

## What is Cloud?

Cloud computing is the delivery of computing services—such as servers, storage, databases, networking, software, and analytics—over the internet ("the cloud"). Instead of owning physical hardware or data centers, users can access and manage these resources on-demand from cloud providers.

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## Key Characteristics of Cloud Computing

1. **On-Demand Self-Service** – Users can provision resources as needed without human intervention from service providers.
  2. **Scalability** – Resources can be scaled up or down based on demand.
  3. **Pay-as-You-Go Pricing** – Users pay only for what they use.
  4. **Global Access** – Services are available anytime, anywhere via the internet.
  5. **Security & Reliability** – Cloud providers ensure data redundancy, security, and disaster recovery.
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## Types of Cloud Computing

1. **Public Cloud** – Managed by third-party providers (AWS, Azure, Google Cloud). Resources are shared among multiple users.
2. **Private Cloud** – Dedicated infrastructure for a single organization, offering more control and security.
3. **Hybrid Cloud** – Combination of public and private clouds, allowing businesses to balance flexibility and security.
4. **Multi-Cloud** – Using services from multiple cloud providers for different workloads.

## Cloud Service Models

1. **IaaS (Infrastructure as a Service)** – Provides virtual machines, storage, and networking (e.g., AWS EC2, Azure VM).
2. **PaaS (Platform as a Service)** – Provides development platforms with pre-configured environments (e.g., AWS Elastic Beanstalk, Google App Engine).
3. **SaaS (Software as a Service)** – Ready-to-use applications delivered over the internet (e.g., Gmail, Dropbox, Office 365).

## What is AWS?

AWS (Amazon Web Services) is a cloud computing platform provided by Amazon that offers a wide range of services, including computing power, storage, databases, networking, security, machine learning, and more. AWS enables businesses and individuals to build and scale applications without managing physical infrastructure.

## Key Features of AWS

- On-Demand Resources** – Access servers, databases, and storage anytime.
- Scalability** – Scale resources up or down based on demand.
- Pay-as-You-Go Pricing** – Only pay for what you use.
- Global Reach** – AWS has data centers across multiple regions for high availability.
- Security & Compliance** – Advanced security features and compliance certifications.

## AWS Service Categories & Key Services

### 1. Compute Services

- **EC2 (Elastic Compute Cloud)** – Virtual servers in the cloud.

### 2. Storage Services

- **S3 (Simple Storage Service)** – Scalable object storage.

### 3. Database Services

- **RDS (Relational Database Service)** – Managed databases like MySQL, PostgreSQL, and Oracle.

### 4. Networking Services

- **VPC (Virtual Private Cloud)** – Private network setup in AWS.

### 5. Security, Identity & Compliance

- **AWS IAM (Identity and Access Management)** – User access control & security policies.

## Why Choose AWS?

- Most Widely Used Cloud Provider** – Largest market share in cloud computing.
- Global Infrastructure** – 30+ regions and 100+ availability zones worldwide.
- Pay-as-You-Go Pricing** – No upfront investment, flexible pricing models.
- Highly Secure & Compliant** – Follows global security standards (ISO, SOC, HIPAA, GDPR).
- Diverse Service Portfolio** – Covers compute, storage, databases, AI, analytics, DevOps, and more.

## What is Linux?

**Linux** is an open-source, Unix-like operating system (OS) that manages hardware and software resources on a computer. It is widely used in servers, cloud computing, DevOps, and embedded systems due to its **stability, security, and flexibility**.

### Key Features of Linux

- Open-Source** – Free to use, modify, and distribute.
- Multi-User & Multi-Tasking** – Supports multiple users and processes at the same time.
- Highly Secure** – Built-in user permissions and security controls.
- Stable & Reliable** – Rarely crashes compared to other OS.
- Lightweight & Fast** – Uses fewer system resources.
- Customizable** – Users can modify and optimize it as needed.
- Supports CLI & GUI** – Command-line interface (CLI) and graphical user interface (GUI).

### Linux Architecture

1. **Kernel** – The core of the OS that interacts with hardware.
2. **Shell** – Interface between user and OS (Bash, Zsh, etc.).
3. **File System** – Organizes files and directories.
4. **System Libraries** – Helps applications communicate with the kernel.
5. **Applications** – User programs like browsers, text editors, etc.

### Popular Linux Distributions (Distros)

1. **Ubuntu** – User-friendly, great for beginners.
2. **CentOS / RHEL** – Enterprise-grade stability, used in servers.
3. **Debian** – Stable and secure, widely used for servers.
4. **Fedor**a – Cutting-edge features, used for development.
5. **Arch Linux** – Minimalist, highly customizable.
6. **Kali Linux** – Designed for penetration testing and cybersecurity.

### Why is Linux Important in DevOps & Cloud?

- Runs Most Servers** – 90% of cloud servers run Linux (AWS, Azure, GCP).
- Essential for DevOps** – Used in automation, CI/CD pipelines, and containerization.
- Highly Secure & Efficient** – Ideal for large-scale infrastructure.
- Used in Kubernetes & Docker** – Most containerized apps run on Linux.

## What is a Server?

A **server** is a computer or system that provides services, resources, or data to other computers (clients) over a network. Servers are designed to handle multiple requests, ensuring reliability, security, and scalability in IT environments.

### Types of Servers

#### 1. Web Server

- 👉 Hosts websites and web applications.
- ◆ Examples: Apache, Nginx, Microsoft IIS.

#### 2. Application Server

- 👉 Runs applications and middleware between users and databases.
- ◆ Examples: Tomcat, JBoss, WebLogic.

#### 3. Database Server

- 👉 Stores and manages structured data.
- ◆ Examples: MySQL, PostgreSQL, Oracle DB, MongoDB.

#### 8. Virtualization & Cloud Server

- 👉 Hosts virtual machines (VMs) and cloud-based applications.
- ◆ Examples: AWS EC2, Microsoft Azure, VMware ESXi.

### Why Are Servers Important in DevOps & Cloud?

- Hosts Applications & Websites** – Essential for deploying software.
- Enables Cloud Computing** – Powers AWS, Azure, and GCP services.
- Supports CI/CD Pipelines** – Automates software builds, testing, and deployment.
- Manages Databases & Storage** – Critical for handling big data and enterprise applications.
- Enhances Security & Performance** – Load balancing, firewalls, and monitoring tools optimize performance.

## What is DevOps?

**DevOps** is a combination of **Development (Dev)** and **Operations (Ops)** that focuses on automating and integrating software development, testing, deployment, and operations. It promotes **collaboration, automation, and continuous delivery (CI/CD)** to improve software quality and deployment speed.

## Why DevOps?

- ◆ **Faster Software Delivery** – Automates CI/CD pipelines.
- ◆ **Improved Collaboration** – Bridges the gap between Dev & Ops teams.
- ◆ **Higher Stability & Reliability** – Reduces errors and downtime.
- ◆ **Scalability & Flexibility** – Easily adapts to cloud & modern architectures.
- ◆ **Enhanced Security** – Implements DevSecOps (Security in DevOps).

## DevOps Lifecycle

DevOps follows a continuous workflow:

### 1. Plan

- Define project goals and requirements.
- Tools: **JIRA, Confluence, GitHub Issues**.

### 2. Develop

- Code writing and version control.
- Tools: **Git, GitHub, GitLab, Bitbucket**.

### 3. Build

- Convert source code into executable applications.
- Tools: **Maven, Gradle, Ant**.

### 4. Test

- Automated testing to detect bugs early.
- Tools: **Selenium, JUnit, TestNG**.

### 5. Release

- Package and prepare for deployment.
- Tools: **Jenkins, Nexus, Artifactory**.

## 6. Deploy

- Deploy applications in different environments (staging, production).
- Tools: **Docker, Kubernetes, Ansible, Terraform, AWS ECS/EKS**.

## 7. Operate

- Monitor application performance & ensure uptime.
- Tools: **Prometheus, Grafana, Splunk, Datadog**.

## 8. Monitor & Feedback

- Collect logs & analytics to improve the system.
- Tools: **ELK Stack (Elasticsearch, Logstash, Kibana), CloudWatch**.

## DevOps Tools & Technologies

Category	Tools
<b>Version Control</b>	Git, GitHub, GitLab, Bitbucket
<b>Build Automation</b>	Maven, Gradle, Ant
<b>CI/CD Pipeline</b>	Jenkins, GitHub Actions, GitLab CI/CD
<b>Configuration Management</b>	Ansible, Puppet, Chef
<b>Containerization</b>	Docker, Podman
<b>Orchestration</b>	Kubernetes, OpenShift
<b>Infrastructure as Code (IaC)</b>	Terraform, CloudFormation
<b>Monitoring &amp; Logging</b>	Prometheus, Grafana, ELK Stack, Splunk
<b>Cloud Providers</b>	AWS, Azure, Google Cloud

## DevOps Benefits

- ✓ **Accelerated Time-to-Market** – Faster feature releases.
- ✓ **Improved Collaboration** – No silos between development & operations.
- ✓ **Enhanced Stability** – Reliable deployments with rollback capabilities.
- ✓ **Cost Efficiency** – Automation reduces manual errors & infrastructure costs.
- ✓ **Scalability** – Easily scale applications with Kubernetes & cloud computing.

## Why DevOps is Crucial in Modern IT?

- 📌 Supports **Cloud & Microservices Architectures** (AWS, Azure, GCP).
- 📌 Enables **Continuous Integration & Continuous Deployment (CI/CD)**.
- 📌 Reduces **Downtime & Human Errors** with automation.
- 📌 Strengthens **Security with DevSecOps** (integrating security into DevOps).

## What is a Service?

A **service** is a program or process that runs in the background to perform specific tasks without direct user interaction. Services are commonly used in **operating systems, cloud computing, networking, and DevOps environments** to manage resources, automate tasks, and provide functionalities.

## How Services Work?

- Services **start automatically** or **manually** when needed.
- They **run in the background** and do not require direct user input.
- Can be **monitored, restarted, or stopped** based on requirements.

## 2. Cloud Services

👉 Provides computing resources over the internet.

◆ Examples (AWS, Azure, GCP):

- **Compute Services** (EC2, Lambda, Azure VM)
- **Storage Services** (S3, Azure Blob, Google Cloud Storage)
- **Database Services** (RDS, DynamoDB, Cloud SQL)

