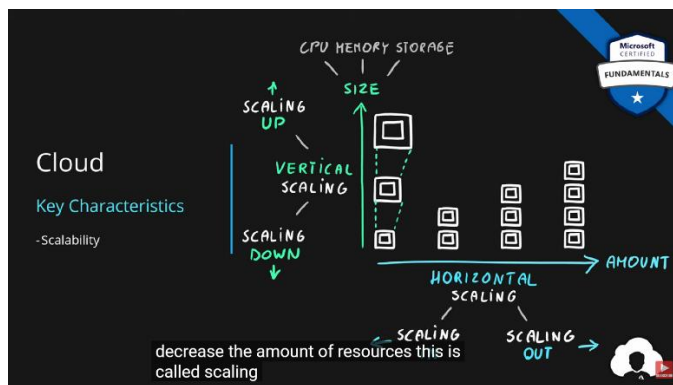


# 1. CLOUD VOCABULARY

## Cloud Computing

Service delivery model over the internet (cloud). This includes but is not limited to

- **compute power** meaning servers such as windows, linux, hosting environments, etc.
  - **storage** like files and/or databases
  - **networking** in azure but also outside when connecting to your company network
  - **analytics** services for visualization and telemetry data
1. While cloud computing contains a number of service types, the four most common ones by the definition are Compute Power, Storage, Analytics, and Networking.



## Key concepts

- **scalability** is the ability to scale, so allocate and deallocate resources at any time
  - **elasticity** is the ability to scale dynamically
  - **agility** is the ability to react fast (scale quickly)
  - **fault tolerance** is the ability to maintain system uptime while physical and service component failures happen
  - **disaster recovery** is the process and design principle which allows a system to recover from natural or human induced disasters
  - **high availability** is the agreed level of operational uptime for the system. It is a simple calculation of system uptime versus whole lifetime of the system.
    - $\text{availability} = \frac{\text{uptime}}{\text{uptime} + \text{downtime}}$
2. The system is elastic that means it can adjust its processing power to match the demand. This happens only when the system is able to allocate and deallocate resources dynamically. Basically elasticity is up and down scalability.
  3. Microsoft is a big company, Azure is also big. Because of that, their price per unit is low and as such customers can take advantage of competitive infrastructure and platform pricing. This is so-called economies of scale principle which is one of the cloud benefits.

## 2. EXPENDITURE

### CapEx vs OpEx

Differences between Capital Expenditure and Operational Expenditure

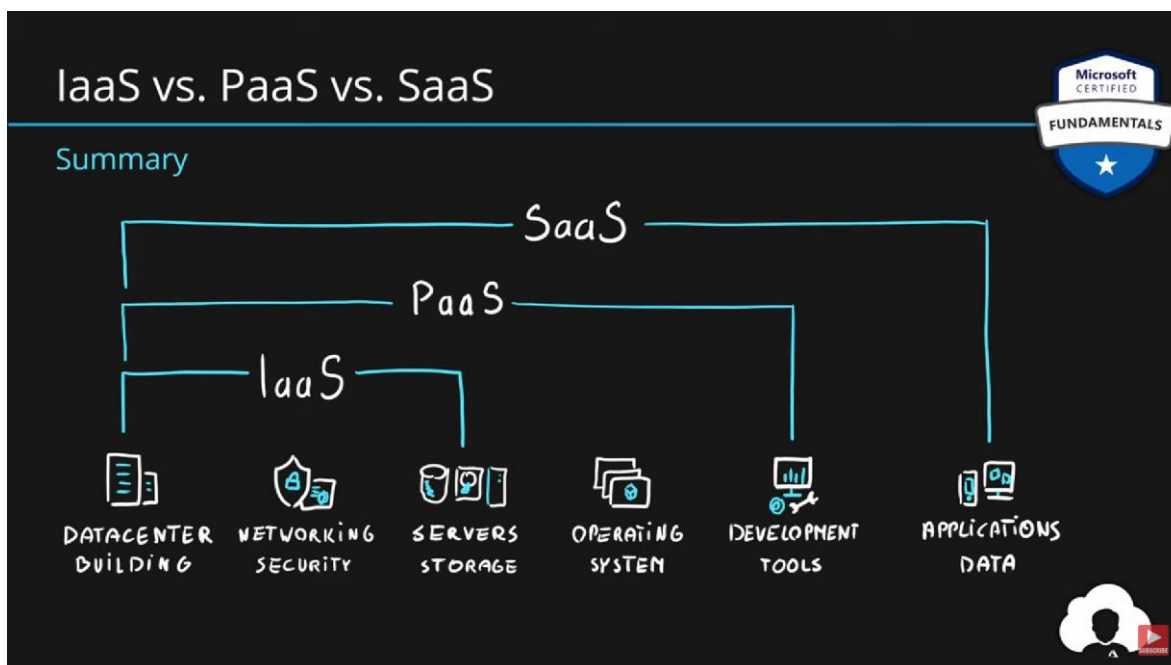
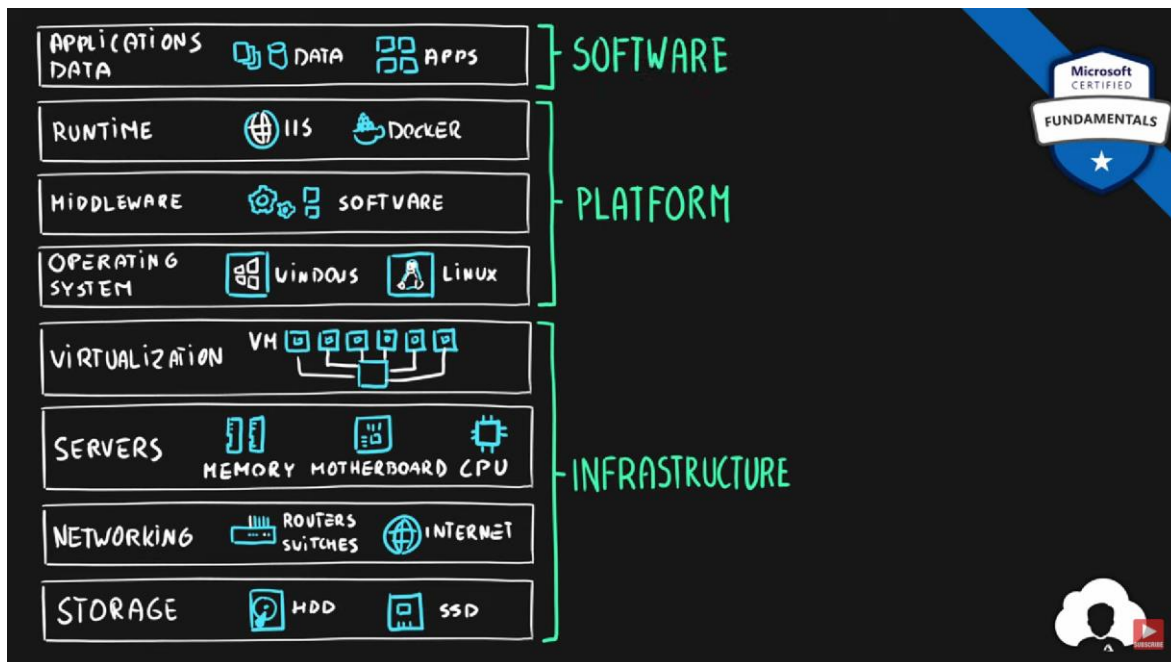
	Capital Expenditure	Operational Expenditure
Up front cost	Significant	None
Ongoing cost	Low	Based on usage
Maintenance	Significant	Low
Value over time	Lowers	No change

The consumption-based model is a **pricing model** used in the cloud so that customers are only charged **based on their resource usage**.

1. Consumption based model means that customers only pay when they use resources, as such they have no upfront cost associated. Because of that you can create resources at any time and delete them at any time, so you don't waste any resources. Once resources are deleted, customers stop paying.

### 3. Cloud Service Models

IAAS : Infrastructure as a service , PAAS: Platform as a service , SAAS: Software as a service



1. Virtual Machines are example of IAAS. When customer purchases virtual machines in Azure they don't maintain any Infrastructure but they need to manage everything else, including system patches, middleware, etc.
2. SQL server installed on VM is IAAS, while SQL DATABASE is PAAS.

## 4. Cloud deployment models

**Cloud Deployment Model** is simple a separation which describes where are the company resources deployed. Whenever this is in public cloud provider environment or private datacenter.

Below table presents high level deployment model separation

Layer	Cloud Provider	Own Datacenter
<b>Public</b>	✓	✗
<b>Hybrid</b>	✓	✓
<b>Private</b>	✗	✓

### Public Cloud

#### Key Characteristics

- Everything runs on cloud provider hardware
- No local hardware
- Some services share hardware with other customers

#### Advantages

- No CapEx (No initial investment)
- High Availability
- Agility
- Pay as you Go (PAYG) pricing
- No hardware maintenance
- No deep technical skills required

#### Disadvantages

- Not all security and compliance policies can be met
- No ownership over the physical infrastructure
- Rare specific scenarios can't be done

# Private Cloud

## Key Characteristics

- Everything runs on your own datacenter
- Self-service should be provided
- You maintain the hardware

## Advantages

- Can support any scenario
- Total control over security and infrastructure
- Can meet any security and compliance policy

## Disadvantages

- Initial investment is required (CapEx)
- Limited agility constrained by server capacity and team skills
- Very dependent on IT skills & expertise

# Hybrid Cloud

Deployment model which allows for building applications by utilizing your own datacenter and cloud provider Infrastructure.

## Key Characteristics

- Combines both Public & Private cloud

## Advantages

- Great flexibility
- You can run any legacy apps in private cloud
- Can utilize existing infrastructure
- Meet any security & compliance requirements
- Can take advantage of all public cloud benefits

## Disadvantages

- Can be more expensive
- Complicated to manage due to larger landscape
- Most dependent on IT skills & expertise from all three models

# 5. Physical Infrastructure

## Data Center

- **Physical facility**
- **Hosting** for group of networked **servers**
- Own **power, cooling & networking** infrastructure

## Availability Zone

- **Regional feature**
- A **zone** is **one or more data centers**
- Grouping of **physically separate** facilities
- Designed to **protect from data center failures**
- If zone goes down **others continue working**
- Two service **categories**
  - **Zonal** services (Virtual Machines, Disks, etc.)
  - **Zone-redundant** services (SQL, Storage, etc.)

1. Availability Zones are designed to help customers protect from data center failures by logically grouping physically separate facilities which have their own independent cooling, power and networking infrastructure and allowing services to take advantage of this fact.

## Region

- **Geographical area** on the planet
- **One but usually more datacenters** connected with **low-latency network** (<2 milliseconds)
- **Location** for your services
- Some services are **available only in certain regions**
- Some services are **global services**, as such are not assigned/deployed in specific region
- **Not all** regions support zones , **Supported** region has **three or more zones**

## Region Pair

- **Each region** is **paired** with another region making it a region pair
- Region **pairs are static** and cannot be chosen

- Each pair resides within the **same geography\***
- **Physical isolation** with at least 300 miles distance (when possible)
- Some services have **platform-provided replication**
- **Planned updates** across the pairs
- **Data residency** maintained for disaster recovery

2. It is a requirement that all Azure regions have a region pair but regions always have exactly one pair assigned. Microsoft ensures that updates across region pairs are synchronized to ensure that they are not updated at the same time. Region pairs are always within the same geography so customers can maintain their data residency.

## Geographies

- **Discrete market**
- Typically **contains two or more regions**
- Ensures **data residency**, **sovereignty**, **resiliency**, and **compliance** requirements are met
- **Fault tolerant** to protect from region wide failures
- Broken up into areas
  - **Americas**,
  - **Europe**,
  - **Asia Pacific**,
  - **Middle East and Africa**
- Each **region belongs only to one Geography**

3. Both Region Pairs and Geographies are designed to be fault-tolerant and help customers replicate their solutions across regions as such allowing them to create highly available applications capable of withstanding region-wide failures.

# 6. Resource Management

## Azure Resource

- Object **used to manage services** in Azure
- Represents **service lifecycle**
- Saved as **JSON definition**

1. Azure resources represent purchased Azure services. While they use JSON format to do it, it's simply for purposes of storing their configuration in a commonly accepted and readable format.

## Resource Groups

- **Grouping** of resources
- Holds **logically related** resources
- Typically organizing by
  - **Type**
  - **Lifecycle** (app, environment)
  - **Department**
  - **Billing,**
  - **Location** or
  - **combination of those**

## Resource Manager

- **Management Layer** for all resources and resource groups
- **Unified** language
- **Controls access** and **resources**



# Additional Info

- Each **resource must** be in one, and **only one resource group**
- Resource **groups have their own location** assigned
- Resources in the resource groups **can reside in a different locations**
- Resources **can be moved** between the resource groups
- Resource **groups can't be nested**
- Organize based on your organization needs but consider
  - Billing
  - Security and access management
  - Application Lifecycle

# 7. Compute Services

## Virtualization

- Emulation of physical machines
- Different virtual hardware configuration per machine/app
- Different operating systems per machine/app
- Total separation of environments
  - file systems,
  - services,
  - ports,
  - middleware,
  - configuration

## Virtual Machines

- Infrastructure as a Service (IaaS)
- Total control over the operating system and the software
- Supports marketplace and custom images
- Best suited for
  - Custom software requiring custom system configuration
  - Lift-and-shift scenarios
- Can run any application/scenario
  - web apps & web services,
  - databases,
  - desktop applications,
  - jumpboxes,
  - gateways, etc.

## Virtual Machine Scale Sets

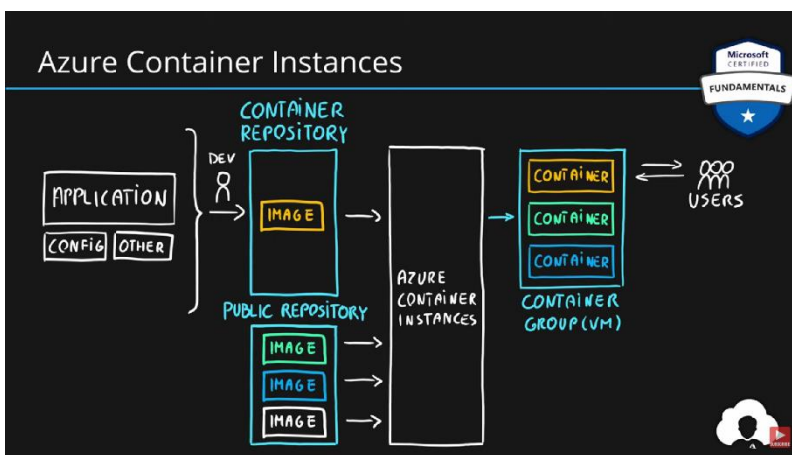
- Infrastructure as a Service (IaaS)
- Set of identical virtual machines
- Built-in auto scaling features
- Designed for manual and auto-scaled workloads like web services,\* batch processing, etc.

# Containers

- Use host's operating system
- Emulate operating system (VMs emulate hardware)
- Lightweight (no O/S)
  - Development Effort
  - Maintenance
  - Compute & storage requirements
- Respond quicker to demand changes
- Designed for almost any scenario

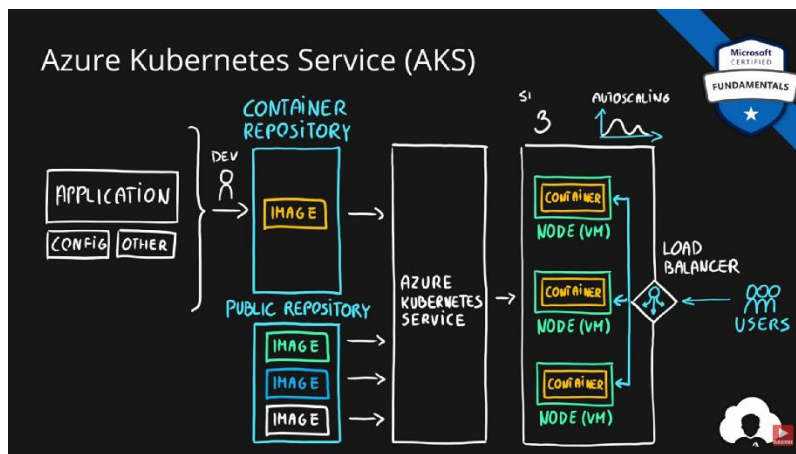
## Azure Container Instances

- Simplest and fastest way to run a container in Azure
- Platform as a Service
- Serverless Containers
- Designed for
  - Small and simple web apps/services
  - Background jobs
  - Scheduled scripts



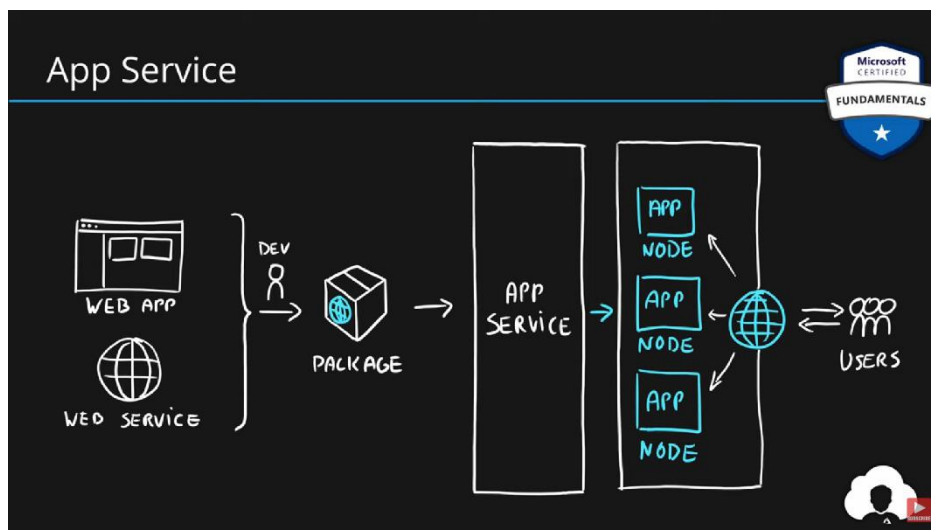
## Azure Kubernetes Service (AKS)

- Open-source container orchestration platform
- Platform as a Service
- Highly scalable and customizable
- Designed for high scale container deployments (anything really!)



## App Service

- Designed as enterprise grade web application service
- Platform as a Service
- Supports multiple programming languages and containers



Though all services like VMS , containers, AKS can be used to host webapp / sites.  
App service is just preferred one, though all can be used.

## Azure Functions (Function Apps)

- Platform as a Service
- Serverless
- Two hosting/pricing models
  - Consumption-based plan
  - Dedicated plan
- Designed for micro/nano-services

# Summary

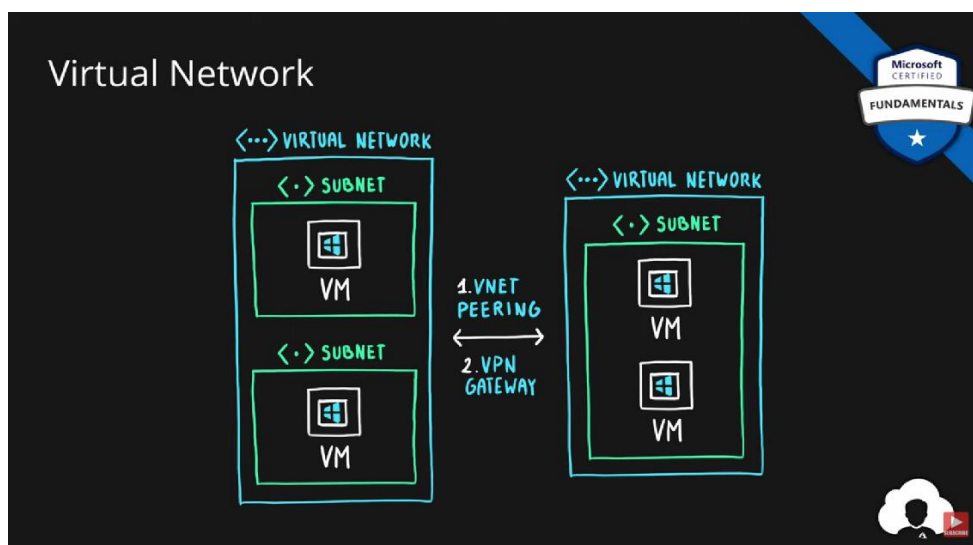
- Virtual Machines (IaaS) - Custom software, custom requirements, very specialized, high degree of control
- VM Scale Sets (IaaS) - Auto-scaled workloads for VMs
- Container Instances (PaaS) - Simple container hosting, easy to start
- Kubernetes Service (PaaS) - Highly scalable and customizable \* container hosting platform
- App Services (PaaS) - Web applications, a lot of enterprise web \* hosting features, easy to start
- Functions (PaaS) (Function as a Service) (Serverless) - micro/nano-services, excellent consumption-based pricing, easy to start

## 8. Azure Networking

- Connect cloud and on-premises
- On-premise networking functionality

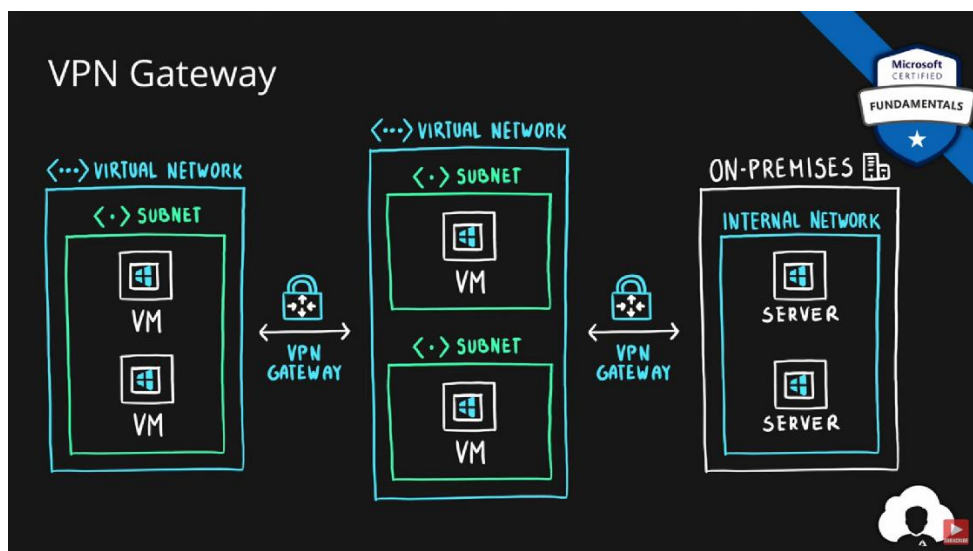
### Azure Virtual Network

- Logically isolated networking components
- Segmented into one or more subnets, Subnets are discrete sections
- Enable communication of resources with each-other, internet and on-premises
- Scoped to a single region
- VNet peering allow cross region communication
- Isolation, Segmentation, Communication, Filtering, Routing



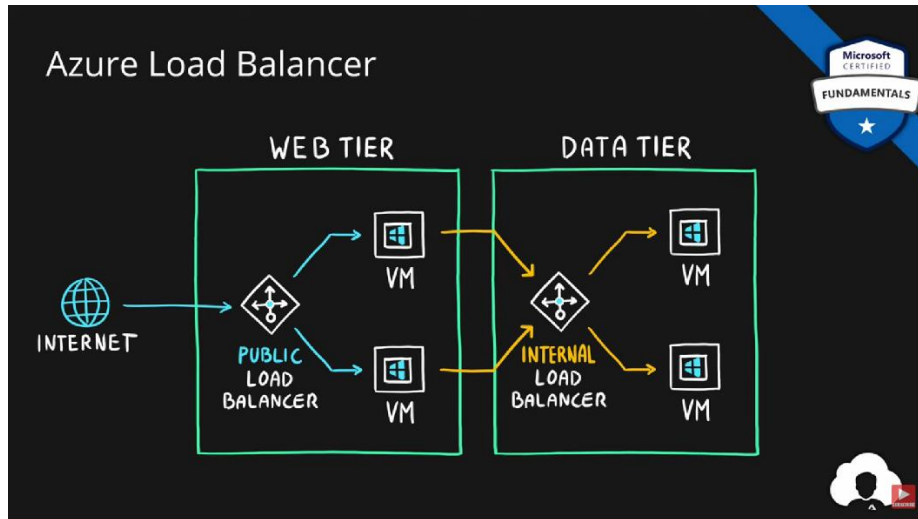
### VPN Gateway

- Specific type of virtual network gateway for on-premises to azure traffic over the public internet



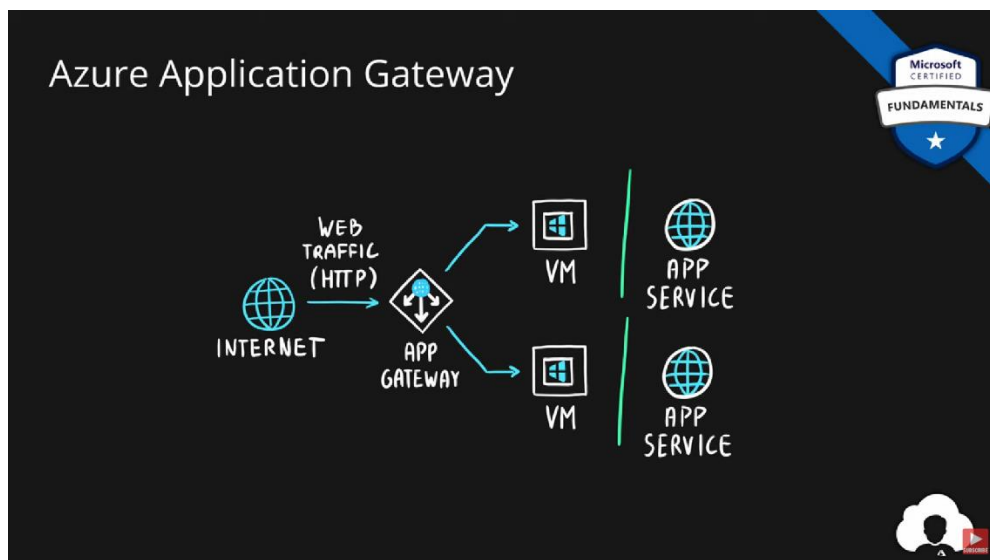
# Azure Load Balancer

- Even traffic distribution
- Supports both inbound and outbound scenarios
- Both TCP (transmission control protocol) and UDP (user datagram protocol) applications
- Internal and External traffic
- Port Forwarding



# Application Gateway

- Web traffic load balancer
- Web application firewall
- Redirection
- Session affinity
- URL Routing
- SSL termination



# Content Delivery Network

- Define content
- Minimize latency
- POP (points of presence) with many locations

## Azure Networking Services



### Summary

- Azure **Virtual Network** – Emulation/representation of physical networking in the cloud, grouping, filtering and segmentation of network related resources
- Azure **VPN Gateway** – Connecting On-Premises with the Virtual Network and Virtual Networks with each other (remember about VNet Peering)
- Azure **Load Balancer** – Even traffic distribution for non-HTTP (non-web) traffic
- Azure **Application Gateway** – Even traffic distribution for HTTP (web) traffic
- Azure **Content Delivery Network (CDN)** – Global content caching & distribution to offload web applications and reduce latency





# 9. Azure Storage

## Blob Storage

- BLOB – binary large object – file
- Designed for storage of files of any kind
- Three storage tiers
  - Hot – frequently accessed data
  - Cool – infrequently accessed data (lower availability, high durability)
  - Archive – rarely (if-ever) accessed data

## Queue Storage

- Storage for small pieces of data (messages)
- Designed for scalable asynchronous processing

## Table Storage

- Storage for semi-structured data (NoSQL)
  - No need for foreign joins, foreign keys, relationships or strict schema
  - Designed for fast access

## File Storage

- Storage for files accessed via shared drive protocols
- Designed to extend on-premise file shares or implement lift-and-shift scenarios

## Disk Storage

- Disk emulation in the cloud
- Persistent storage for Virtual Machines
- Different
  - sizes,
  - types (SSD, HDD)
  - performance tiers
- Disk can be unmanaged or managed

# Azure Storage Services



## Summary

- Azure **Storage Account** – Highly scalable and highly durable storage service consisting group of smaller services (blob, file, queue and table storage services)
- Azure **Blob Storage** – General purpose (blob) file storage, fits any scenario
- Azure **File Storage** – File share service in the cloud, lift-and-shift scenarios
- Azure **Queue Storage** – Service for storing small messages for asynchronous processing
- Azure **Table Storage** – Scalable NoSQL storage service for semi-structured data
- Azure **Disk Storage** – Disk emulation service in the cloud



## Cosmos DB

- Globally distributed NoSQL (semi-structured data) Database service
- Schema-less
- Multiple APIs (SQL, MongoDB, Cassandra, Gremlin, Table Storage)
- Designed for
  - Highly responsive (real time) applications with super low latency responses <10ms
  - Multi-regional applications

# 10. Serverless Computing

## What is Serverless?

**Serverless computing** is cloud-hosted execution environment that allows customers to **run their applications** in the cloud while **completely abstracting underlying infrastructure**.

## Azure Functions

- Serverless coding platform (Functions as a Service, FaaS)
- Designed for nano-service architectures and event-based applications
- Scales up and down very quickly
- Highly scalable
- Supports popular languages and frameworks (.NET & .NET Core, Java, Node.js, Python, PowerShell, etc.)

## Azure Logic Apps

- Serverless enterprise integration service (PaaS)
- Designed for orchestration of
  - business processes,
  - integration workflows for applications, data, systems and services
- No-code solution

## Azure Event Grid

- Fully managed serverless event routing service
- Uses publish-subscribe model
- Designed for event-based and near-real time applications
- Supports dozen of built-in events from most common Azure services

# 11. Azure Tools

## Azure Portal

- Public web-based interface for management of Azure platform
- Designed for self-service
- Customizable
- Simple tasks

## Azure PowerShell

- PowerShell and module
- Designed for automation
- Multi-platform with PowerShell Core
- Simple to use
  - Connect-AzAccount – log into Azure
  - Get-AzResourceGroup – list resource groups
  - New-AzResourceGroup – create new resource group
  - New-AzVm – create virtual machine

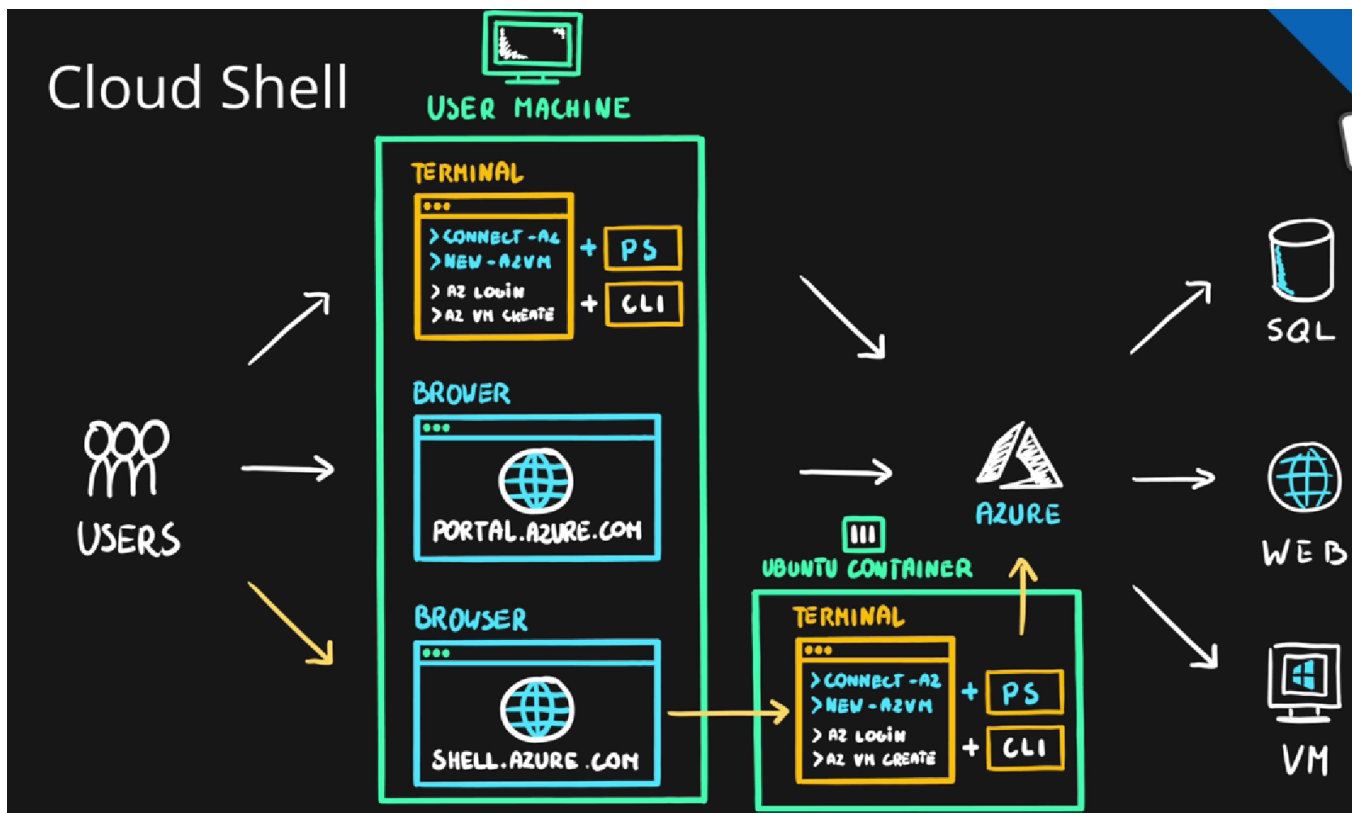
## Azure CLI

- Command Line Interface for Azure
- Designed for automation
- Multi-platform (Python)
- Simple to use
  - az login – log into Azure
  - az group list – list resource groups
  - az group create – create new resource group
  - az vm create – create virtual machine
- Native OS terminal scripting

## Azure Cloud Shell

- Cloud-based scripting environment
- Completely free
- Supports both Azure PowerShell and Azure CLI

- Dozen of additional tools
- Multiple client interfaces
  - Azure Portal integration (portal.azure.com)
  - Shell Portal (shell.azure.com)
  - Visual Studio Code Extension
  - Windows Terminal
  - Azure Mobile App
  - Microsoft Docs integration



# 12. Azure security and access control

## 1. Network Security Groups

- Designed to **filter traffic** to (inbound) and from (outbound) Azure resources located in - Azure Virtual Network
- Filtering controlled by **rules**
- Ability to have **multiple** inbound and outbound **rules**
- Rules are created by specifying
  - **Source/Destination** (IP addresses, service tags, application security groups)
  - **Protocol** (TCP, UDP, any)
  - **Port** (or Port Ranges, ex. 3389 – RDP, 22 – SSH, 80 HTTP, 443 HTTPS)
  - **Direction** (inbound or outbound)
  - **Priority** (order of evaluation)

## 2. Application Security Groups

- Feature that allows **grouping of virtual machines** located in Azure virtual network
- Designed to **reduce** the **maintenance effort** (assign ASG instead of the explicit IP address)

### Summary

- **Network Security Groups** – Filtering of incoming and outgoing traffic for virtual network resources
- **Application Security Groups** – Logical grouping of virtual network resources for easier maintenance

# Firewall

Firewall is a network security service that monitors and controls incoming and outgoing traffic.

## 3. Azure Firewall

- Managed, cloud-based **firewall service** (PaaS, Firewall as a Service)
- Built-in **high availability**
- Highly **Scalable**
- **Inbound & outbound** traffic filtering rules
- Support for **FQDN** (Fully Qualified Domain Name), ex. microsoft.com
- Fully integrated with Azure monitor for logging and analytics
- By default all traffic through the firewall is blocked, a rule has to be added in order to enable traffic flow.

**An NSG works much like a firewall.** While an Azure Firewall monitors traffic at more of a global level, an NSG is more defined and is applied to specific subnets and/or network interfaces. Both firewall and NSG allow you to apply rules based on IP addresses, port numbers, networks, and subnets

## Question 4

Conotoso company wants to block all traffic to the internet websites from their network with exception of domain names like [www.contoso.com](http://www.contoso.com) and [www.internal.conotoso-partner.com](http://www.internal.conotoso-partner.com). For that they want to use Network Security Groups, will it solve their challenge?

☒ Yes

☐ No

CHECK ANSWER

✗ That's not correct

🗨️ **No**, Azure NSGs do not offer features for creating rules based on FQDN (fully qualified domain name). Contoso should use Azure Firewall.

## DoS - Denial of Service

Cyber-attack with intent to cause temporary or indefinite **disruption of service**

## DDoS - Distributed Denial of Service

**DoS** attack that is originating **from multiple servers**

## 4. Azure DDoS Protection

- **DDoS protection service** in Azure
- Designed to
  - **Detect malicious traffic and block it** while allowing legitimate users to connect
  - **Prevent additional costs** for auto-scaling environments
- Two tiers
  - **Basic** – automatically enabled for Azure platform
  - **Standard** – additional mitigation & monitoring capabilities for Azure Virtual Network resources
- Standard tier uses machine learning to **analyze traffic patterns** for better accuracy

## 5. Azure Security Center

Azure Security Center is a service that protects Azure IaaS and PaaS services by providing a centralized and unified experience with recommendations and advanced security features.

Azure Security Center is a monitoring service that includes which of the following features? Choose 5.

☒ Security Recommendations

☒ Monitoring of security settings for cloud and on-premises (hybrid) workloads

☒ Automatic security assessments

☐ Azure Network analysis and filtering rules

☒ Analysis of potential inbound attacks and threats

☐ Firewall for virtual machines

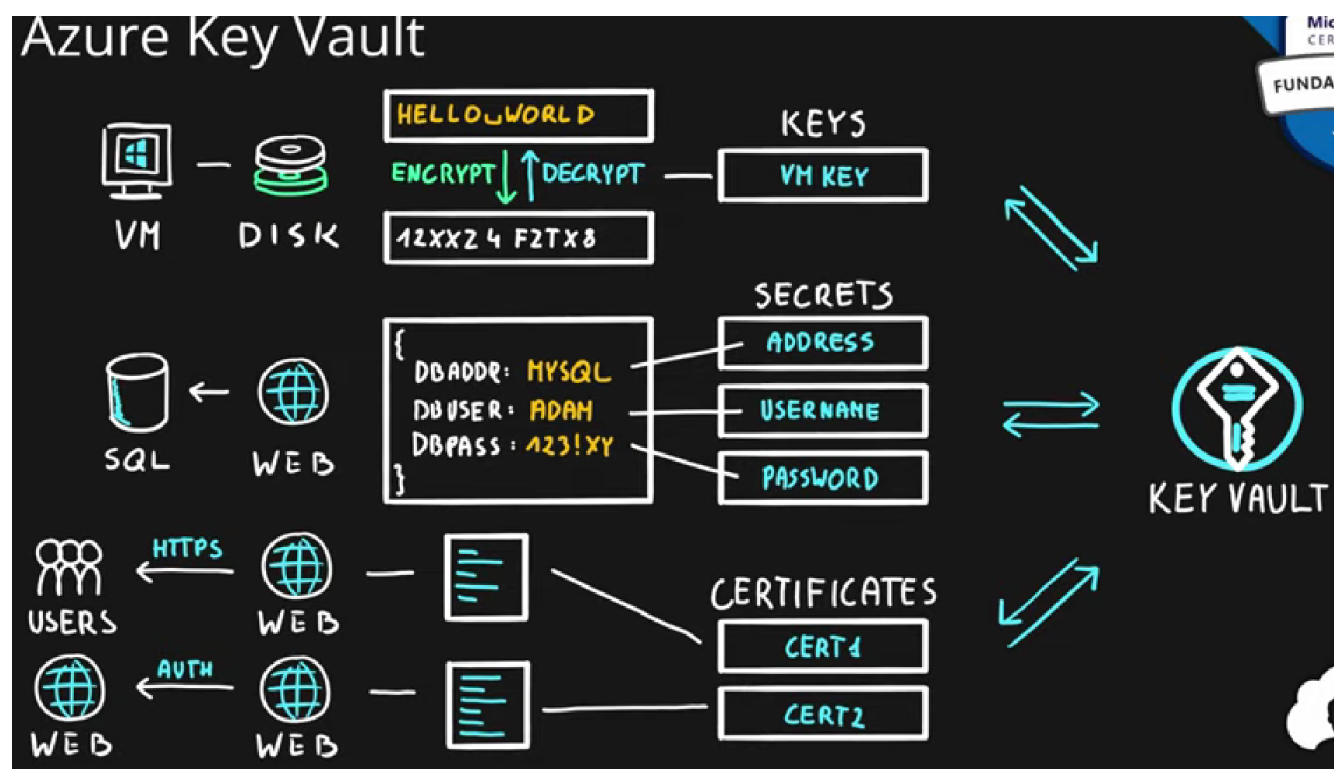
☒ Just-in-time (JIT) VM access



Security Center includes features like **security recommendations**, **monitoring for cloud and on-premises workloads**, **automatic security assessments**, **analysis of threats and attacks**, **just-in-time VM access**, and many more.

## 6. Azure Key Vault

- **Managed service** for **securing sensitive information** (application/platform) (PaaS)
- **Secure storage service** for
  - **Keys**,
  - **Secrets** and
  - **Certificates**
- **Highly integrated** with other Azure services (VMs, Logic Apps, Data Factory, Web Apps, etc.)
- **Access monitoring** and **logging**



# Authentication

The process of **verification/assertion of identity**

# Authorization

The process of **ensuring** that only **authenticated identities** get **access to the resources** for which they have been granted access.

# Access Management

The process of **controlling, verifying, tracking** and **managing access** to authorized users and applications.

# Identity

Identities can be users with username and password or applications/servers with secret keys/certificates.

## 7. Azure Active Directory

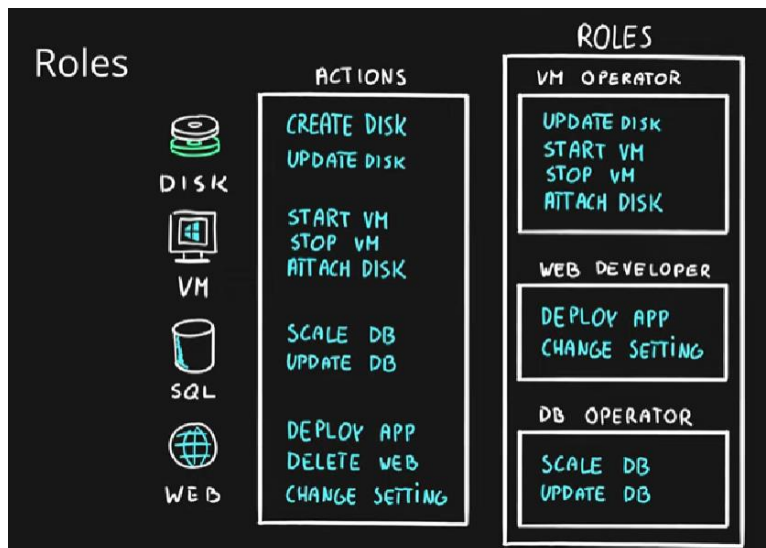
- Identity and Access Management service in Azure
- Identities management – users, groups, applications
- Access management – subscriptions, resource groups, roles, role assignments, authentication & authorization settings, etc.
- Used by multiple Microsoft cloud platforms
  - Azure
  - Microsoft 365
  - Office 365
  - Live.com services (Skype, OneDrive, etc.)

## Multi-factor Authentication (MFA)

- Process of authentication using more than one factor (evidence) to prove identity
- Factor types
  - Knowledge Factor – “Something you know”, ex. password, pin
  - Possession Factor – “Something you have”, ex. phone, token, card, key
  - Physical Characteristic Factor – “Something you are”, ex. fingerprint, voice, face, eye iris
  - Location Factor – “Somewhere you are”, ex. GPS location
- Supported by Azure AD by default (simple on-off switch)

## 8. Azure Role-based Access Control (RBAC)

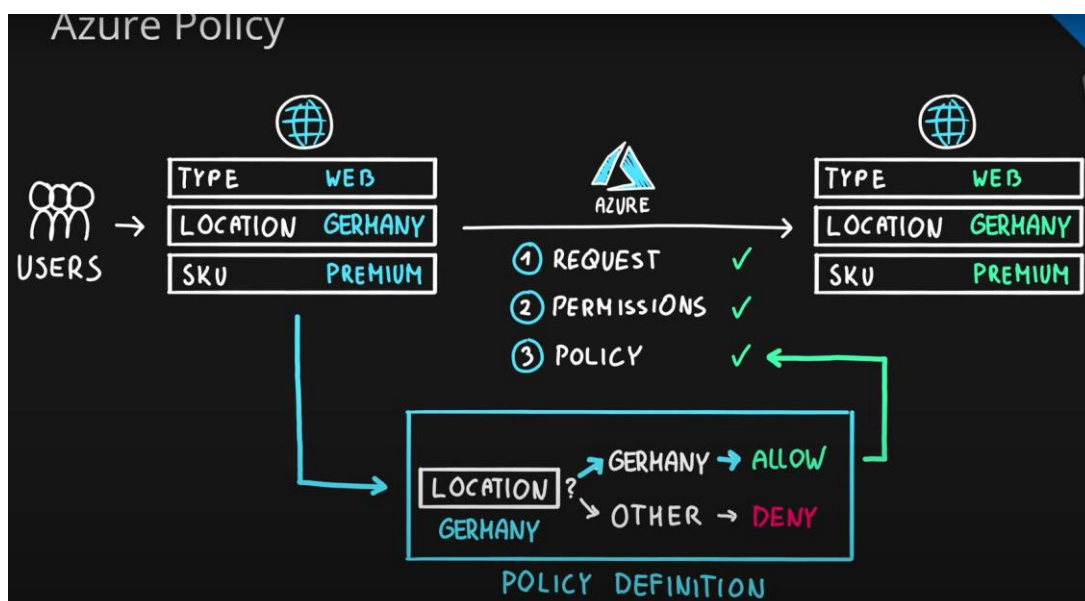
- Authorization system built on Azure Resource Manager (ARM)
- Designed for fine-grained access management of Azure Resources
- Role assignment is combination of
  - Role definition – list of permissions like create VM, delete SQL, assign permissions, etc.
  - Security Principal – user, group, service principal and managed identity and
  - Scope – resource, resource groups, subscription, management group
- Hierarchical
  - Management Groups > Subscriptions > Resource Groups > Resources
- Built-in and Custom roles are supported



# 13. Azure Governance

## 1. Azure Policy

- Designed to help with resource **governance**, **security**, **compliance**, **cost management**, etc.
- **Policies** focus on **resource properties** (RBAC focused on **user actions**)
- Policy **definition** – Defines what should happen
  - Define the **condition** (if/else) and the **effect** (deny, audit, append, modify, etc.)
  - Examples include allowed *resource types*, *allowed locations*, *allowed SKUs*, *inherit resource tags*
- **Built-in** and **custom** policies are supported
- Policy **initiative** – a **group** of policy definitions
- Policy **assignment** – assignment of a policy definition/initiative to a scope
  - Scopes can be assigned to
    - management groups,
    - subscriptions,
    - resource groups, and
    - resources
- Policies allow for **exclusions of scopes**
- Checked during **resource creation** or **updates** and **existing ones with remediation tasks**



1. Azure Policy inspects properties of Azure resources using simple if/else conditions and allows customers to choose actions (effects) based on their values.
2. Azure Policy Initiative is a collection of Azure policy definitions.

## 2. Azure Blueprints

- **Package** of various Azure components (**artifacts**)
  - **Resource Groups**
  - **ARM Templates**
  - **Policy Assignments**
  - **Role Assignments**
- **Centralized storage** for organizationally **approved design patterns**
- Blueprint **definition** – describing what should happen (reusable package)
- Blueprint **assignment** – describing where it should happen (package deployment)

1. Blueprint definition consists of four Azure components. Those are Azure Resource Manager (ARM) templates, role assignments, policy assignments, and Azure resource groups.

## 3. Azure Resource Lock

- Designed to **prevent accidental deletion** and/or **modification**
- Used in conjunction with RBAC
- Two types of locks
  - **Read-only (ReadOnly)** – only read actions are allowed
  - **Delete (CanNotDelete)** – all actions except delete are allowed
- Scopes are **hierarchical (inherited)**
  - Subscriptions > Resource Groups > Resources
- **Management Groups** can't be locked
- Only **Owner** and **User Access Administrator** roles can manage locks (**built-in** roles)

## Azure Resource Tags

Resource Tags are key-value pairs (labels) that allow customers to attach any information to their azure resources for better management of their Azure environment.

- Tags are simple **Name** (key) - **Value** pairs
- Designed to help with **organization of Azure resources**

- Used for resource **governance, security, operations management, cost management, automation**, etc.
- Typical **tagging strategies**
  - **Functional** – mark by **function** ( ex: environment = production )
  - **Classification** – mark by **policies used** ( ex: classification = restricted )
  - **Finance/Accounting** – mark for **billing purposes** ( ex: department = finance )
  - **Partnership** – mark by **association of users/groups** ( ex: owner = adam )
- Applicable for **resources, resource groups** and **subscriptions**
- **NOT inherited** by default

## Azure Sovereign Regions

Azure Sovereign Regions provide Azure services in markets with very strict regulatory requirements

- Azure Government designed for the US government
  - Separate instance of Azure (lifecycle, services, portal, etc.)
  - Physically isolated from other Azure regions
  - Only authorized scanned personnel can get access
- Azure China designed for the Chinese market
  - Separate instance of Azure (lifecycle, services, portal, etc.)
  - Physically isolated from other Azure regions
  - Operated by a Chinese telecom company called 21Vianet

## Azure Advisor

**Azure Advisor** is a service that works just like a personalized consultant which provides you with recommendations to improve your Azure resource management.

- Designed to provide **recommendations** and **best practices** for
  - **Cost** (SKU sizes, idle services, reserved instances, etc.)
  - **Security** (MFA settings, vulnerability settings, agent installations, etc.)
  - **Reliability** (redundancy settings, soft delete on blobs, etc.)
  - **Performance** (SKU sizes, SDK versions, IO throttling, etc.)
  - **Operational Excellence** (service health, subscription limits, etc.)
- **Actionable** recommendations

# 14. Azure Cost Management

## Cost Affecting Factors

- Base Cost
  - **Resource Types** – All Azure services (resources) have resource-specific pricing models. Typically consisting of one or more metrics.
  - **Services** – Azure specific offers (Enterprise, Web Direct, CSP, etc.) have different cost and billing components like prepaids, billing cycles, - discounts, etc.
  - **Location** – running Azure services vary between Azure regions
  - **Bandwidth** – network traffic when uploading (inbound/ingress) data to Azure or downloading (outbound/egress) from Azure
- Savings
  - Reserved Instances
  - Hybrid Benefits

## Tools

- **Pricing calculator** – estimate the cost of Azure services
  - Select service
  - Adjust parameters (usage)
  - View the price
- **Total Cost of Ownership (TCO) calculator** – estimate and compare the cost of running workloads in datacenter versus Azure
  - Define your workloads
  - Adjust assumptions
  - View the report

# 15. Service Level Agreement (SLA)

- **Formal agreement** between **Microsoft** & the **customer**
- Calculated as a **percentage of service availability** (**uptime & connectivity**) (a promise)
- Breaking the SLA provides a discount from the final monthly bill (**Service Credit**)
- **Higher tier** services offer better **SLAs**
- **Free** services typically have **no SLA** (0% SLA)
- **Preview** services have **no SLA**
- **Composite SLA** is a combined SLA of all application components

Calculate Composite SLA

