Azure Fundamentals: AZ-900 Certification

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Candidates

Who is this course for?

- ❑ Azure beginners
- ❑ Want to learn more about Azure
- ❑ Want to become Azure certified

Azure Fundamentals Outline: Module 1

Cloud Concepts

- ❑ Benefits of Cloud Services
- ❑ Types of Cloud models
- ❑ Types of Cloud Services

Azure Fundamentals Outline: Module 2

Core Azure Services

- ❑ Core Azure Architectural components
- ❑ Core Azure Services and Products
- ❑ Azure Solutions
- ❑ Azure management tools

Azure Fundamentals Outline: Module 3

Security, Privacy, Compliance and Trust

- ❑ Securing network connectivity in Azure
- ❑ Core Azure Identity services
- ❑ Security tools and features
- ❑ Azure governance methodologies
- ❑ Monitoring and Reporting in Azure
- ❑ Privacy, Compliance and Data Protection standards in Azure

Azure Fundamentals Outline: Module 4

Azure Pricing and Support

- ❑ Azure subscriptions
- ❑ Planning and managing costs
- ❑ Support options available with Azure
- ❑ Azure Service Level Agreements (SLAs)
- ❑ Service lifecycle in Azure

Module 1:
Cloud Concepts

Cloud Concepts: Learning Objectives

After completing these topics, you will be able to:

- ❑ Describe and understand cloud services and their benefits
- ❑ Understand key terms you will encounter when working with cloud services
- ❑ Understand public, private, and hybrid cloud models
- ❑ Understand Infrastructure-as-a-Service (IaaS)
- ❑ Understand Platform-as-a-Service (PaaS)
- ❑ Understand Software-as-a-Service (SaaS)

Module 1:
Cloud Concepts
Lesson 1: Why Cloud Services?

Why use Cloud Services

Benefits of cloud services

- ❑High availability
- ❑ Scalability
- ❑Agility
- ❑ Fault tolerance
- ❑ Disaster recovery

Why use Cloud Services

Benefits of cloud services

- **High Availability (HA):** This refers to a system's ability to minimize downtime and ensure continuous operation. In Azure, this can be achieved through features like redundant virtual machines, load balancing, and automatic failover. Even if one component fails, your application or service remains available.

Imagine you run a bakery with two ovens. If one oven malfunctions, you can still bake using the other, keeping your business running with minimal disruption. In Azure, this translates to having backup systems in place, so if one server has an issue, your application or service keeps functioning.

Why use Cloud Services

Benefits of cloud services

- **Scalability:** This describes the ability to easily adjust resources (like processing power, storage) up or down based on demand. Azure offers both vertical scaling (adding resources to an existing machine) and horizontal scaling (adding more machines) for optimal performance and cost-efficiency.

Think of a clothing store during the holidays. You might bring in extra staff (scale up) to handle the increased customer flow. Then, after the holidays, you can reduce staff (scale down) to normal levels.

Why use Cloud Services

Benefits of cloud services

- **Agility:** This refers to the speed and flexibility of deploying and managing resources in the cloud. Azure's self-service model and automation tools allow for quicker development, testing, and deployment of applications. This agility helps businesses adapt to changing needs and market demands.

Remember that school project due tomorrow night? Azure's agility is like being able to write, edit, and format your paper quickly and efficiently.

Why use Cloud Services

Benefits of cloud services

- **Fault Tolerance:** This is a subset of High Availability, focusing on a system's ability to withstand component failures without impacting service. For instance, Azure virtual machines running on redundant hardware can tolerate hardware failure by automatically switching to a healthy machine.

Ever fly on a plane that had an engine failure? A fault-tolerant system is like having a twin engine plane that can fly with only one engine.

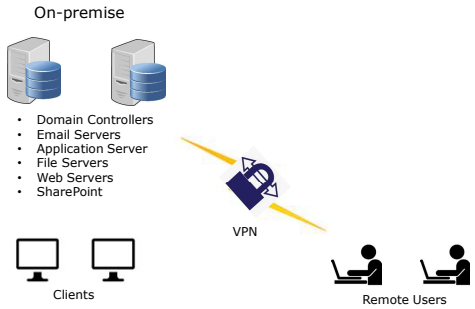
Why use Cloud Services

Benefits of cloud services

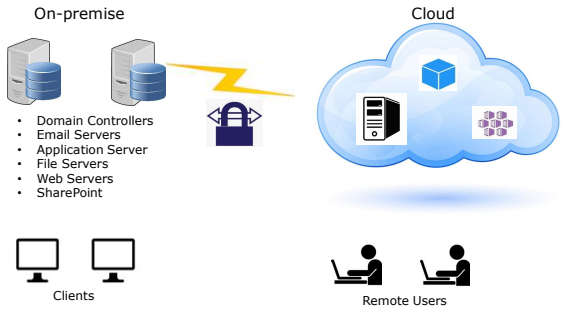
- **Disaster Recovery (DR):** This is a broader strategy for recovering from larger outages or disasters that might entirely disable a data center. Azure offers tools like Azure Site Recovery to replicate data and applications to a secondary location for quick restoration in case of a major disruption.

A fire damages your bakery. Disaster recovery is like having a backup of your recipes and ingredients stored at a friend's bakery. You can have those recipes and ingredients sent to a new bakery. With Azure's DR tools, you can replicate your data and applications to a separate location, allowing for quick restoration if a major disruption occurs at your primary location.

Why use Cloud Services



Why use Cloud Services



Why use Cloud Services

Benefits of cloud services

- ❑High availability. The ability to keep services up and running for long periods of time, with very little downtime, depending on the service in question.
- ❑Scalability. The ability to add or remove additional resources.
- ❑Elasticity. The ability to automatically or dynamically increase or decrease resources as needed. Elastic resources match the current needs, and resources are added or removed automatically to meet future needs. A distinction between scalability and elasticity is that elasticity is done automatically

Why use Cloud Services

Benefits of cloud services

- ❑Agility. The ability to *scale* quickly. Cloud services can allocate and deallocate resources quickly, on-demand.
- ❑Fault tolerance. The ability to remain up and running even in the event of a component or service no longer functioning. Typically, redundancy is built into cloud services architecture so if one component fails, a backup component takes its place.
- ❑Disaster recovery. The ability to recover from an event which has taken down a cloud service.

Why use Cloud Services

Benefits of cloud services

- ❑High availability
- ❑ Scalability
- ❑ Elasticity
- ❑ Agility
- ❑ Fault tolerance
- ❑ Disaster recovery

What is Cloud Computing?

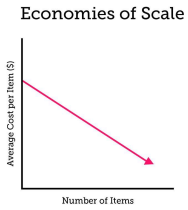
- ❑ Rather than building and operating dedicated infrastructure to provide IT services, Cloud Computing services are shared resources offered and maintained by a third party to multiple IT "tenants" or organizations

Benefits:

- ❑ Faster acquisition and deployment of computing resources
- ❑ Lower capital equipment expenditures

Economies of scale

- The concept of ***economies of scale*** is the ability to do things less expensively, but more efficiently when operating at a larger scale in comparison to operating at a smaller scale
- Cloud providers such as Microsoft, Google, and Amazon Web Services (AWS) are very large businesses, and thus can leverage the benefits of economies of scale and then pass those benefits on to their customers



Capital Expense compared to Operational Expense

Capital Expenditure (CapEx) is the spending of money on physical infrastructure up front, and then deducting that expense from your tax bill over time. CapEx is an upfront cost which has a value that reduces over time.

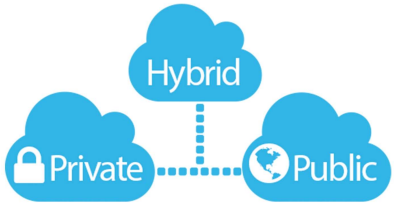
Operational Expenditure (OpEx) is spending money on services or products and being billed for them immediately. You can deduct this expense from your tax bill in the same year. There is no upfront cost, you pay for a service or product as you use it.

Consumption based model

- Only pay for resources that are consumed
- Lower costs
- Additional resources on demand

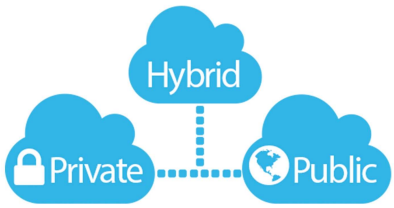
Module 1:
Cloud Concepts
Lesson 2: Types of cloud models

Public Cloud



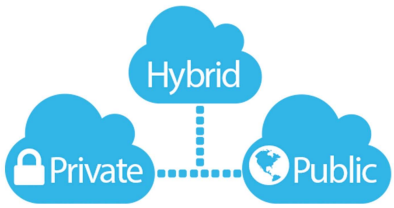
A *public cloud* is owned by a cloud services provider (also known as a *hosting provider*). It provides resources and services to multiple organizations and users who connect to the cloud service via a secure network connection, typically over the internet

Private Cloud



A *private cloud* is owned and operated by the organization that uses the resources from that cloud. They create a cloud environment in their own datacenter and provide self-service access to compute resources to users within their organization. The organization remains the owner, entirely responsible for the operation of the services they provide.

Hybrid Cloud



hybrid cloud combines both public and private clouds, allowing you to run your applications in the most appropriate location

Comparing Cloud Models

Public cloud:

- **No CapEx**. You don't have to buy a new server to scale up.
- **Agility**. Applications can be made accessible quickly, and deprovisioned whenever needed.
- **Consumption-based model**. Organizations pay only for what they use, and operate under an OpEx model.

Private cloud:

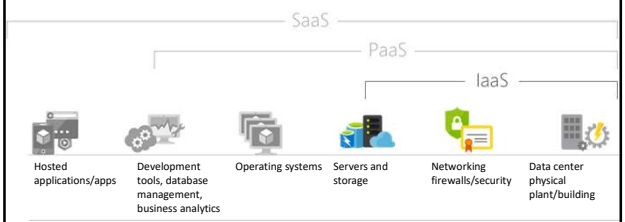
- **CapEx**. Organization owns all infrastructure components
- **Control**. Organizations have complete control over resources.
- **Security**. Organizations have complete control over security.

Hybrid cloud:

- **Flexibility**. The most flexible scenario. With a hybrid cloud setup, an organization can determine whether to run their applications in a private cloud or in a public cloud.
- **Compliance**. Organizations maintain the ability to comply with strict security, compliance, or legal requirements as needed.

Module 1:
Cloud Concepts
Lesson 3: Types of cloud services

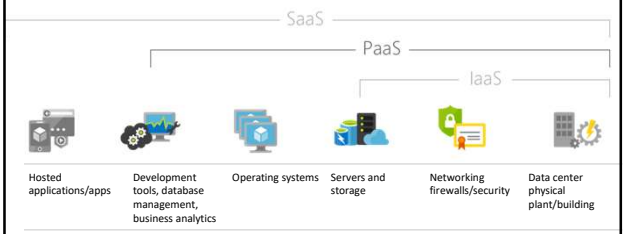
IaaS (Infrastructure-as-a-Service)



IaaS is the most basic category of cloud computing services. With IaaS, you rent IT infrastructure servers, and virtual machines (VMs), storage, networks, and operating systems from a cloud provider on a pay-as-you-go basis. It's an instant computing infrastructure, provisioned and managed over the internet.

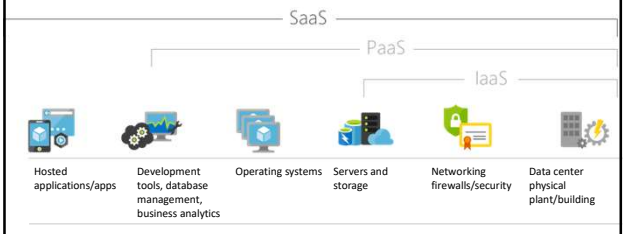
All services, compute virtual machines, storage

PaaS (Platform-as-a-Service)



PaaS provides an environment for building, testing, and deploying software applications. The goal of PaaS is to help create an application as quickly as possible without having to focus on managing the underlying infrastructure.

SaaS (Software-as-a-Service)



SaaS is software that is centrally hosted and managed for the end customer. It allows users to connect to and use cloud-based apps over the internet. Common examples are email, calendars, and office tools such as Microsoft Office 365.

Comparing cloud service types

IaaS: Flexibility. IaaS is the most flexible cloud service as you have control to configure and manage the hardware running your application.

PaaS: Productivity. Users can focus on application development only, as all platform management is handled by the cloud provider. Working with distributed teams as services is easier, as the platform is accessed over the internet and can be made globally available more easily.

SaaS: Pay-as-you-go pricing model. Users pay for the software they use on a subscription model, typically monthly or yearly, regardless of how much they use the software.

Module 2:
Core Azure Services

Core Azure Services: Learning Objectives

After completing these topics, you will be able to:

- ❑ Understand and describe core Azure architectural components
- ❑ Understand and describe core Azure services and products
- ❑ Understand and describe Azure solutions
- ❑ Understand and describe Azure management tools

Module 2:
Core Azure Services
Lesson 1: Core Azure architectural components

Azure Regions

Where in the world is Azure located?

- Azure is made up of ***datacenters*** located around the globe. These datacenters are organized and made available to end users by country/region
- Related to datacenters, a ***region*** is a geographical area on the planet containing at least one, but potentially multiple datacenters that are in close proximity and networked together with a low-latency network

Azure Regions

http://azure.microsoft.com/regions

Azure Regions

Types of Azure regions

Special Azure regions:

- Azure also has some special regions that you might want to use when building out your applications for compliance or legal purposes. Special regions are:
  - **Azure Government**
  - **Azure Germany**
  - **Azure China 21Vianet**

Region pairs:

- Each Azure region is paired with another region within the same geography (such as US, Europe, or Asia). This approach allows for the replication of resources (such as virtual machine (VM) storage) across a geography that helps reduce the likelihood of interruptions due to events such as natural disasters, power outages, or physical network outages affecting both regions at once.

Azure Region Pairs

Geographies

What are Azure geographies?

- A *geography* is a discrete market typically containing two or more regions that preserves data residency and compliance boundaries
- Geographies allow customers with specific data-residency and compliance needs to keep their data and applications close
- Geographies are broken up into Americas, Europe, Asia Pacific, Middle East, and Africa

Geographies- Americas

	United States	Azure Government	Canada	Brazil
Regions	Central US, East US 2, East US, North Central US, South Central US, West US 2, West Central US, West US	US DoD Central, US DoD East, US Gov Arizona, US Gov Iowa, US Gov Texas, US Gov Virginia, US Sec East[1], US Sec West[1]	Canada Central, Canada East	Brazil South
Data residency / Sovereignty[2]	Data stored at rest in US	Data stored at rest in US. A sovereign offering - physically isolated instance of Microsoft Azure.	Stored at rest in Canada	Data replication to US
Compliance[3]	International, regional, and industry-specific	Continuous commitment to the highest breadth and depth of US government-specific or US DoD-specific compliance standards	International, regional, and industry-specific	International, regional, and industry-specific
Available to	All	US government entities and their partners only	All	All

Geographies- Europe

	France	United Kingdom	Germany	Switzerland	Norway	
Regions	North Europe, West Europe, Germany North[1], Germany West Central[1]	France Central, France South	UK South, UK West	Germany Central, Germany Northeast	Switzerland North[1], Switzerland West[1]	Norway West[1], Norway East[1]
Data residency / Sovereignty[2]	Stored at rest in Europe	Stored at rest in France	Stored at rest in UK	A sovereign offering – a physically and logically separate instance of Azure services with dedicated network between Germany datacenters	Stored at rest in Switzerland	Stored at rest in Norway
Compliance[3]	International, regional, and industry-specific	International, regional, and industry-specific	International, regional, and industry-specific	Designed to meet the strictest EU data protection, under control of German Data Trustee	Coming soon	Coming soon
Available to	All	France Central: All France South: Reserved for France Central customers requiring in-country disaster recovery	All	Customers and partners in EU/European Free Trade Association (EFTA) only	All	Coming soon

Geographies- Asia Pacific

	Asia Pacific	Australia	China	India	Japan	Korea
Regions	East Asia, Southeast Asia	Australia Central, Australia Central 2, Australia East, Australia Southeast	China East, China North, China East 2, China North 2	Central India, South India, West India	Japan East, Japan West	Korea Central, Korea South
Data residency / Sovereignty	Stored at rest in Asia Pacific region	Stored at rest in Australia	A sovereign offering – independent, dedicated network within China	Stored at rest in India	Stored at rest in Japan	Stored at rest in Korea
Compliance	International, regional, and industry-specific	Local and industry-specific	China-specific	Local and industry-specific	Local and industry-specific	Coming soon
Available to	All	All Australia Central and Central 2 are designed for Australian and New Zealand government organizations and partners	Organizations with a business presence in China	All	All	All

Geographies- Middle East and Africa

	Africa	United Arab Emirates
Regions	South Africa North, South Africa West	UAE Central, UAE North
Data residency / Sovereignty	Stored at rest in South Africa	Stored at rest in UAE
Compliance	International, regional, and industry-specific	International, regional, and industry-specific
Available to	South Africa North: All South Africa West: Reserved for South Africa North customers requiring in-country disaster recovery	UAE North: All UAE Central: Reserved for UAE North customers requiring in-country disaster recovery

Azure Product Availability

What products are available in my region?

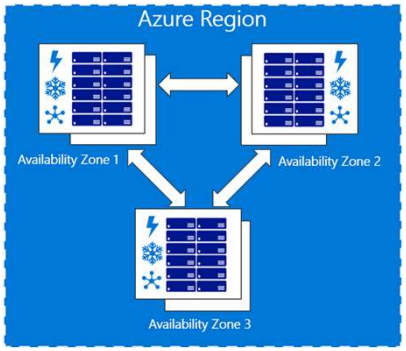
- Not all Azure services are available in all regions
- For the most current availability to go:
https://azure.microsoft.com/global-infrastructure/services/?products=all

Availability Zones

What are availability zones?

- *Availability zones* are physically separate locations within an Azure region.
- Each availability zone is made up of one or more datacenters equipped with independent power, cooling, and networking.
- Availability Zones are set up to be an isolation boundary.
- If one availability zone goes down, the other continues working.

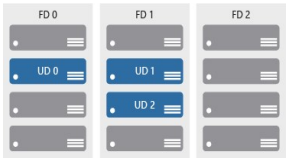
Availability Zones



Availability Sets

What are availability sets?

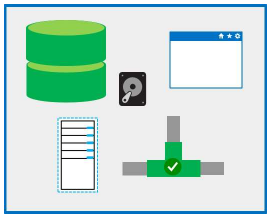
- Availability sets are a way to help ensure applications remain online if a high-impact maintenance event is required, or a hardware failure occurs
- Availability sets are made up of update domains and fault domains:
  - Update domains. When a maintenance event occurs (such as a performance update or critical security patch applied), the update is sequenced through update domains.
  - Fault domains. Fault domains provide for the physical separation of a workload across different hardware in the Datacenter.



Resource Groups

What are resource groups?

- A *resource group* is a unit of management for resources in Azure.
- Think of a resource group as a container that allows you to aggregate and manage all the resources required for an application in a single manageable unit
  - Metering and billing
  - Policies
  - Monitoring and alerts
  - Quotas
  - Access control



Azure Resource Manager

What is Azure Resource Manager?

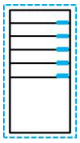
- Azure Resource Manager is a management layer in which resource groups and all the resources within it are created, configured, managed, and deleted
- With Azure Resource Manager, you can:
- Deploy application resources
- Organize resources
- Control access and resources

Module 2:
Core Azure Services
Lesson 2: Core Azure services and products

Azure Compute Services

Azure compute is an on-demand computing service for running cloud-based applications. It provides computing resources such as disks, processors, memory, networking and operating systems.

- Resources are available on-demand and can typically be made available in minutes or even seconds. You pay only for the resources you use and only for as long as you're using them



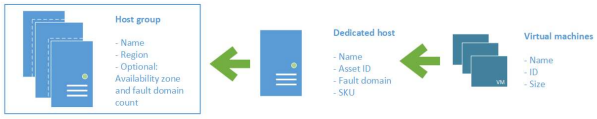
Azure compute services - virtual machine services

VMs are software emulations of physical computers. Examples of Azure services for virtual machines include:

- Azure VMs. Infrastructure as a service (IaaS) to create and use VMs in the cloud
- VM Scale sets are a group of identically configured VMs
- App services. platform as a service (PaaS) offering to build, deploy, and scale enterprise-grade web, mobile, and API apps
- Functions. Creates infrastructure based on an event

Azure Dedicated Hosts

Azure Dedicated Host is a service that provides physical servers - able to host one or more virtual machines - dedicated to one Azure subscription. Dedicated hosts are the same physical servers used in Microsoft's data centers. You can provision dedicated hosts within a region, availability zone, and fault domain. Then, you can place VMs directly into your provisioned hosts, in whatever configuration best meets your needs.



Azure compute services - container services

Containers are a virtualization environment. However, unlike virtual machines, they do not include an operating system. Containers are meant to be lightweight, and are designed to be created, scaled out, and stopped dynamically. Examples of Azure services for containers include:

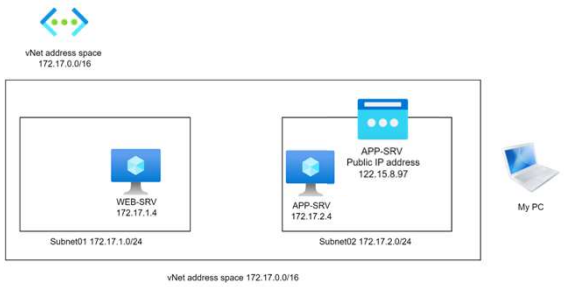
- Azure Container Instances. A PaaS offering that allows you to upload your containers, which it then will run for you
- Azure Kubernetes Service. A container orchestrator service for managing large numbers of containers

Azure network services

Networking on Azure allows you to connect cloud and on-premises infrastructure and services.

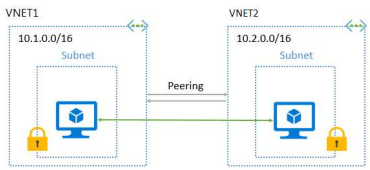
- Azure Virtual Network. An IaaS service to create and use VMs in the cloud
- Azure Load Balancer. Designed for automatic scaling of identical VMs
- VPN Gateway. A PaaS offering to build, deploy, and scale enterprise-grade web, mobile, and API apps
- Azure Application Gateway. Manage web traffic to applications
- Content Delivery Network. Delivers web content to users

vNet Example

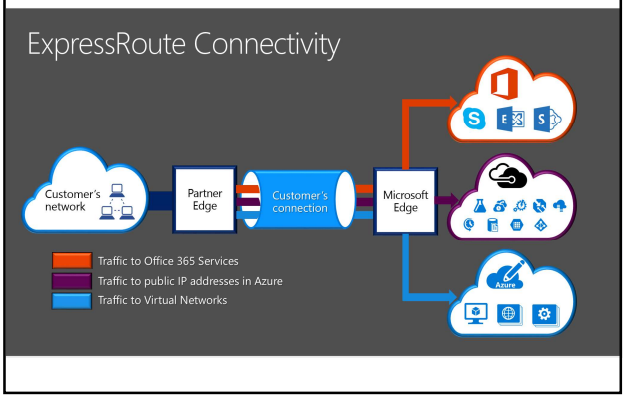


Azure network services

- VNet Peering



Azure network services

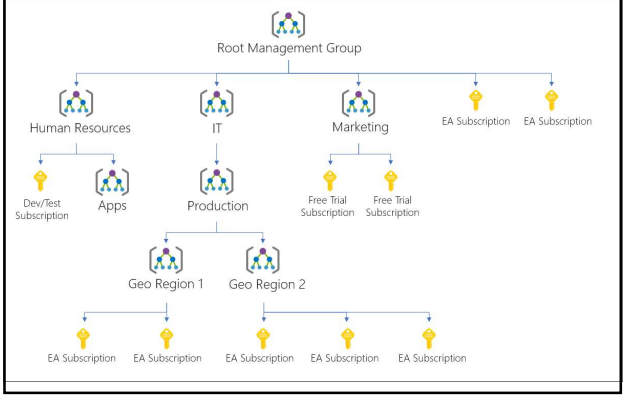


Management Groups

Important facts about management groups

- ❑ 10,000 management groups can be supported in a single directory.
- ❑ A management group tree can support up to six levels of depth.
- ❑ This limit doesn't include the Root level or the subscription level.
- ❑ Each management group and subscription can only support one parent.
- ❑ Each management group can have many children.
- ❑ All subscriptions and management groups are within a single hierarchy in each directory.

Management Groups



Azure Tagging

You apply **tags** to your **Azure** resources, resource groups, and subscriptions to logically organize them.

Each **tag** consists of a name and a value pair. For example, you can apply the name "Environment" and the value "Production" to all the resources in production

Azure Storage Services- Data Categories

Structured data

- Data that adheres to a schema, so all of the data has the same fields or properties. Structured data can be stored in a database table with rows and columns. Financial data is an example.

Semi-structured data

- Data is less organized than structured data, and is not stored in a relational format, meaning the fields do not neatly fit into tables, rows, and columns. Referred to as *non-relational* or *NoSQL* data

Unstructured data

- Data that has no designated structure to it. This also means that there are no restrictions on the kinds of data it can contain. For example, a ***blob*** can hold a PDF document, a JPG image, a JSON file, or video content

Azure Storage Services- Azure Services

Azure Storage is a service that you can use to store files, messages, tables, and other types of information.

Blob storage. No restrictions on the kinds of data it can hold. Blobs are highly scalable

Disk storage. Provides disks for virtual machines, applications, and other services

File storage. Azure Files offers fully-managed file shares in the cloud

Archive storage. Storage facility for data that is rarely accessed

Azure Database Services

Azure database services are fully-managed PaaS database services that free up valuable time you'd otherwise spend managing your database

Azure Cosmos DB. A globally-distributed database service that enables you to elastically and independently scale throughput and storage

Azure SQL Database. A relational database as a service (DaaS) based on the latest stable version of the Microsoft SQL Server database engine

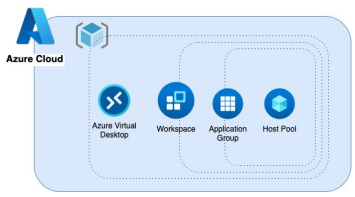
Azure Database Migration. A fully-managed service designed to enable seamless migrations from multiple database sources to Azure data platforms with minimal downtime

Azure Marketplace

- Azure Marketplace is a service on Azure that helps connect end users with Microsoft partners, independent software vendors (ISVs), and start-ups that are offering their solutions and services, which are optimized to run on Azure
- Azure Marketplace allows customers—mostly IT professionals and cloud developers—to find, try, purchase, and provision applications and services from hundreds of leading service providers, all certified to run on Azure. At the time of writing, this includes over 8,000 listings

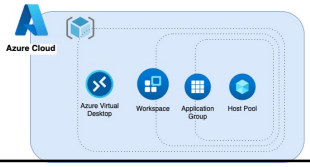
Azure Virtual Desktop

Azure Virtual Desktop (AVD), previously known as Windows Virtual Desktop (WVD), is a cloud-based service from Microsoft that allows you to deliver virtual desktops and applications to users anywhere with an internet connection. It utilizes Microsoft Azure's cloud infrastructure to provide a scalable and secure platform for remote desktop services.



Azure Virtual Desktop

- **Host Pool:** A host pool is a collection of virtual machines (VMs) in Azure that are configured to function as session hosts for remote desktop services. These VMs all use the same base image to ensure a consistent user experience.
- An **Application Group** in AVD is a logical grouping of applications (RemoteApp) or a desktop that you publish for users to access remotely. These applications or desktops reside on the VMs within the host pool.
- **Workspace:** A workspace is a logical grouping of application groups within Azure Virtual Desktop. Users assigned to a workspace can access the remote desktop applications and desktops published from the application groups associated with that workspace.



Azure Virtual Desktop

- Here's a breakdown of the key features and functionalities of Azure Virtual Desktop:
- **Desktop and Application Delivery:** AVD enables you to deploy virtual desktops and applications that users can access remotely using various devices like laptops, tablets, and even thin clients. This provides a familiar Windows desktop experience or access to specific applications, regardless of the user's physical location or device.
- **Scalability:** AVD offers a significant advantage in scalability. You can easily scale your virtual desktop infrastructure up or down based on your user needs. This eliminates the need to manage physical desktops and allows you to provision resources dynamically.

Azure Virtual Desktop

- **Cost Optimization:** By leveraging Azure's cloud infrastructure, you can potentially optimize costs compared to traditional on-premises desktop deployments. You only pay for the resources you use, eliminating the upfront costs of physical hardware and ongoing maintenance expenses.
- **Security:** AVD benefits from Azure's robust security features. You can leverage multi-factor authentication, manage user access controls, and implement security best practices to protect your virtual desktops and applications from unauthorized access.

Azure Virtual Desktop

- **Centralized Management:** AVD provides a centralized platform for managing your virtual desktops and applications. You can manage user assignments, application deployments, and desktop configurations from a single console, simplifying administration and reducing complexity.

Azure Virtual Desktop

- **Multiple User Sessions:** AVD supports two main desktop session types:
  - **Single-session:** This assigns a dedicated virtual machine to a single user, offering a personal desktop experience with guaranteed resources.
  - **Multi-session:** This allows multiple users to share a pool of virtual machines, making it a more cost-effective option for less resource-intensive tasks.

Azure Virtual Desktop

- **Platform Agnostic:** Users can access their virtual desktops and applications from various devices running Windows, macOS, Android, iOS, and even through HTML5 web browsers. This provides flexibility and allows users to work from any location with a suitable internet connection.

Azure Virtual Desktop

Azure Virtual Desktop offers a compelling solution for organizations looking to:

- Enable secure remote work access for their employees.
- Deliver applications and desktops to users on various devices.
- Benefit from cloud-based scalability and cost optimization.
- Leverage a centralized management platform for their virtual desktop infrastructure.

Module 2:
Core Azure Services
Lesson 3: Azure solutions

Internet of Things

The internet allows any item that's online-capable to access valuable information. This ability for devices to garner and then relay information for data analysis is referred to as the *Internet of Things* (IoT)

Microsoft IoT Central. A fully-managed global IoT software as a service (SaaS) solution that makes it easy to connect, monitor, and manage your IoT assets at scale

Azure IoT Hub. A managed service hosted in the cloud that acts as a central message hub for bidirectional communication between your IoT application and the devices it manages

Big data and analytics

Big data refers to large volumes of data that become increasingly hard to make sense of, or consequently make decisions about. Some big data and analytic services in Azure include:

Azure SQL Data Warehouse: A cloud-based Enterprise Data Warehouse that leverages massively parallel processing (mpp) to run complex queries quickly across petabytes of data

Azure HDInsight: A fully-managed, open-source analytics service for enterprises. It is a cloud service that makes it easier, faster, and more cost-effective to process massive amounts of data

Azure Data Lake Analytics: An on-demand analytics job service that simplifies big data. Instead of deploying, configuring, and tuning hardware, you write queries to transform your data and extract valuable insights.

Azure Synapse Analytics

Data Ingestion
Data Warehousing
Big Data Analytics

Artificial Intelligence

Artificial Intelligence (AI), in the context of cloud computing, is based around a broad range of services, the core of which is machine learning. Machine learning is a data science technique that allows computers to use existing data to forecast future behaviors, outcomes, and trends. Using machine learning, computers learn without being explicitly programmed. Some AI services in Azure include:

Azure Machine Learning service. Provides a cloud-based environment used to develop, train, test, deploy, manage, and track machine learning models

Azure Machine Learning Studio. A collaborative, drag-and-drop visual workspace where you can build, test, and deploy machine learning solutions without needing to write code

Serverless computing

Serverless computing is a cloud-hosted execution environment that runs your code but abstracts the underlying hosting environment. Some serverless services in Azure include:

Azure Functions. Concerned with the code running your service and not the underlying platform or infrastructure. Creates infrastructure based on an event.

Azure Logic Apps. A cloud service that helps you automate and orchestrate tasks, business processes, and workflows when you need to integrate apps, data, systems, and services across enterprises or organizations.

Azure Event Grid. A fully-managed, intelligent event routing service that uses a publish-subscribe model for uniform event consumption.

DevOps

DevOps allows you to create, build, and release applications. It brings together people, processes, and technology

Azure DevOps Services: provides development collaboration tools and cloud-based load testing

Azure DevTest Labs: Allows you to quickly create environments in Azure while minimizing waste and controlling cost

Module 2:
Core Azure Services
Lesson 4: Azure Management solutions

Azure management tools

You can configure and manage Azure using a broad range of tools and platforms. Some of these tools are:

- Azure Portal. A website accessed via a web browser at: https://portal.azure.com or https://portal.azure.com/app/download
- Azure PowerShell. A command shell scripting language available for Windows, MacOS and Linux
- Azure Command-Line Interface (Azure CLI). A cross-platform command-line scripting program for Windows, Linux, or MacOS operating systems: https://aka.ms/InstallAzureCLIwindows
- Azure Cloud Shell. A browser-based scripting environment in your portal.

Azure Advisor

Azure Advisor is a free service built into Azure that provides recommendations on high availability, security, performance, and cost. Advisor analyzes your deployed services and looks for ways to improve your environment across those four areas

- With Azure Advisor, you can:
- Get proactive, actionable, and personalized best practices recommendations
- Improve the performance, security, and high availability of your resources as you identify opportunities to reduce your overall Azure costs
- Get recommendations with proposed actions

Module 3:
Security, Privacy, Compliance and Trust

Security, Privacy, Compliance and Trust : Learning Objectives

After completing these topics, you will be able to:

- ❑ Understand how to secure network connectivity in Microsoft Azure
- ❑ Understand core Azure identity services
- ❑ Understand security tools and features
- ❑ Understand Azure governance methodologies
- ❑ Understand and describe monitoring and reporting in Azure
- ❑ Understand privacy, compliance, and data protection standards in Azure

Module 3:
Security, Privacy, Compliance and Trust
Lesson 1: Securing network connectivity in Azure

Azure Firewall

- ❑ A *firewall* is a service that grants server access based on the originating IP address of each request
- ❑ *Azure Firewall* is a managed, cloud-based network security service that protects your Azure Virtual Network resources. It is a fully stateful firewall as a service with built-in high availability and unrestricted cloud scalability
- ❑ Azure Firewall includes many features, including:
  - ❑Built-in high availability
  - ❑Unrestricted cloud scalability
  - ❑Inbound and outbound filtering rules
  - ❑Azure Monitor logging

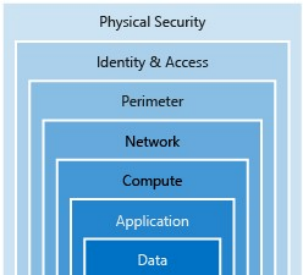
Azure DDoS Protection

- **Distributed denial of service (DDoS)** *attacks* attempt to overwhelm and exhaust an application's resources, making the application slow or unresponsive to legitimate users
- Azure DDoS Protection service protects your Azure applications by scrubbing traffic at the Azure network edge before it can impact your service's availability
- Azure DDoS Protection provides the following service tiers:
  - **Basic**. The Basic service tier is automatically enabled as part of the Azure platform.
  - **Standard**. The Standard service tier provides additional mitigation capabilities that are tuned specifically to Microsoft Azure Virtual Network resources.

Network Security Groups

- *Network Security Groups* (NSGs) allow you to filter network traffic to and from Azure resources in an Azure virtual network. An NSG can contain multiple inbound and outbound security rules that enable you to filter traffic to and from resources by source and destination IP address, port, and protocol
- Network security rule properties:
  - A network security group can contain as many rules as you want within Azure subscription limits.
  - When you create a network security group, Azure creates a series of default rules to provide a baseline level of security. You cannot remove the default rules, but you can override them by creating new rules with higher priorities.

Azure Network Security Solutions



Azure Network Security Layers

- Perimeter layer. The network perimeter layer is about protecting organizations from network-based attacks against your resources. Some options are to use Azure DDoS Protection and Azure Firewall
- Networking layer. At this layer, the focus is on limiting network connectivity across all your resources and only allowing what is required. Some options are set to deny by default, restrict inbound internet access, and limit outbound

Module 3: Security, Privacy, Compliance and Trust
Lesson 2: Core Azure identity services

Authentication and authorization

Two fundamental concepts that should be understood when talking about identity and access are authentication and authorization:

- ***Authentication*** is the process of establishing the identity of a person or service looking to access a resource. Requires credentials. It establishes if they are who they say they are
- ***Authorization*** is the process of establishing what level of access an authenticated person has. It specifies what data they're allowed to access and what they can do with it.

Azure Active Directory

- **Azure Active Directory (Azure AD)** is a Microsoft cloud-based identity and access management service. Azure AD helps employees of an organization sign in and access resources
- Azure AD provides services such as:
  - Authentication
  - Single sign-on (SSO)
  - Application management

Azure Multi-Factor Authentication

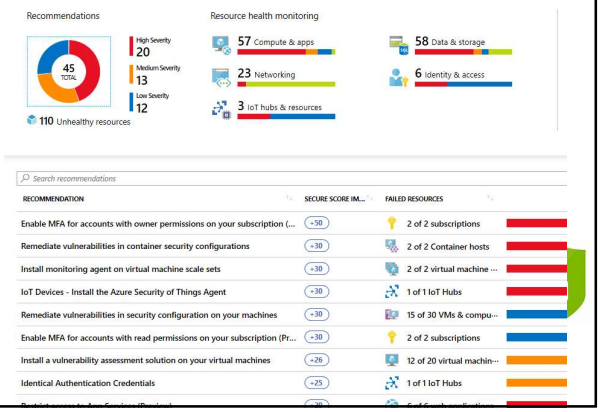
- **Azure Multi-Factor Authentication (MFA)** provides additional security for your identities by requiring two or more elements for full authentication. These elements fall into three categories:
- **Something you know:** This could be a password or the answer to a security question
- **Something you possess**: This might be a mobile app that receives a notification, or a token-generating device
- **Something you are:** This is typically some sort of biometric property, such as a fingerprint or face scan used on many mobile devices.

Module 3:
Security, Privacy, Compliance and Trust
Lesson 3: Security tools and features

Azure Security Center

- **Azure Security Center** is a monitoring service that provides threat protection across all of your services both in Azure, and on-premises.
- Azure Security Center can:
  - Provide security recommendations based on your configurations, resources, and networks.
  - Monitor security settings across on-premises and cloud workloads, and automatically apply required security to new services as they come online.

Azure Security Center- Secure Score



Azure Key Vault

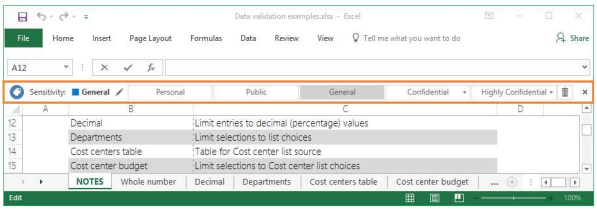
- **Azure Key Vault** is a centralized cloud service that you use for storing application secrets. Key Vault helps you control your applications' secrets by keeping them in a single, central location and providing secure access, permissions control, and access logging.

- Key Vault usage scenarios:
  - Secrets management
  - Key management
  - Certificate management
  - Store secrets backed by hardware security modules (HSMs)

Azure Information Protection

- **Microsoft Azure Information Protection** is a cloud-based solution that helps organizations classify and help protect its documents and emails by applying labels. Labels can be applied:
  - Automatically by administrators who define rules and conditions
  - Manually by users
  - A combination of the two, where users are given recommendations
- Usage scenario:
  - A user saves a Microsoft Word document containing a Social Security Number.
  - A custom tooltip displays recommending that the file be labelled *Confidential\All Employees*, which is the label that the administrator has configured.
  - This label classifies the document and protects it.

Azure Information Protection



Azure Advanced Threat Protection

- *Azure Advanced Threat Protection* (Azure ATP) is a cloud-based security solution that identifies, detects, and helps you investigate advanced threats, compromised identities, and malicious insider actions directed at your organization

- Azure ATP consists of the following components:
  - Azure ATP portal. Azure ATP has it's own portal through which you monitor and respond to suspicious activity
  - Azure ATP sensor: Azure ATP sensors are installed directly on your domain controllers.
  - Azure ATP cloud service. Azure ATP cloud service runs on Azure infrastructure.

Module 3:
Security, Privacy, Compliance and Trust
Lesson 4: Azure governance methodologies

Azure Policy

- Azure Policy is a service in Azure that you use to create, assign, and, manage policies that enforce different rules and effects over your resources, so those resources stay compliant with your corporate standards and service-level agreements (SLAs).
- With Azure Policy, provides the following:
  - Azure Policy uses policies and initiatives to run evaluations of your resources and scans for those not compliant with the policies you have created.
  - Azure Policy comes with a number of built-in policy and initiative definitions that you can use, under categories such as Storage, Networking , Compute, Security Center, and Monitoring.

Role-based access control

- Role-based access control (RBAC) provides fine-grained access management for Azure resources:
  - Grant users only the rights they need to perform their jobs
  - Provided at no additional cost to all Azure subscribers

Examples of when you might use RBAC include when you want to:

- Allow one user to manage VMs in a subscription, and another user to manage virtual networks, and another user manage storage.
- Allow a database administrator (group to manage Microsoft SQL Server databases in a subscription.
- Allow a user to manage all resources in a resource group, such as VMs, websites, and subnets.

Locks

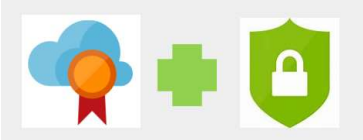
Locks help you prevent accidental deletion or modification of your Azure resources. You manage these locks from within the Azure portal.

You may need to lock a subscription, resource group, or resource to prevent other users in your organization from accidentally deleting or modifying critical resources. You can set the lock level to:

- CanNotDelete. Authorized users can still read and modify a resource, but they can't delete the resource.
- ReadOnly. Authorized users can read a resource, but they can't delete or update the resource. Applying this lock is similar to restricting all authorized users to the permissions granted by the Reader role.

Azure Advisor security assistance

- Azure Advisor provides security recommendation by integrating with Azure Security Center
- View the security recommendations on the Security tab of the Advisor dashboard
- Click deeper into the Security Center recommendations to improve and enhance your security governance



Azure Blueprints

- Azure Blueprints enable cloud architects to define a repeatable set of Azure resources that implement and adhere to an organization's standards, patterns, and requirements.
- Usage Scenarios:
  - Use Azure Blueprints' artifacts and tools to help with auditing, traceability, and compliance with your deployments
  - Use with Azure DevOps scenarios, where blueprints are associated with specific build artifacts and release pipelines, and require more rigorous tracking.

Module 3:
Security, Privacy, Compliance and Trust
Lesson 5: Monitoring and reporting in Azure

Azure Monitor

Azure Monitor increases availability and performance of applications by collecting information from cloud and on-premises environments

As soon as you create an Azure subscription and start adding resources, Azure Monitor starts collecting data:

- Activity Logs. Record when resources are created or modified.
- Metrics tell. Show how the resource is performing and the resources that it's consuming

Azure Service health

Azure Service Health is a suite of experiences that provide guidance and support when issues with Azure services occur, providing notifications to help you understand the impact of issues, and provide updates as the issue is being resolved.

- Azure Service Health is composed of:
  - Azure Status. Provides a global view of the health state of Azure services
  - Service Health. A dashboard that tracks the state of Azure services in the regions where you use them
  - Azure Resource Health: Diagnose and obtain support when an Azure service issue affects your resources.

Module 3:
Security, Privacy, Compliance and Trust
Lesson 6: Privacy, compliance and data protection standards in Azure

Compliance Terms and Requirements

Microsoft provides the most comprehensive set of compliance offerings (including certifications and attestations) of any cloud service provider. Some compliance offering include:

CJIS (Criminal Justice Information Services)	**HIPAA** (Health Insurance Portability and Accountability Act)
CSA STAR Certification	**ISO/IEC 27018**
General Data Protection Regulation (GDPR)	**National Institute of Standards and Technology (NIST)**

You can view all the Microsoft compliance offerings at
https://www.microsoft.com/trustcenter/compliance/complianceofferings

Microsoft privacy statement

- ❑ Explains what personal data Microsoft processes, how Microsoft processes it, and for what purposes.
- ❑ Applies to the interactions Microsoft has with users and Microsoft products such as Microsoft services, websites, apps, software, servers, and devices.
- ❑ Is intended to provide openness and honesty about how Microsoft deals with personal data in its products and services.

For more information, review the privacy statement at:
https://privacy.microsoft.com/privacystatement

Trust Center

- Trust Center is a website resource containing information and details about how Microsoft implements and supports security, privacy, compliance, and transparency in all our cloud products and services

- The Trust Center site provides:
  - In-depth information about security, privacy, compliance offerings, policies, features, and practices across Microsoft cloud products.
  - Recommended resources in the form of a curated list of the most applicable and widely-used resources for each topic.
  - Information specific to key organizational roles, including business managers, tenant admins or data security teams, risk assessment and privacy officers, and legal compliance teams.

  https://www.microsoft.com/trust-center/product-overview

Service Trust Portal

The Service Trust Portal (STP) is the Microsoft public site for publishing audit reports and other compliance-related information related to Microsoft's cloud services.

It also hosts the Compliance Manager service.

- STP is a companion feature to the **Trust Center**, and allows you to:
  - Access audit reports across Microsoft cloud services on a single page.
  - Access compliance guides to help you understand how can you use Microsoft cloud service features to manage compliance with various regulations.
  - Access trust documents to help you understand how Microsoft cloud services help protect your data.

  https://servicetrust.microsoft.com/

Compliance Manager

- Compliance Manager is a workflow-based risk assessment in the Trust Portal that enables you to track, assign, and verify your organization's regulatory compliance activities

- It provide details related to Microsoft professional services and Microsoft cloud services such as Microsoft Office 365, Microsoft Dynamics 365, and Azure.

Azure

- Azure Government services
- Azure Germany services
- Azure China 21Vianet

Module 4:
Azure Pricing and Support

Azure Pricing and Support: Learning Objectives

After completing these topics, you will be able to:

- Understand and describe Microsoft Azure subscriptions and management groups
- Recognize ways to plan and manage Azure costs
- Identify Azure support options
- Understand and describe features of Azure service-level agreements (SLAs)
- Understand and describe the service lifecycle in Azure

Module 4:
Azure Pricing and Support
Lesson 1: Azure Subscriptions

Azure subscriptions

- An Azure subscription provides you with authenticated and authorized access to Azure products and services, and allows you to provision resources on Azure. It is a logical unit of Azure services that links to an Azure account.

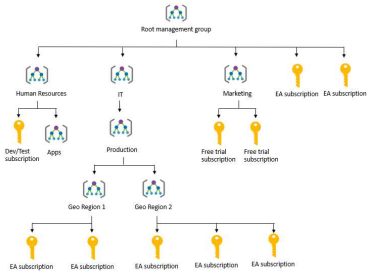
- Azure offers free and paid subscription options to suit different needs and requirements. An account can have one subscription or multiple subscriptions that have different billing models, and to which you apply different access-management policies.

Subscription uses and options

- You can use Azure subscriptions to define boundaries around Azure products, services, and resources
- Two types of subscription boundaries that you can use:
  - Billing boundary. This subscription type determines how an Azure account is billed for using Azure. You can create multiple subscriptions for different types of billing requirements
  - Access control boundary. Azure will apply access management policies at the subscription level, and you can create separate subscriptions to reflect different organizational structures
- Several other subscription types to choose from include the Free account, and Pay-As-You-Go

Management groups

- Azure Management groups are containers for managing access, policies, and compliance across multiple Azure subscriptions
- Management groups allow you to order your Azure resources hierarchically into collections, which provide a further level of classification beyond subscriptions.



Module 4:
Azure Pricing and Support
Lesson 2: Planning and managing costs

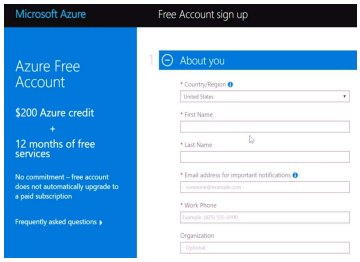
Purchasing Azure products and services

Three main customer types on which the available purchasing options for Azure products and services are contingent are:

- Enterprise. Enterprise customers sign an Enterprise Agreement with Azure that commits them to spending a negotiated amount on Azure services, which they typically pay annually.
- Web direct. Web direct customers sign up for Azure through the Azure website: https://azure.microsoft.com
- Cloud solution providers (CSPs) typically are Microsoft partner companies that a customer hires to build solutions on top of Azure. Payment and billing for Azure usage occurs through the customer's CSP.

Azure free account

- An Azure free account provides subscribers with a $200 Azure credit that they can use for paid Azure products during a 30-day trial period.
- Once you use that $200 credit or reach your trial's end, Azure suspends your account unless you sign up for a paid account.



Factors affecting costs

Three factors affect costs:

- Resource Type: Costs are resource-specific, so the usage that a meter tracks and the number of meters associated with a resource depend on the resource type
- Services: Azure usage rates and billing periods can differ between Enterprise, Web Direct, and CSP customers
- Location: The Azure infrastructure is globally distributed, and usage costs might vary between locations that offer particular Azure products, services, and resources.

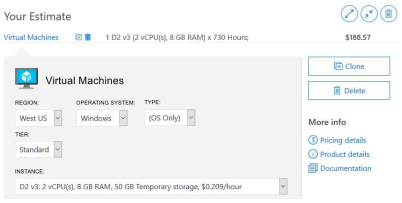
Zones for Billing Purposes

Bandwidth refers to data moving in and out of Azure datacenters. Some inbound data transfers are free, such as data going into Azure datacenters. For outbound data transfers—such as data going out of Azure datacenters—pricing is based on Zones.

- A zone is a geographical grouping of Azure Regions for billing purposes. Zones are:
  - Zone 1. Includes West US, East US, West Europe, and others.
  - Zone 2 . Includes Australia Central, Japan West, Central India, and others.
  - Zone 3. Includes Brazil South only.
  - DE Zone 1. Includes Germany Central and Germany Northeast.

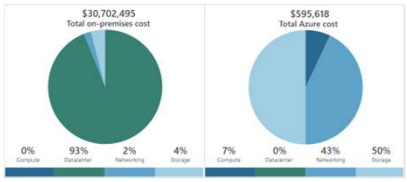
Pricing calculator

- Azure provides a detailed estimate of the costs associated with your selections and configurations



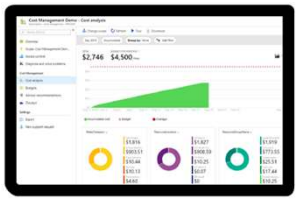
Total cost of ownership (TCO) calculator

- A tool that you use to estimate cost savings you can realize by migrating to Azure
- A report compares the costs of on-premises infrastructures with the costs of using Azure products and services to host infrastructure in the cloud



Azure Cost Management

Azure Cost Management is an Azure product that provides a set of tools for monitoring, allocating, and optimizing Azure costs



- Reporting. Generate reports
- Budgets. Monitor resource demand trends, consumption rates, and cost patterns
- Alerting. Get alerts based on your cost and usage budgets
- Recommendations. Receive recommendations to eliminate idle resources and to optimize provisioned Azure resources

Module 4:
Azure Pricing and Support
Lesson 3: Support options available with Azure

Support plan options

Every Azure subscription includes:

- Free access to billing and subscription support
- Azure products and services documentation
- Online self-help documentation
- Community support forums

- Paid Azure support plans:
  - **Developer**. For Azure use in trial and nonproduction environments
  - **Standard**. Appropriate for Azure use in production environments
  - **Professional Direct**. Appropriate for organizations with business-critical dependence on Azure
  - **Premier**. Ideal for organizations with substantial dependence on Microsoft products, including Azure.

Opening a support ticket

- Request assistance for an Azure issue from the Azure support team
- To open a support ticket:
  - Sign in to the Azure portal.
  - Choose **Help + support** from the left navigation menu.
  - From the **Help + Support** blade, select **New support request**, fill in the required details, and then click **Create** to submit the support request.
- You can also Monitor a support request in the **Help + support** blade

Alternative support channels

Other support channels available outside of the Azure official support plans:

- Azure community support: https://azure.microsoft.com/support/community/
- stack overflow: https://stackoverflow.com/questions/tagged/azure/
- Azure Feedback Forums at Microsoft Azure general feedback: https://feedback.azure.com/forums/34192--general-feedback
- Twitter. Tweet @AzureSupport to get answers and support

Knowledge Center

- Azure Knowledge Center is a searchable database that contains support questions and answers from a community of Azure experts, developers, customers, and users
- Browse through all answers within the Azure Knowledge Center by entering keyword search terms into the text-entry field and further refine your search results by selecting products or tags from the dropdown lists
- See Azure Knowledge Center for more information: https://azure.microsoft.com/resources/knowledge-center/

Module 4:
Azure Pricing and Support
Lesson 4: Azure SLAs

Service Level Agreements (SLAs)

SLAs document the specific terms that define Azure performance standards

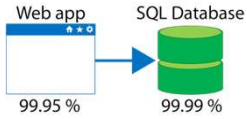
- SLAs define Microsoft's commitment to an Azure service or product
- Individual SLAs are available for each Azure product and service
- SLAs also define what happens if a service or product fails to meet the designated availability commitments

- For more information about specific Azure SLAs for individual products and services, see Service Level Agreements: https://azure.microsoft.com/support/legal/sla/summary/

Composite SLAs

- At the time of this writing, an App Service web app that writes to Azure SQL Database has the following SLAs:
  - App Service Web Apps is 99.95 percent
  - SQL Database is 99.99 percent

- Question: What is the maximum downtime you would expect for this application?
- Answer: The composite SLA for this application is 99.95% × 99.99% = 99.94%.
- This is lower than the individual SLAs. However, you can construct SLAs to improve overall application SLA.



SLA Downtime

The following table lists the potential cumulative downtime for various SLA levels over different durations

SLA	Downtime per week	Downtime per month	Downtime per year
99%	1.68 hours	7.2 hours	3.65 days
99.9%	10.1 minutes	43.2 minutes	8.76 hours
99.95%	5 minutes	21.6 minutes	4.38 hours
99.99%	1.01 minutes	4.32 minutes	52.56 minutes
99.999%	6 seconds	25.9 seconds	5.26 minutes

Module 4:
Azure Pricing and Support
Lesson 5: Service lifecycle in Azure

General, Public and private preview features

- Microsoft offer previews of Azure features for evaluation purposes
- With Azure previews, you can test beta and other pre-release features, products, services, software, and regions
- General availability is no longer in preview and is available to all Azure customers
- Two types of Azure preview modes:
  - Private Preview. An Azure feature is available to certain Azure customers for evaluation purposes
  - Public Preview. An Azure feature is available to all Azure customers for evaluation purposes

How to access preview features

- Review a list of preview features that are available for evaluation at Azure Preview Features
  https://azure.microsoft.com/updates/?status=inpreview

Portal Preview features:

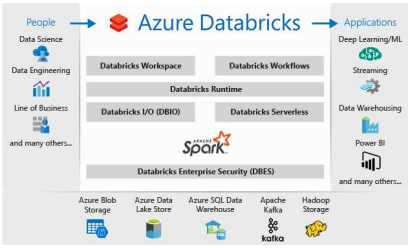
- Typical portal preview features provide performance, navigation, and accessibility improvements to the Azure portal interface

Monitoring feature updates

- Information about the latest updates to Azure products, services, and features, and product roadmaps, and announcements are available at Azure updates: https://azure.microsoft.com/updates/
- Azure updates page:
  - View details about all Azure updates
  - See which updates are in general availability, preview, or development
  - Subscribe to Azure update notifications

Azure Databricks

Azure Databricks, an Apache Spark-based analytics platform with one-click setup, streamlined workflows, and an interactive workspace for collaboration between data scientists, engineers, and business analysts.



Azure Databricks

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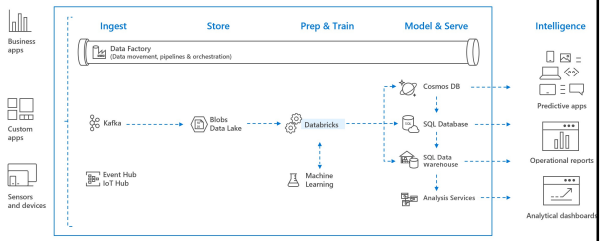
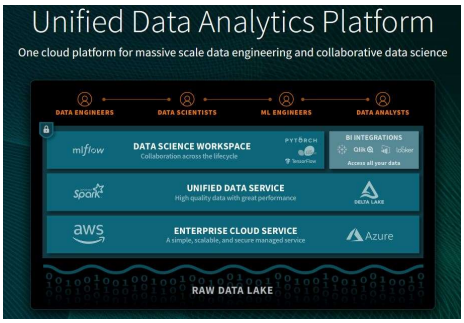


Azure Databricks



Azure CLI and PowerShell

Azure CLI

- ❑ Download and Install the AzureCLI.MSI file to your local computer

PowerShell:

- ❑Install the Azure PowerShell module on your local computer