# Azure Fundamentals (AZ-900) Study Guide

## I. Cloud Concepts

### Cloud Computing

Cloud computing is the delivery of computing services over the internet (“the cloud”), including servers, storage, databases, networking, software, analytics, and intelligence. Cloud computing enables flexible resources, rapid provisioning, and economies of scale.

### Public Cloud

Services provided by third-party providers over the public internet and available to anyone who wants to purchase them. Examples include Microsoft Azure, AWS, and Google Cloud Platform.

### Private Cloud

Computing resources used exclusively by a single business or organization. The private cloud can be physically located at an organization’s on-site datacenter or hosted by a third-party service provider.

### Hybrid Cloud

A computing environment that combines a public cloud and a private cloud by allowing data and applications to be shared between them. Provides greater flexibility and optimization of existing infrastructure.

### Multi-Cloud

The use of multiple cloud computing services from different providers in a single heterogeneous architecture. Helps avoid vendor lock-in and allows organizations to leverage best services from each provider.

### IaaS (Infrastructure as a Service)

Provides virtualized computing resources over the internet. The provider manages the physical hardware, while customers manage operating systems, applications, and data. Examples: Azure VMs, Azure Storage.

### PaaS (Platform as a Service)

Provides hardware and software tools over the internet, typically for application development. The provider manages hardware and software, while customers manage applications and data. Examples: App Service, Logic Apps.

### SaaS (Software as a Service)

Complete software applications delivered over the internet on a subscription basis. The provider manages everything, and users simply use the software. Examples: Microsoft 365, Dynamics 365.

### CapEx (Capital Expenditure)

The upfront spending of money on physical infrastructure, then deducting that expense from tax bill over time. CapEx is a significant upfront cost with value that reduces over time.

### OpEx (Operational Expenditure)

Spending money on services or products now and being billed for them now. OpEx is deducted from tax bill in the same year. Cloud computing falls under OpEx.

### Scalability

The ability to increase or decrease IT resources to meet changing demand. Vertical scaling (scaling up) adds resources to existing infrastructure, while horizontal scaling (scaling out) adds more instances of resources.

### Elasticity

The ability to automatically scale resources up or down as needed, often in response to demand. Elasticity is a key benefit of cloud computing that allows for cost optimization.

### Agility

The ability to rapidly develop, test, and launch software applications that drive business growth. Cloud computing increases agility by providing self-service resources and eliminating procurement processes.

### Fault Tolerance

The ability of a system to continue operating properly in the event of the failure of one or more of its components. Implemented through redundancy and failover mechanisms.

### Disaster Recovery

The process of restoring application functionality in the wake of a catastrophic loss. Cloud computing provides cost-effective disaster recovery solutions for all types of enterprise systems.

### High Availability

Designed to ensure that systems are operational for a high percentage of time, minimizing downtime. Azure provides various availability options including availability sets and availability zones.

### Shared Responsibility Model

Defines which security tasks are handled by the cloud provider and which are handled by the customer. Responsibilities vary depending on service model (IaaS, PaaS, SaaS).

### Edge Computing

Brings computation and data storage closer to the location where it is needed to improve response times and save bandwidth. Azure supports edge computing through Azure IoT Edge.

### Cloud Adoption Framework (CAF)

Microsoft’s guidance for organizations to achieve cloud adoption success. It includes best practices, documentation, and tools to help with cloud adoption initiatives.

## II. Core Azure Services

### Compute:

#### Virtual Machines (VMs)

IaaS offering that provides virtualized computing environments. Users can choose from various VM sizes and types to meet specific workload requirements.

#### Azure App Service

PaaS offering for building, deploying, and scaling web apps. Supports multiple languages and frameworks.

#### Web Apps

Part of Azure App Service that hosts web applications, REST APIs, and mobile back ends in the programming language of your choice.

#### API Apps

Part of Azure App Service that makes it easy to build and consume Cloud APIs. Provides enterprise-grade security and DevOps capabilities.

#### Azure Functions

Serverless compute service that enables running code on-demand without having to explicitly provision or manage infrastructure. Pay only for the compute time used.

#### Azure Container Instances (ACI)

Fastest and simplest way to run a container in Azure, without having to manage any virtual machines or adopt a higher-level service.

#### Azure Kubernetes Service (AKS)

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

#### Azure Logic Apps

Integration Platform as a Service (iPaaS) that automates workflows and integrates apps, data, systems, and services across organizations.

#### Azure Batch

Service for running large-scale parallel and high-performance computing batch jobs efficiently in Azure.

### Networking:

#### Virtual Network (VNet)

Enables Azure resources to securely communicate with each other, the internet, and on-premises networks. Provides isolation and segmentation.

#### Subnet

A range of IP addresses in a VNet. You can divide a VNet into multiple subnets for organization and security.

#### Network Security Group (NSG)

Contains security rules that allow or deny inbound or outbound network traffic. Can be associated with subnets or individual network interfaces.

#### Azure Load Balancer

Distributes incoming traffic among healthy service instances in cloud services or virtual machines. Provides high availability and network performance.

#### Azure DNS

Hosting service for DNS domains that provides name resolution using Microsoft Azure infrastructure. Manages DNS records for Azure services.

#### Azure ExpressRoute

Establishes private connections between Azure datacenters and on-premises infrastructure. Offers higher security, reliability, and speeds with lower latencies.

#### VPN Gateway

Sends encrypted traffic between an Azure virtual network and an on-premises location over the public Internet or via ExpressRoute.

#### Azure Firewall

Managed, cloud-based network security service that protects Azure Virtual Network resources with built-in high availability and unrestricted cloud scalability.

#### Azure DDoS Protection

Protects Azure applications from distributed denial of service (DDoS) attacks by providing detection and automated mitigation.

#### Azure Content Delivery Network (CDN)

Delivers high-bandwidth content to users by caching content at strategically placed physical nodes around the world.

### Storage:

#### Azure Blob Storage

Object storage solution for the cloud. Optimized for storing massive amounts of unstructured data such as text or binary data.

#### Azure File Storage

Managed file shares for cloud or on-premises deployments. Accessible via industry standard SMB protocol.

#### Azure Queue Storage

Service for storing large numbers of messages that can be accessed from anywhere via authenticated calls using HTTP or HTTPS.

#### Azure Disk Storage

Block-level storage volumes for Azure VMs. Similar to physical disks in on-premises servers but virtualized.

#### Storage Tiers (Hot, Cool, Archive)

Different storage tiers for blob data with different costs and access latencies. Hot for frequently accessed data, Cool for infrequently accessed, Archive for rarely accessed.

#### Azure Backup

Service that backs up and recovers your data in the Microsoft cloud. Replaces existing on-premises or off-site backup solutions with a cloud-based solution.

#### Azure Site Recovery

Service that provides business continuity and disaster recovery strategy for your applications and workloads by orchestrating replication from primary to recovery site.

### Databases:

#### Azure SQL Database

Fully managed relational database service based on Microsoft SQL Server. Provides predictable performance with multiple resource types and service tiers.

#### Azure Cosmos DB

Globally distributed, multi-model database service. Supports document, key-value, wide-column, and graph databases with guaranteed low latency.

#### Azure Database for MySQL

Fully managed MySQL database service. Provides high availability, security, and scalability built in at no additional cost.

#### Azure Database for PostgreSQL

Fully managed PostgreSQL database service with built-in intelligence and security.

#### Azure Database for MariaDB

Fully managed MariaDB database service. Based on the open-source MariaDB server engine.

### Internet of Things:

#### Azure IoT Hub

Managed service that enables bidirectional communication between IoT devices and an Azure-based backend.

#### Azure IoT Central

Fully managed IoT SaaS solution that makes it easy to connect, monitor, and manage IoT assets at scale.

### Messaging & Integration:

#### Azure Service Bus

Fully managed enterprise message broker with message queues and publish-subscribe topics.

#### Event Grid

Serverless event routing service that enables event-based architectures and simplifies event-based applications.

#### Event Hubs

Big data streaming platform and event ingestion service capable of receiving and processing millions of events per second.

## III. Azure Pricing, Service Level Agreements, and Lifecycles

### Pay-as-you-go

A pricing model that charges based on actual usage of resources. No upfront costs or long-term commitments.

### Azure Reservations

Provides discounted pricing when you make a one-year or three-year commitment to specific services, such as virtual machines.

### Spot VMs

Allows you to purchase unused VM capacity at significant discounts. Ideal for interruptible workloads.

### Azure Cost Management

A set of tools to monitor, allocate, and optimize your Azure costs. Includes budgets, alerts, and recommendations.

### Azure Cost Calculator

Online tool that helps estimate costs for Azure services based on your specific requirements.

### Service Level Agreement (SLA)

A formal agreement between a service provider and customer that defines expected service levels. Azure SLAs guarantee specific levels of service availability.

### Availability Zones

Physically separate datacenters within an Azure region. Provides protection against datacenter failures through redundancy and isolation.

### Regions

Geographical areas containing one or more datacenters networked together. Allows customers to place resources close to users to reduce latency.

### Azure Support Plans

Various support options offered by Microsoft for Azure customers: - Basic: Available to all Azure accounts, includes access to documentation, community support, and ability to create support tickets - Developer: For trial and non-production environments - Standard: For production workload environments - Professional Direct: For business-critical dependence on Azure - Premier: Comprehensive support for enterprises with business-critical dependence on Microsoft products

### Subscription Types

Different Azure subscription options available to customers: - Free tier - Pay-as-you-go - Enterprise Agreement (EA) - Cloud Solution Provider (CSP) - Student

## IV. Azure Management Tools and Governance

### Azure Portal

Web-based unified console for building, managing, and monitoring Azure resources. Provides a graphical user interface.

### Azure PowerShell

Command-line interface for managing Azure resources. Uses PowerShell cmdlets and scripts.

### Azure CLI

Command-line interface for managing Azure resources. Uses Bash commands and scripts.

### Azure Resource Manager (ARM)

Deployment and management service for Azure. Provides a consistent management layer for creating, updating, and deleting resources.

### Resource Groups

Containers that hold related resources for an Azure solution. Resources in a group share the same lifecycle, permissions, and policies.

### ARM Templates

JSON files that define the infrastructure and configuration for an Azure deployment. Enables infrastructure as code.

### Azure Policy

Service used to create, assign, and manage policies that enforce rules on resources. Ensures resources comply with corporate standards and service level agreements.

### Azure Monitor

Comprehensive solution for collecting, analyzing, and acting on telemetry from cloud and on-premises environments.

### Azure Activity Log

Platform service that provides insights into subscription-level events in Azure. Includes information about resource changes and service health.

### Role-Based Access Control (RBAC)

Authorization system built on Azure Resource Manager that provides fine-grained access management of Azure resources.

### Azure Blueprints

Enables organizations to define a repeatable set of Azure resources that implements and adheres to standards, patterns, and requirements.

### Management Groups

Containers that help you manage access, policy, and compliance for multiple subscriptions. All subscriptions in a management group inherit conditions applied to the management group.

### Azure Resource Locks

Help prevent accidental deletion or modification of resources by users. Can be set to either Delete or ReadOnly.

### Azure Service Health

Provides personalized guidance and support when issues in Azure services affect you. Includes current status, historical information, and future planned maintenance.

### Cloud Shell

Browser-based shell experience that makes it easy to manage Azure resources through a command-line interface without having to install any tools locally.

### Tags

Metadata elements that you can apply to Azure resources for logical organization according to categories you define.

### Azure Migrate

Service that helps you discover, assess, and migrate on-premises applications and infrastructure to Azure.

### Azure Mobile App

Mobile application that allows you to monitor and manage your Azure resources from your iOS or Android phone or tablet.

## V. Core Azure Security & Compliance

### Azure Active Directory (Azure AD, now called Microsoft Entra ID)

Microsoft’s cloud-based identity and access management service. Helps users sign in and access resources in Microsoft cloud applications and on-premises applications.

### Multi-Factor Authentication (MFA)

Security process that requires users to provide two or more verification factors to gain access to a resource, enhancing account security beyond just a password.

### Conditional Access

Feature that allows controlling access to applications based on specific conditions (location, device, application, risk) and applying access controls when conditions are met.

### Azure Key Vault

Service for securely storing and accessing secrets such as API keys, passwords, certificates, and cryptographic keys.

### Azure Information Protection

Cloud-based solution that helps organizations classify and protect documents and emails by applying labels.

### Microsoft Defender for Cloud

Unified security management system and advanced threat protection service for workloads in Azure, other clouds, and on-premises.

### Zero Trust Security Model

Security framework that assumes breach and verifies each request as though it originates from an uncontrolled network, regardless of where the request originated.

### Compliance Terms

Various regulatory compliance standards that Azure helps customers meet: - GDPR (General Data Protection Regulation) - HIPAA (Health Insurance Portability and Accountability Act) - ISO (International Organization for Standardization) standards - SOC (Service Organization Control) reports - FedRAMP (Federal Risk and Authorization Management Program)

### Azure Trust Center

Portal that provides information about privacy, compliance, and security practices in Microsoft cloud products.

### Microsoft Privacy Statement

Document that explains what personal data Microsoft collects, how they use it, and for what purposes.

### Service Trust Portal

Portal that provides access to various resources about Microsoft security, compliance, and privacy practices.

### Compliance Manager

Tool to help organizations meet complex compliance obligations by performing risk assessments on Microsoft cloud services.

## VI. Azure Identity Services

### Authentication vs. Authorization

Authentication confirms the user’s identity, while authorization determines what resources a user can access and what operations they can perform.

### Azure Single Sign-On (SSO)

Enables users to sign in once and gain access to many applications and resources using the same credentials.

### Azure B2B (Business-to-Business)

Feature that enables access to organizational applications and services for guest users from other organizations while maintaining control over corporate data.

### Azure B2C (Business-to-Consumer)

Identity management service that enables custom authentication experiences for consumer-facing applications, with integration for social media accounts.

### Managed Identities

Feature that provides Azure services with an automatically managed identity in Azure AD, which can be used to authenticate to any service that supports Azure AD authentication.

## Additional Terms (Good to Know):

### Azure Marketplace

Online store that offers applications and services built by industry-leading technology companies. Solutions can be deployed quickly on Azure.

### Azure Advisor

Free service that provides recommendations to help optimize Azure deployments for reliability, security, operational excellence, performance, and cost.

### Azure Security Center (now Defender for Cloud)

Unified security management system that strengthens the security posture of your data centers and provides advanced threat protection.

### Azure DevOps

A set of development tools, services, and features that enables teams to plan work, collaborate on code development, build, and deploy applications.

### Azure Arc

Set of technologies that extends Azure management and services to any infrastructure, including on-premises, multi-cloud, and edge environments.