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**☁️** Compute

## Azure Virtual Machines

Provides scalable, on-demand virtualized compute resources with full control over OS and configurations.

Ideal for lifting-and-shifting applications, running custom software, or legacy workloads.

Supports Windows & Linux, with flexible pricing (pay-as-you-go or reserved instances).

**Example**: Running a legacy ERP system on Windows Server that requires full control over the OS and custom software installations.

## Azure App Service

Fully managed platform for building, deploying, and scaling web apps, APIs, and mobile backends.

Supports multiple languages (C#, Java, Node.js, Python, PHP) and integrates with DevOps tools.

Offers auto-scaling, high availability, and built-in security (SSL, authentication).

**Example**: Hosting a company’s customer-facing e-commerce website built with .NET Core that needs auto-scaling during peak sales.

## Azure Kubernetes Service (AKS)

Managed Kubernetes service for deploying, scaling, and managing containerized applications.

Simplifies cluster management with automated updates, scaling, and security.

Integrates with Azure DevOps, monitoring (Azure Monitor), and CI/CD pipelines.

**Example**: Deploying a microservices-based SaaS application with Docker containers that needs automatic scaling and rolling updates

## Azure Functions (Serverless)

Event-driven serverless compute service for running small code snippets (functions) without managing infrastructure.

Scales automatically and supports triggers (HTTP, timers, queues, databases).

Pay only for execution time, ideal for microservices, automation, and lightweight APIs.

**Example**: Processing real-time image uploads (e.g., resizing thumbnails) triggered by Azure Blob Storage events.

## Azure Container Instances (ACI)

Simplest way to run containers in Azure without managing servers or orchestration.

Quick to deploy, billed per second, and ideal for short-lived or burst workloads.

Supports both Linux and Windows containers with direct integration into virtual networks.

**Example**: Quickly running a one-time data processing job in a Docker container without managing a full Kubernetes cluster.

## Azure Batch

Enables large-scale parallel and high-performance computing (HPC) workloads in the cloud.

Automates job scheduling, scaling, and management of compute-intensive tasks.

Used for rendering, financial modeling, scientific simulations, and big data processing.

**Example**: Processing thousands of satellite images in parallel for a weather forecasting simulation using GPU-powered VMs.

### 🗃️ Storage

Comparison Cheat Sheet

| **Service** | Data Model | Primary Use Case | Access Method |
| --- | --- | --- | --- |
| **Blob Storage** | Objects (files) | Media, backups, static websites | HTTP/REST API |
| **File Storage** | File shares | Shared drives for apps/VMs | SMB/NFS mount |
| **Queue Storage** | Messages | Decoupling app components | Async message processing |
| **Table Storage** | Key-value pairs | NoSQL metadata or logging | PartitionKey/RowKey queries |
| **Disk Storage** | Block storage | VM disks (OS/data) | Attached to VMs |

Cheat Sheet for E-Commerce Storage

| **Data Type** | Azure Service | Use Case Example |
| --- | --- | --- |
| **Product Images/Videos** | Blob Storage | CDN-delivered product galleries |
| **Database (PostgreSQL)** | Azure Database for PostgreSQL (or Disk Storage for VMs) | Customer orders, inventory |
| **Order Queue Processing** | Queue Storage | Async order fulfillment |
| **User Sessions** | Redis Cache | Fast cart/session management |
| **Shared Admin Files** | File Storage | CSV exports for analytics |

# Databases

| **Need** | **Choose** | **Why** |
| --- | --- | --- |
| Enterprise RDBMS | **Azure SQL DB** | Full SQL Server compatibility |
| Global low-latency | **Cosmos DB** | <15ms P99 latency worldwide |
| Open-source RDBMS | **PostgreSQL/MySQL** | Flexible licensing |
| JSON/Geospatial | **PostgreSQL** | Advanced data types |
| Cost-sensitive | **MariaDB** | Cheaper than MySQL |

## Networking

## Azure Virtual Network (VNet)

What: Private network infrastructure in Azure

Best for: Isolating and securing resources

Example: Connecting VMs privately for a 3-tier app

Key Feature: Subnet segmentation, NSGs

## Azure Load Balancer

What: Layer 4 (TCP/UDP) traffic distribution

Best for: High availability at transport layer

Example: Distributing traffic across VM web servers

Key Feature: Health probes, 5-tuple hashing

## Azure Application Gateway

What: Layer 7 (HTTP/HTTPS) load balancer

Best for: Web application traffic management

Example: URL-path based routing for microservices

Key Feature: WAF integration, SSL termination

## Azure VPN Gateway

What: Secure cross-premises connectivity

Best for: Site-to-site or point-to-site VPNs

Example: Connecting on-prem datacenter to Azure

Key Feature: IPsec/IKE protocols

## Azure ExpressRoute

What: Private dedicated network connection

Best for: High-throughput, low-latency needs

Example: Connecting financial systems with SLA

Key Feature: BGP routing, 99.95% SLA

## Azure DNS

What: Domain hosting service

Best for: DNS domain management

Example: Hosting DNS records for your website

Key Feature: Fast propagation, alias records

## Azure Front Door

What: Global HTTP load balancer

Best for: CDN with application acceleration

Example: Global SaaS application delivery

Key Feature: Anycast, DDoS protection

## Azure Traffic Manager

What: DNS-based traffic distribution

Best for: Global routing to closest region

Example: Disaster recovery failover

Key Feature: Multiple routing methods

Comparison Cheat Sheet

| Service | Layer | Best For | Unique Feature |
| --- | --- | --- | --- |
| VNet | L3 | Private clouds | Network isolation |
| Load Balancer | L4 | VM traffic distribution | Transport layer HA |
| App Gateway | L7 | Web apps | Path-based routing |
| VPN Gateway | L3 | Hybrid cloud | Secure tunnels |
| ExpressRoute | L2 | Enterprise connectivity | Private fiber |
| DNS | L7 | Domain management | Fast propagation |
| Front Door | L7 | Global apps | Anycast networking |
| Traffic Manager | DNS | Global routing | Failover policies |

When to Use Which?

Need private networking? → VNet

Basic VM load balancing? → Load Balancer

Web app routing? → App Gateway

Site-to-site VPN? → VPN Gateway

Enterprise connection? → ExpressRoute

Domain management? → Azure DNS

Global web app? → Front Door

DNS-based failover? → Traffic Manager

# Identity & Security

## Azure Active Directory (Azure AD)

Core Function: Identity and access management (IAM)

Key Features:

Single Sign-On (SSO) for 3,000+ SaaS apps

Conditional Access policies (MFA, location-based access)

Identity Protection (real-time risk detection)

Example: Employees securely access Office 365, Salesforce, and custom apps with one credential set.

Pro Tip: Use Privileged Identity Management (PIM) for just-in-time admin access.

## Azure Key Vault

Core Function: Centralized secrets management

Key Features:

Securely store API keys, certificates, passwords

Hardware Security Module (HSM)-backed keys

Access auditing and rotation automation

Example: Your e-commerce app retrieves database connection strings securely instead of hardcoding them.

Pro Tip: Enable soft delete to prevent accidental secret deletion.

## Azure DDoS Protection

Core Function: Mitigate distributed denial-of-service attacks

Key Features:

Standard tier: Always-on monitoring with 100 Gbps mitigation

Network layer protection (L3/L4)

Example: Your public-facing API stays online during a volumetric attack.

Pro Tip: Combine with Web Application Firewall (WAF) for L7 protection.

## Azure Firewall

Core Function: Managed network firewall

Key Features:

Threat intelligence-based filtering

Outbound SNAT and inbound DNAT support

Example: Restrict outbound VM traffic to only approved SaaS APIs.

Pro Tip: Use Firewall Manager for centralized policy governance.

## Microsoft Defender for Cloud (formerly Azure Security Center)

Core Function: Cloud Security Posture Management (CSPM)

Key Features:

Continuous security assessments (CIS benchmarks)

Just-in-time VM access

Multi-cloud support (AWS, GCP)

Example: Auto-remediate misconfigured NSGs exposing RDP ports.

Pro Tip: Enable Defender plans for advanced threat detection.

Cheat Sheet: When to Use Which?

| Service | Best For | Key Benefit |
| --- | --- | --- |
| Azure AD | Identity governance | SSO + Conditional Access |
| Key Vault | Secrets management | Eliminate hardcoded credentials |
| DDoS Protection | Public IP protection | Mitigate volumetric attacks |
| Azure Firewall | Network traffic control | Stateful firewall as a service |
| Defender for Cloud | Security posture | Unified cloud security |

Critical Integration:

Use Azure AD with Conditional Access to enforce MFA for admin portals.

Store Firewall rules in Key Vault for audit compliance.

Let Defender for Cloud monitor all services continuously.

# ****🛠️ DevOps & Development****

| **Service** | **Purpose** | **Key Feature** | **Example Use Case** |
| --- | --- | --- | --- |
| **Azure DevOps** | End-to-end DevOps platform | Boards, Repos, Pipelines, Test Plans | Agile project management + CI/CD |
| **GitHub** (Microsoft-owned) | Code hosting + collaboration | GitHub Actions, Copilot | Open-source projects with CI/CD |
| **Azure Pipelines** | CI/CD automation | Multi-platform builds (Linux/Windows/macOS) | Deploy containerized apps to AKS |
| **Azure Repos** | Private Git repositories | Branch policies, pull requests | Enterprise code collaboration |
| **Azure Test Plans** | Manual/Automated testing | Exploratory testing toolkit | Validate e-commerce checkout flow |
| **Azure Artifacts** | Package management | Maven, npm, NuGet feeds | Share internal libraries across teams |

**Pro Tip**: Combine **GitHub Actions** with **Azure Pipelines** for hybrid CI/CD workflows.

# ****🧰 Monitoring & Management****

| **Service** | **Purpose** | **Key Feature** | **Example Use Case** |
| --- | --- | --- | --- |
| **Azure Monitor** | Unified monitoring | Metrics, logs, alerts | Track VM CPU/memory 24/7 |
| **Log Analytics** | Log query/analysis | Kusto Query Language (KQL) | Investigate app failures |
| **Application Insights** | App performance (APM) | Distributed tracing | Debug microservices latency |
| **Azure Automation** | Process automation | Runbooks (PowerShell/Python) | Auto-scale VMs on schedule |
| **Azure Advisor** | Cost/security optimization | Personalized recommendations | Right-size underused VMs |
| **ARM Templates** | Infrastructure-as-Code (IaC) | JSON-based deployments | Version-controlled environment setup |

**Critical Integration**:

* Use **Application Insights** with **Log Analytics** for full-stack diagnostics.
* Deploy resources via **ARM/Bicep** templates stored in **Azure Repos**.

# ****🌍 IoT Services****

| **Service** | **Purpose** | **Key Feature** | **Example Use Case** |
| --- | --- | --- | --- |
| **Azure IoT Hub** | Bi-directional device communication | Device twins, edge module deployment | Fleet management for 10K+ sensors |
| **IoT Central** | SaaS for IoT solutions | No-code dashboard builder | Smart building monitoring |
| **Azure Sphere** | Secure IoT hardware/OS | Certified MCU + security updates | Medical device manufacturing |

**Pro Tip**: Use **IoT Hub** with **Stream Analytics** for real-time telemetry processing.

# ****📦 Migration Tools****

| **Service** | **Purpose** | **Key Feature** | **Example Use Case** |
| --- | --- | --- | --- |
| **Azure Migrate** | Discovery/assessment | Dependency mapping | Plan VMware → Azure VM migration |
| **Azure Site Recovery** | Disaster recovery (DR) | Near-zero RPO/RTO | Failover on-prem VMs to Azure |
| **Azure Backup** | Cloud backup | Application-consistent snapshots | SQL Server point-in-time restore |

**Migration Strategy**:

1. **Assess** with Azure Migrate
2. **Replicate** with Site Recovery
3. **Protect** with Azure Backup

### ****Decision Tree****

1. **Building CI/CD?**
   * Use **Azure Pipelines** (YAML) or **GitHub Actions**
2. **Need APM?**
   * **Application Insights** for code-level insights
3. **Managing IoT?**
   * **IoT Hub** for custom solutions, **IoT Central** for turnkey SaaS
4. **Migrating?**
   * Start with **Azure Migrate** assessment