# What is Cloud Computing?

**Definition:**

- Cloud computing refers to delivering on-demand computing resources—like servers, storage, and applications—over the internet, eliminating the need for local infrastructure.

## Key Terminologies:

- **Cloud**: A metaphor for the internet, representing a virtual environment for delivering resources and services.

## Computing Services:

- **Storage:** Services like Google Drive or Dropbox for saving and retrieving files.
- **Processing Power:** Virtual machines (VMs) for running applications.
- **Networking:** Tools to establish secure communication channels.
- **Databases:** Managed databases like AWS RDS or Firebase.

## Characteristics of Cloud Computing:

- **On-Demand Self-Service:** Users can access resources anytime without human intervention.
    - Example: Creating virtual servers through AWS or Azure portals.
- **Broad Network Access:**
    - Accessible via the internet on various devices like laptops, smartphones, or tablets.
- **Resource Pooling:**
    - Providers use a multi-tenant model, pooling resources for efficiency.
    - Users share physical infrastructure but have isolated virtual environments.
- **Rapid Elasticity:**
    - Resources can be scaled up or down based on demand.
    - Example: E-commerce platforms handling traffic surges during sales.
- **Measured Service:**
    - Pay-as-you-go pricing, with resources metered based on usage.
- **Engagement Activity:**
    - Ask students to name cloud services they use, such as Netflix for streaming, Google Drive for file storage, or Canva for graphic design.

## Evolution of Cloud Computing

- **A Brief History:**
    - 1960s: Mainframe computing introduced time-sharing concepts.
    - 1970s: Virtualization technologies developed, enabling the creation of virtual machines.
- **Late 1990s:**
    - Emergence of SaaS with platforms like Salesforce.
    - Businesses began adopting web-based services.

- 2006: Amazon Web Services (AWS) introduced Elastic Compute Cloud (EC2), marking the rise of modern cloud platforms.

## Key Milestones:

- Birth of virtualization: IBM's virtual machines in the 1970s.
- SaaS applications: Early web-based software for CRM and project management.
- Cloud platforms: AWS, Microsoft Azure, Google Cloud launched.
- **Role of Technology in Evolution:**
  - Internet Speed: High-speed broadband and 4G/5G enable seamless cloud access.
- **Virtualization:**
  - Consolidates resources by running multiple virtual machines on one physical server.
  - Containerization: Technologies like Docker make application deployment faster and more portable.

### Types of Cloud Computing

- **Service Models:**
- **IaaS (Infrastructure as a Service):**
  - Provides virtualized computing resources over the internet.
  - Examples: AWS EC2, Google Compute Engine.
  - Use Case: Hosting websites, running test environments.
- **PaaS (Platform as a Service):**
  - Offers platforms for developers to build and deploy applications.
  - Examples: Google App Engine, Microsoft Azure App Services.
  - Use Case: Developing scalable web applications.
- **SaaS (Software as a Service):**
  - Delivers software applications over the internet.
  - Examples: Gmail, Salesforce, Office 365.
  - Use Case: Collaboration tools, email services.

## Deployment Models:

- **Public Cloud:**
  - Accessible by anyone with an internet connection.
  - Examples: AWS, Google Cloud.
  - Pros: Cost-effective, scalable.
  - Cons: Less control over resources.
- **Private Cloud:**
  - Dedicated to a single organization.
  - Examples: VMware, OpenStack.
  - Pros: Enhanced security, greater control.
  - Cons: Expensive to maintain.
- **Hybrid Cloud:**
  - Combines public and private clouds for flexibility.
  - Example: Using a private cloud for sensitive data and public cloud for less critical tasks.

## Benefits of Cloud Computing

- **Cost Efficiency:**
  - Reduces capital expenses (hardware, maintenance).
  - Pay-per-use pricing.
- **Scalability:**
  - Automatically scale resources based on demand.
  - Example: Traffic surges during flash sales.
- **Accessibility:**
  - Access resources anytime, anywhere.
- **Reliability:**
  - High availability with disaster recovery mechanisms.
- **Security:**
  - Providers offer advanced encryption, identity management, and threat detection.

## Challenges of Cloud Computing

- **Data Security & Privacy Risks:**
  - Risk of unauthorized access or data breaches.
  - Example: Capital One breach due to misconfigured AWS server.
- **Vendor Lock-In:**
  - Difficulty in switching cloud providers due to proprietary tools.
- **Downtime & Connectivity:**
  - Reliance on internet connectivity for operations.
- **Compliance:**
  - Legal requirements for storing sensitive data (e.g., GDPR in the EU).
- **Real-World Example:**
  - 2019 Capital One data breach: Exploited misconfigured AWS systems, exposing sensitive data. Discuss lessons learned.

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| Activity:<br>Discuss which service model (IaaS, PaaS, SaaS) and deployment model would be ideal for:<br>A startup.<br>B large e-commerce company.<br><br>Identify the most significant benefit for a business they are familiar with. |