



Lecture 29 – Microsoft Azure, Cloud Computing



What is Microsoft Azure?

Microsoft Azure is a **cloud computing platform** developed by Microsoft that provides a wide range of **services** such as:

- Virtual Machines (VMs)
- Databases
- Networking
- AI and Machine Learning
- Web Hosting
- Storage and Backup and many more...

Azure allows businesses and individuals to **build, deploy, and manage applications** through Microsoft's global network of **data centers**.



Why Azure? (Key Advantages)

1. Cost-Effective 💰

- You don't need to buy expensive physical servers or maintain them.
 - Pay only for what you use (**Pay-as-you-go model**).
 - Reduces **maintenance, electricity, and hardware costs**.
 - No need to purchase licenses separately — Azure provides them in service plans.
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2. Service-Oriented ⚙️

Azure provides **over 200+ services** under various categories such as:

- **Compute Services:** Virtual Machines, Azure Functions

- **Storage Services:** Blob Storage, File Storage
- **Networking:** Virtual Network, Load Balancer
- **Database:** SQL Database, Cosmos DB
- **Security:** Azure Defender, Key Vault

Everything is managed and scalable via the **Azure Portal** or **CLI**.

3. Integration with VMware

- Azure supports **VMware virtualization** through **Azure VMware Solution**.
 - You can migrate existing **VMware workloads** to Azure **without changing configurations**.
 - This helps enterprises use both **on-premises + cloud infrastructure** efficiently.
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Hardware Concepts (RAM, SSD, Processor)

- **RAM (Random Access Memory):**
Used for running programs and processes temporarily.
Increasing RAM improves multitasking and application speed only if the CPU supports it.
 - **SSD (Solid State Drive):**
Stores data permanently. Faster than HDD.
Increasing SSD improves read/write speed and application loading time.
 - **Processor (CPU):**
Mounted on the motherboard — cannot be upgraded in cloud manually, but **Azure allows you to upgrade virtual processors (vCPUs)** easily.
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In the Cloud (Scalability Example):

In Azure, you can upgrade from a **12th Gen processor VM** to a **13th Gen processor VM** or change specifications (RAM, Storage, Network) **without shutting down the system** or losing data.

➡ This ability to **increase or decrease resources dynamically** is called **Scalability**.

Scalability in Cloud Computing

Scalability means the ability of the system to **increase or decrease resources** (like RAM, CPU, or storage) according to demand — **without affecting performance or uptime**.

Azure provides two types of scalability:

1. Vertical Scalability (Scale Up)

- Increasing or decreasing the **power of existing resources**.
- Example: Upgrading a VM from 4GB RAM to 8GB RAM.
- It enhances performance of the same system.

💡 *Used when you need more processing power or memory for the same application.*

2. Horizontal Scalability (Scale Out)

- Adding or removing **multiple servers (VMs)** to handle increased load.
- Example: When website traffic increases, Azure automatically adds more servers to balance the load.

💡 *Used for large-scale applications, e-commerce sites, or data processing workloads.*

Elasticity in Cloud Computing

Elasticity = Auto-scaling + Load balancing

It allows the system to **automatically adjust resources** based on real-time demand.

🧠 Example:

If one server is overloaded due to high traffic, the cloud engineer can increase it from **1 to 4 servers automatically** using **Azure Auto-Scaling**.

💡 Benefits:

- Reduces downtime.
- Optimizes performance.
- Saves cost by releasing unused resources when not needed.

🔧 Maintenance (No Hardware Hassle)

- Traditional hardware (like Dell, HP) comes with **3-year warranties** and has conditions.
- You need to replace or repair it manually.
- In the cloud, **maintenance is managed by Azure**, which:
 - Handles hardware failures.
 - Ensures updates, patches, and monitoring.
 - Minimizes downtime.
- Hence, **maintenance cost is saved**, and system uptime improves.

🔄 Reliability in Cloud

Reliability ensures that your system continues to operate correctly even when there are hardware or network failures.

Azure achieves reliability through:

1. **Multiple Data Centers:** If one fails, another takes over (Load Shifting).
2. **Data Backup:** Automatic data replication across regions.
3. **Disaster Recovery:** Quick restoration of services in emergencies.
4. **Redundancy:** Duplicates of data to prevent loss.

💡 *Azure guarantees 99.9% uptime (SLA – Service Level Agreement).*

Security in Cloud

Cloud security is divided into **two parts**:

1. Physical Security

- Azure data centers have **restricted access**, CCTV monitoring, and biometric security.
- Only authorized personnel can enter server rooms.


2. Digital Security


- Uses **firewalls, encryption, antivirus, and identity management (Azure AD)**.
- Supports **Multi-Factor Authentication (MFA)** and **Zero Trust Architecture**.
- Regular security audits ensure **data confidentiality and integrity**.

Availability

Availability refers to the **ability to access data or services anytime, anywhere** without interruption.

Azure achieves this using:

- **Global Data Centers**  (spread worldwide)
- **Load Balancing**
- **Failover Clusters**
- **High Uptime (24x7x365 availability)**

 *Example:* You can access your Azure VM or database anytime even if one data center is under maintenance — it automatically switches to another.

Cloud Deployment Models (Detailed Explanation)

Azure offers **three main deployment models**, each with its own use cases 



1. Public Cloud

- Cloud infrastructure is **owned and managed by third-party providers** like Microsoft, AWS, or Google.
- Services are shared across multiple customers.
- Users pay only for what they use.



Examples: Microsoft Azure, AWS, Google Cloud Platform.



Advantages:

- Cost-effective
- No hardware maintenance
- Easy scalability
- Global accessibility



Disadvantages:

- Limited control over data location
- Security concerns for sensitive data



2. Private Cloud

- Dedicated infrastructure used **only by one organization**.
- Provides **higher security, customization, and control**.
- Hosted on-premises or in a dedicated data center.



Example: A bank or government using a private cloud for sensitive data.



Advantages:

- High privacy and security
- Better control and customization
- Ideal for compliance-heavy industries




Disadvantages:

- Expensive setup and maintenance
 - Limited scalability compared to public cloud
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3. Hybrid Cloud

- A **combination of Public + Private Cloud**.
- Sensitive data is stored on **private cloud**, while less critical workloads run on **public cloud**.
- Enables data and application sharing between both environments.

 *Example:*

A company hosts customer data privately but runs its website on the public cloud.

Advantages:

- Balanced security and flexibility
- Cost-effective and scalable
- Disaster recovery and backup options

Disadvantages:


- Complex to manage
 - Requires high network connectivity
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Summary Table

Feature	Public Cloud	Private Cloud	Hybrid Cloud
Ownership	Third-party provider	Single organization	Combination of both
Security	Moderate	High	Very High
Cost	Low	High	Medium
Scalability	Very High	Limited	High

Feature	Public Cloud	Private Cloud	Hybrid Cloud
Maintenance	Managed by provider	Managed internally	Shared responsibility
Example	Azure, AWS	VMware Private Cloud	Azure Hybrid Setup

In Summary

 **Microsoft Azure** is a cost-effective, reliable, and secure cloud platform that provides on-demand computing resources and services worldwide. It offers **scalability, elasticity, high availability, and strong security** with flexible **deployment models (Public, Private, Hybrid)** to suit every business need.

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