

Why Are We Learning Cloud Computing?

1. Traditional IT vs Cloud (Problem Statement)

Earlier, companies had to:

- Buy physical servers
- Set up data centers
- Manage hardware, power, and cooling
- Hire teams for maintenance

This approach was expensive, slow, and difficult to scale.

Cloud computing solves these problems.

2. What Cloud Computing Provides

Cloud computing offers:

- Servers (Compute)
- Storage
- Databases
- Networking
- AI and Machine Learning services

All resources are available over the internet on a pay-as-you-go basis.

Example: Using food delivery services instead of cooking everything at home.

3. Importance of Cloud for MLOps

a) High Resource Requirements

Machine Learning requires:

- High CPU and GPU power
- Large storage
- Heavy computation

Cloud provides powerful machines within minutes.

Example:

- Training on a local laptop: 2 days
- Training on cloud GPU: 2 hours

b) Scalability

Applications may have:

- 100 users today
- 1 million users tomorrow

Cloud automatically scales resources up or down.

Users pay only for what they use.

c) End-to-End ML Lifecycle on Cloud

In real-world companies, the complete ML lifecycle runs on the cloud:

- Data Storage: Amazon S3, Azure Blob, Google Cloud Storage
- Model Training: EC2, Azure ML, Vertex AI

- Deployment: Kubernetes, Cloud Run
 - Monitoring: CloudWatch, Prometheus
 - CI/CD: GitHub integrated with cloud services
- MLOps combines Machine Learning, DevOps, and Cloud Computing.
4. Real-World Use Cases
- Companies like Netflix, Amazon, Swiggy, and Uber use cloud computing to:
- Train ML models
 - Recommend content and products
 - Handle millions of users
 - Deploy applications globally
- Without cloud computing, this scale is not practical.
5. Career and Industry Demand
- Most companies follow a cloud-first approach
 - Cloud skills combined with ML increase job opportunities
- Common job roles include:
- MLOps Engineer
 - Machine Learning Engineer
 - Data Engineer
 - Cloud Engineer
6. Key Summary
- Cloud computing is essential because Machine Learning systems cannot scale, deploy, or run in production without it.
7. Teaching Analogy
- If Machine Learning is the brain, cloud computing is the body that runs it.
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Google Colab vs Jupyter Notebook vs Cloud Platforms

Google Colab

- Online notebook hosted by Google
- Used for learning and quick experiments
- Limited and shared resources
- Temporary storage
- Session timeouts
- Not suitable for deployment or production

Jupyter Notebook

- Notebook tool running locally or on a server
- Used for development and experimentation
- Resource availability depends on local hardware
- No automatic scalability
- Limited production support

Cloud Platforms (AWS, Azure, GCP)

- Complete cloud infrastructure
- Used for production and scalable systems
- Full control over resources
- Scalable CPU, GPU, RAM, and storage
- Supports deployment, CI/CD, monitoring, and security

Summary:

Google Colab and Jupyter are mainly for building and testing models, while cloud platforms are used to run models in real-world production environments.

What Is Cloud Computing?

Definition

Cloud computing is the on-demand availability of computing resources such as servers, storage, databases, networking, and AI tools over the internet, where users pay only for what they use.

In Simple Terms

Cloud computing allows users to rent computing resources instead of buying and maintaining physical servers.

Core Cloud Services

1. Compute: Virtual machines and containers
2. Storage: Object, block, and file storage
3. Networking: Virtual networks, load balancers
4. Databases: SQL and NoSQL databases
5. AI and ML services
6. Security: Identity management, encryption, firewalls

Why Cloud Exists

Traditional IT required high upfront cost, long setup time, and was difficult to scale.

Cloud computing enables:

- Faster provisioning
 - Instant scalability
 - Global access
 - Pay-as-you-go pricing
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On-Premise vs Cloud

On-Premise:

- Company owns and manages hardware
- High initial investment
- Limited scalability
- Complex disaster recovery
- Difficult to support ML and AI workloads

Cloud:

- Infrastructure managed by cloud provider
 - Low or no upfront cost
 - Instant scalability
 - Built-in disaster recovery
 - Rich ML and AI services
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Cloud Providers

A cloud provider is a company that owns and manages data centers and offers computing resources over the internet.

Major Cloud Providers:

- Amazon Web Services (AWS)
- Microsoft Azure
- Google Cloud Platform (GCP)

Cloud providers offer:

- Compute services
 - Storage services
 - Networking
 - Databases
 - AI and ML platforms
 - Security and monitoring tools
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What Is Microsoft Azure?

Microsoft Azure is a cloud computing platform provided by Microsoft that offers computing, storage, networking, databases, and AI/ML services over the internet.

Key Benefits:

- Strong integration with Microsoft tools
- Enterprise-grade security and compliance
- Global data center presence

Azure Services (Beginner Level):

- Compute: Azure Virtual Machines
 - Storage: Azure Blob Storage
 - Networking: Virtual Network
 - Databases: Azure SQL Database
 - ML: Azure Machine Learning
 - DevOps: Azure DevOps
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Azure Resource Group

A Resource Group is a logical container in Azure that holds related resources such as virtual machines, storage accounts, databases, and networks.

Key Points:

- Logical grouping (not physical)
- All resources belong to one region
- Deleting a resource group deletes all resources inside it
- Used to manage access, policies, and monitoring

Analogy:

A resource group is like a project folder that contains all related files.

Azure Subscription

An Azure Subscription is a billing and management boundary that contains Azure resources.

Key Features:

- Tracks billing and costs
- Controls access using role-based access control
- Defines service limits and quotas
- Multiple subscriptions can be used for different projects or environments

Analogy:

Azure is like a shopping mall.

A subscription is like a shop inside the mall.

All resources are items inside the shop, and billing applies to that shop only.

