* A mix of **public + private** cloud
* Share workloads between environments for flexibility

📌 Example: An app that stores sensitive data in private cloud but scales using public cloud  
✅ Best for: large enterprises, gradual cloud migration, flexibility

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**🔶 Cloud Service Models Comparison**

| **Feature** | **IaaS** | **PaaS** | **SaaS** |
| --- | --- | --- | --- |
| **Full Form** | Infrastructure as a Service | Platform as a Service | Software as a Service |
| **Access Level** | Most control over resources | Control over applications only | Just use the software |
| **Managed by User** | OS, runtime, app, data | App, data | Only usage |
| **Managed by Provider** | Hardware, storage, networking | Infra, OS, runtime | Everything (infra + app) |
| **Use Case** | Custom app hosting, VM usage | App development without managing infra | Using email, CRM, collaboration |
| **Examples** | AWS EC2, Azure VM, GCP Compute | Heroku, AWS Elastic Beanstalk, GCP App Engine | Gmail, Google Docs, Salesforce |

**🔷 Cloud Deployment Models Comparison**

| **Feature** | **Public Cloud** | **Private Cloud** | **Hybrid Cloud** |
| --- | --- | --- | --- |
| **Access** | Shared among multiple users | Dedicated to one organization | Combination of both |
| **Infrastructure** | Owned by cloud provider | Owned or rented by the org | Mixed |
| **Cost** | Pay-as-you-go (affordable) | Expensive (high upfront cost) | Moderate (depends on setup) |
| **Security** | Good, but shared | Very high (isolated environment) | Balanced (sensitive data stays private) |
| **Scalability** | Highly scalable | Limited by internal resources | Flexible |
| **Example Providers** | AWS, Azure, Google Cloud | OpenStack, VMware Private Cloud | AWS + On-prem mix, Azure Stack |
| **Best For** | Startups, general apps | Banks, governments, regulated industries | Enterprises needing flexibility |