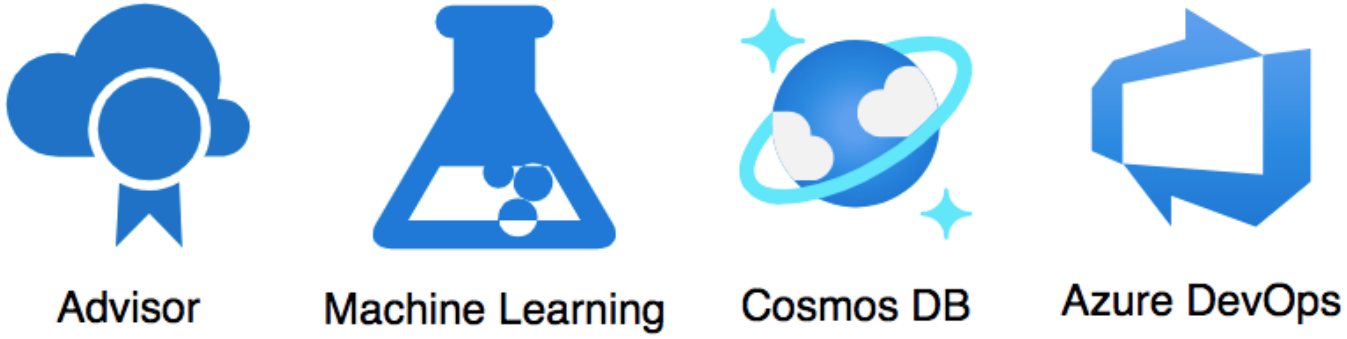
In28 Minutes

# AZ-900
# Azure Fundamentals

# Getting Started






- Azure has *200+ services*. Exam expects you to understand *40+ services*.
- Exam *tests* your **decision making abilities**:
  - Which service do you choose in which situation?
- This course is **designed** to help you *make these choices*
- **Our Goal** : Help you get certified and start your cloud journey with Azure

# How do you put your best foot forward?

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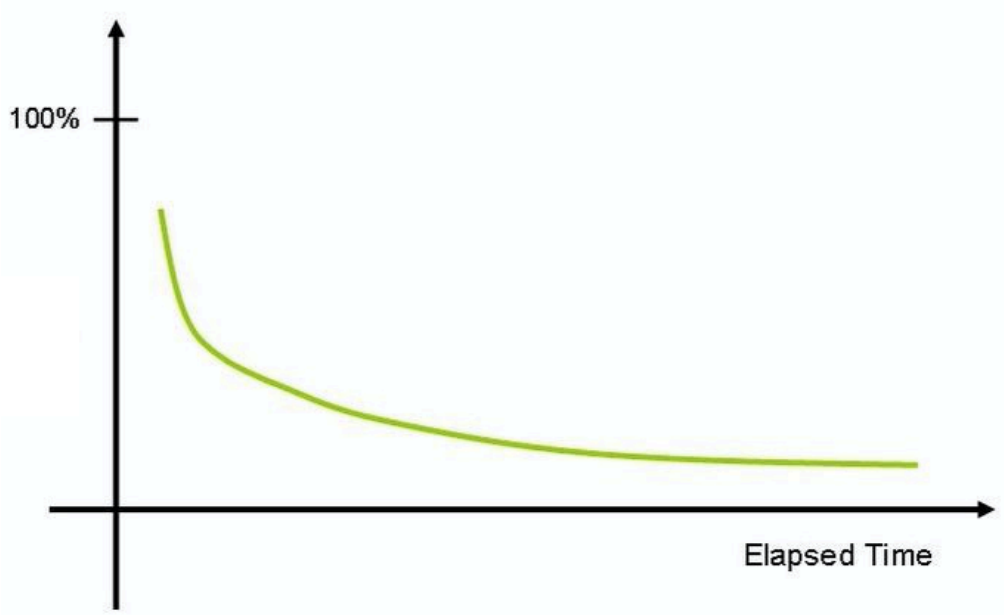
- **Challenging certification** - Expects you to understand and **REMEMBER** a number of services
- As time passes, humans forget things.
- How do you improve your chances of remembering things?
  - **Active learning** - think and take notes
  - **Review** the presentation every once in a while



# Our Approach

- Three-pronged approach to reinforce concepts:
  - Presentations (Video)
  - Demos (Video)
  - **Two kinds of quizzes**:
    - Text quizzes
    - Video quizzes
- (Recommended) Take your time. Do not hesitate to replay videos!
- (Recommended) Have Fun!

# FASTEST ROADMAPS

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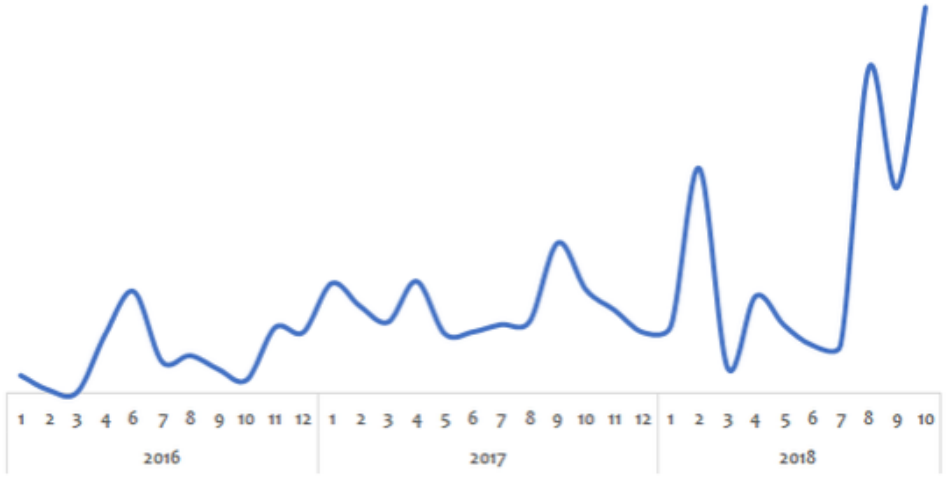
- Google Cloud Certifications
- Azure Certifications
- AWS Certifications
- DevOps
- Java Full Stack
- Java Microservices

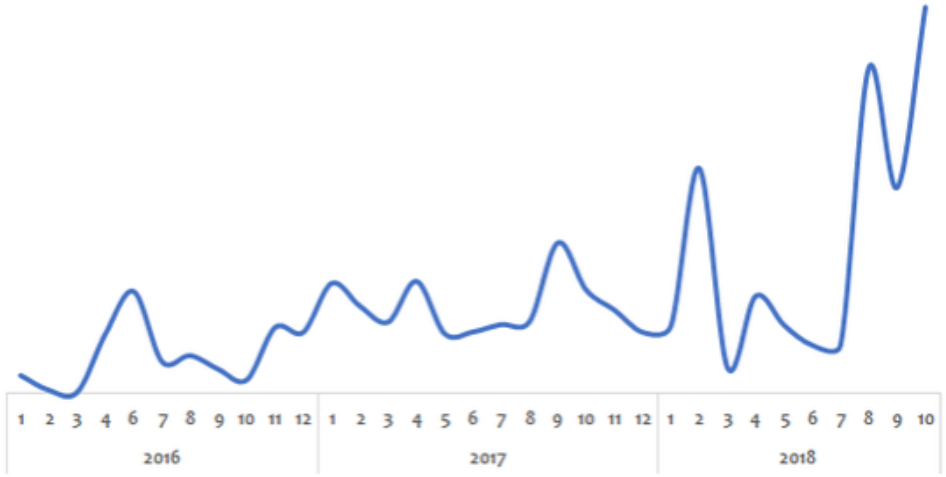
# Getting Started - Azure

# Before the Cloud - Example 1 - Online Shopping App




- Challenge:
  - Peak usage during holidays and weekends
  - Less load during rest of the time
- Solution (before the Cloud):
  - **Procure** (Buy) infrastructure **for peak load**
    - What would the infrastructure be doing during periods of low loads?

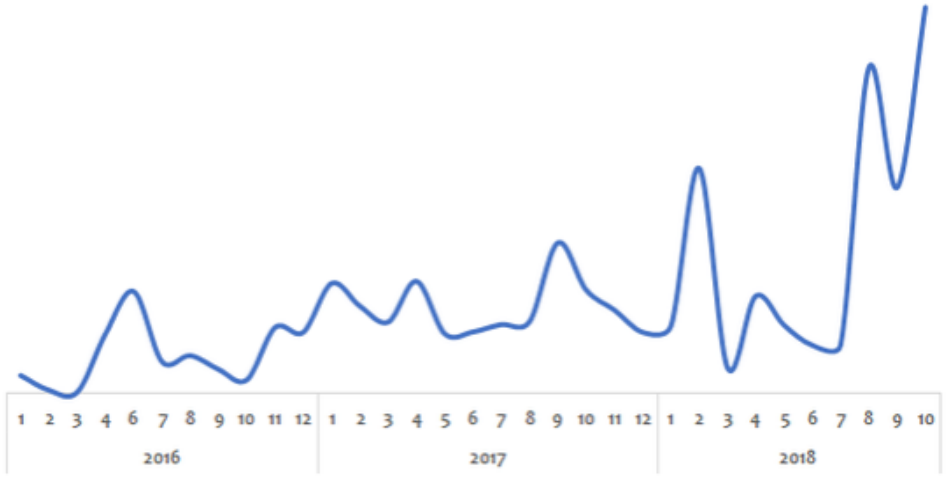
# Before the Cloud - Example 2 - Startup




- Challenge:
  - It suddenly becomes popular.
  - How to handle the **sudden increase** in load?
- Solution (before the Cloud):
  - **Procure** (Buy) infrastructure assuming they would be successful
    - What if they are not successful?

# Before the Cloud - Challenges






- High cost of procuring infrastructure
- Needs ahead of time planning (**Can you guess the future?**)
- Low infrastructure utilization (**PEAK LOAD** provisioning)
- Dedicated infrastructure maintenance team (**Can a startup afford it?**)

# Silver Lining in the Cloud

In28 Minutes

- How about **provisioning (renting) resources** when you want them and releasing them back when you do not need them?
  - **On-demand resource provisioning**
  - Also called **Elasticity**

# Cloud - Advantages

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- Trade **"capital expense"** for **"variable expense"**
- Benefit from massive **economies of scale**
- Stop **guessing** capacity
- Stop spending money running and maintaining data centers
- **"Go global"** in minutes

# Microsoft Azure

- One of the leading cloud service providers
- Provides 200+ services
- Reliable, secure and cost-effective
- The entire course is all about Azure. You will learn it as we go further.

# Best path to learn Azure!



Advisor

Machine Learning

Cosmos DB

Azure DevOps

- Cloud applications make use of multiple Azure services.
- There is **no single path** to learn these services independently.
- HOWEVER, we've worked out a simple path!

# Setting up Azure Account

- Create Azure Account

# Regions and Zones

# Data Center - What is it?

In 28 Minutes

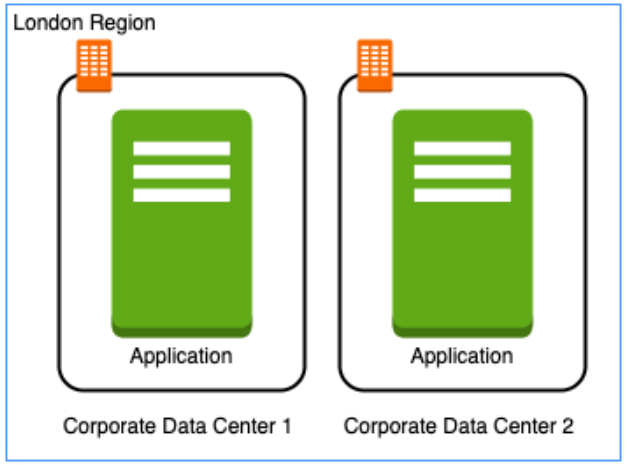
- **Thousands of servers**: A typical enterprise has thousands of servers running different applications
- **Need to be Managed**: All these servers need to be secured and managed
- How about putting all servers together?
  - **Data Center**: A facility used to house an organization's IT operations and equipment
- **Improved Security**: Centralized security measures to protect data and infrastructure
- **Efficiency**: Streamlined management and maintenance of IT resources

# Regions and Zones



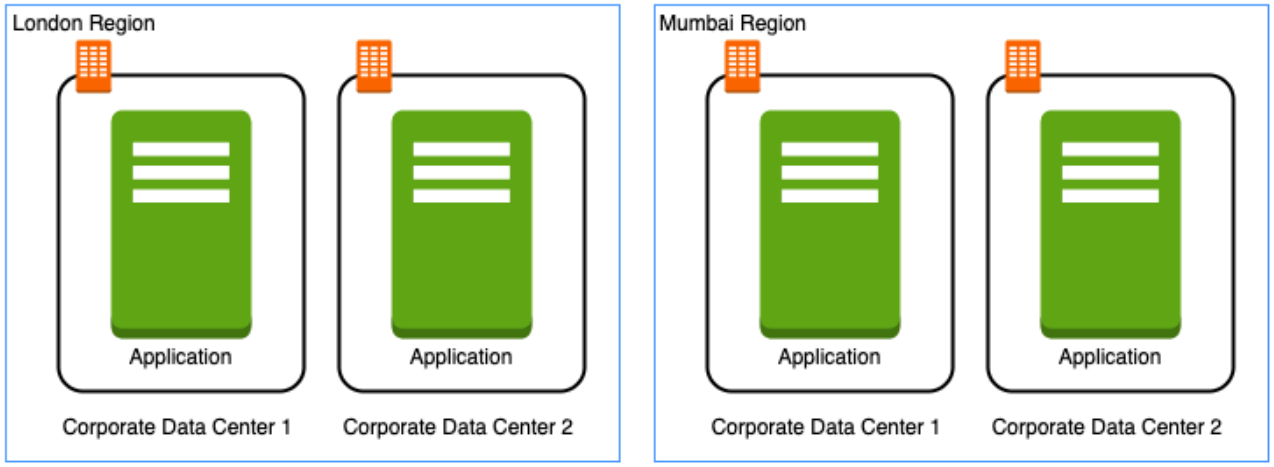

- Imagine that your application is deployed in a data center in London
- What would be the challenges?
  - Challenge 1 : Slow access for users from other parts of the world (**high latency**)
  - Challenge 2 : What if the data center crashes?
    - Your application goes down (**low availability**)

# Multiple data centers




- Let's **add in one more data center** in London
- What would be the challenges?
  - Challenge 1 : Slow access for users from other parts of the world
  - Challenge 2 (**SOLVED**) : What if one data center crashes?
    - Your application is **still available** from the other data center
  - Challenge 3 : What if **entire region** of London is unavailable?
    - Your application goes down

# Multiple regions




- Let's add a new region : Mumbai
- What would be the challenges?
  - Challenge 1 (**PARTLY SOLVED**) : Slow access for users from other parts of the world
    - You can solve this by adding deployments for your applications in other regions
  - Challenge 2 (SOLVED) : What if one data center crashes?
    - Your application is still live from the other data centers
  - Challenge 3 (**SOLVED**) : What if entire region of London is unavailable?
    - Your application is served from Mumbai

# Regions

- Imagine setting up data centers in different regions around the world
  - **Would that be easy?**
- (Solution) Azure provides **60+ regions** around the world
  - Expanding every year
- **Region** : Specific geographical location to host your resources
- **Advantages**:
  - High Availability
  - Low Latency
  - Global Footprint
  - Adhere to government **regulations**

# Availability Zones

- How to achieve high availability in the same region (or geographic location)?
  - Enter **Availability Zones**
    - Multiple AZs (3) in a region
    - **One or more discrete data centers**
    - Each AZ has **independent** & **redundant** power, networking & connectivity
    - AZs in a region are connected through **low-latency** links
- (Advantage) **Increased availability and fault tolerance** within same region
  - Survive the failure of a complete data center
- (Remember) NOT all Azure regions have Availability Zones

# Regions and Availability Zones examples

In 28 Minutes

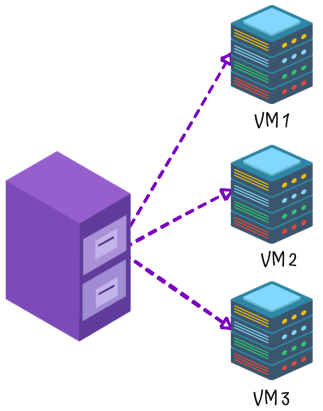
*New Regions and AZs are constantly added*

| Region | Availability Zones |
|---|---|
| (US) East US | 3 |
| (Europe) West Europe | 3 |
| (Asia Pacific) Southeast Asia | 3 |
| (South America) Brazil South | 3 |
| (US) West Central US | 0 |

# Azure Virtual Machines

# Virtualization - What is it?

- **Physical Server**: CPU(s) + Memory + Storage
- **Early Days**: One Application on One Physical Server
  - **Underutilized Resources**: Inefficiency and higher costs
- **Virtualization**: Use Software (Hypervisor) to run multiple Virtual Machines (VMs) on a single physical server
  - **Result**: Improved resource utilization by sharing hardware resources
  - **Flexibility**: Easily create, modify, and move VMs to meet changing demands
- **Virtualization and Cloud Computing**: Foundation of cloud services like AWS, Azure, and Google Cloud



# Azure Virtual Machines

- In corporate data centers, applications are deployed to physical servers
- Where do you deploy applications in the cloud?
  - Rent virtual servers
  - **Virtual Machines** - Virtual servers in Azure
  - **Azure Virtual Machines** - Provision & Manage Virtual Machines

VM

# Azure Virtual Machines - Features

In28 Minutes

- Create and manage lifecycle of Virtual Machine (VM) instances
- **Load balancing** and **auto scaling** for multiple VM instances
- **Attach storage** to your VM instances
- Manage **network connectivity and configuration** for your VM instances
- **Our Goal**:
  - Setup VM instances as HTTP (Web) Server
  - Distribute load with Load Balancers

VM

VM Scale Set

# Azure Virtual Machines Hands-on

In28 Minutes

- Let's create a few VM instances and play with them
- Let's SSH into VM instances and install web server!

VM

# Azure Virtual Machines - Key Concepts

In28 Minutes

| Feature | Explanation |
| --- | --- |
| **Image** | Choose Operating System and Software |
| **VM Family** | Choose the right family of hardware (General purpose or Compute/Storage/Memory optimized or GPU or HPC) |
| **VM Size (B1s, B2s, ...)** | Choose the right quantity of hardware (2 vCPUs, 4GB of memory) |
| **Disks** | Attach Virtual Disks to VMs (Block Storage) |

# Useful Commands

In28 Minutes

```
#!/bin/sh
sudo su
apt-get -y update
apt-get -y install nginx
echo "Getting started with Azure Virtual Machines" > /var/www/html/index.html
echo "Welcome to in28minutes $(whoami)" > /var/www/html/index.html
echo "Welcome to in28minutes $(hostname)" > /var/www/html/index.html
```

- Commands:
  - `sudo su` - execute commands as a root user
  - `apt-get -y update` - Update package index - pull the latest changes from the repositories
  - `apt-get -y install nginx` - Install and start nginx web server
  - `echo "Hello World" > /var/www/html/index.html` - Write to index.html
  - `$(hostname)` - Get host name
  - `$(hostname -I)` - Get host internal IP address

# Availability

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- Are the applications available **when the users need them**?
  - **Percentage of time** an application provides the operations expected of it
- **Example**: 99.99% availability. Also called four 9's availability

## Availability Table

| Availability | Downtime (in a month) | Comment |
|---|---|---|
| **99.95%** | 22 minutes | |
| **99.99% (four 9's)** | 4 and 1/2 minutes | Most online apps aim for 99.99% (four 9's) |
| **99.999% (five 9's)** | 26 seconds | Achieving 5 9's availability is tough |

# Increasing Availability for Azure VMs

In28 Minutes

- Single Instance VM:
  - Premium SSD or Ultra Disk: 99.9%
  - Standard SSD Managed Disks: 99.5%
  - Standard HDD Managed Disks: 95%
- Two or more instances in same Availability Set: 99.95%
  - Availability set is a logical grouping of VMs
    - **Fault domains**: Group of VMs sharing a common power source and network switch
    - **Update domains**: Group of VMs that are rebooted (updated) at the same time
- Two or more instances in two or more Availability Zones in the same Azure region: 99.99%
- **Summary**: Create multiple instances in multiple AZs if you want high availability

VM

# Virtual Machine Scale Sets

In28 Minutes

- How do you simplify creation and management of multiple VMs?
  - Enter **Virtual machine scale sets**
- Allow you to create and manage a group of Azure VMs
  - Provides high availability to your applications
- (Optional) Add a load balancer
- (Optional) Distribute VM instances across Multiple AZs (where available)
- Supports Manual Scaling and Auto Scaling
- Supports up to 1,000 VM instances
- **DEMO TIME**

VM Scale Set

# Azure Virtual Machines - More Features

In28 Minutes

| Feature | Explanation |
| --- | --- |
| **Static IP Address** | Assign a fixed IP address to your VM<br>Public IP addresses are charged per IP per hour |
| **Azure Monitoring** | Monitoring for your Azure VMs |
| **Dedicated Hosts** | Physical servers dedicated to one customer |
| **Create cheaper, temporary instances for non critical workloads** | Azure Spot instances |
| **Reserve compute instances ahead of time** | Reserved VM Instances (1 or 3 years) |

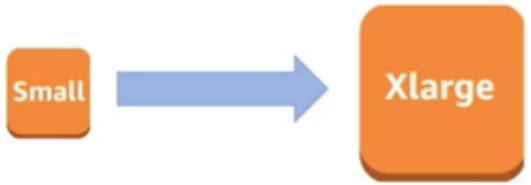
# Designing Good Solutions with VMs

In28 Minutes

| Terminology | Description | Azure VMs |
|---|---|---|
| **Availability** | Are apps available **when your users need them**? | Availability Sets and Scale Sets |
| **Scalability** | Can we handle a **growth in users, traffic, or data size** without any drop in performance? | VM Size, Scale Sets and Load Balancers |
| **Resilience** | Ability of system to provide acceptable behavior even when one or more parts of the system fail | Scale Sets and Load Balancers |
| **Geo-distribution** | Distribute applications across regions and zones | Scale Sets and Load Balancers |
| **Disaster Recovery** | How to keep your systems running in face of disasters? | Site Recovery |
| **Managing Costs** | You want to keep costs low | Auto Scaling (Elasticity), Reservations, Spot Instances |
| **Security** | Secure your VMs | Dedicated Hosts(More to come...) |

# Vertical Scaling

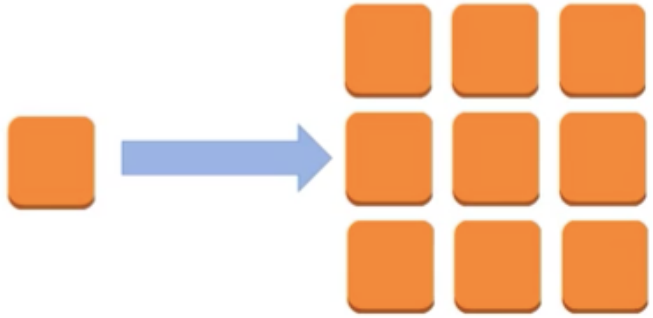





- Deploying application/database to **bigger instance**:
  - A larger hard drive
  - A faster CPU
  - More RAM, CPU, I/O, or networking capabilities
- In Azure: We can increase VM size
- There are limits to vertical scaling

# Horizontal Scaling





- Deploying multiple instances of application/database
- (Typically but not always) Horizontal Scaling is preferred to Vertical Scaling:
  - Vertical scaling has limits
  - Vertical scaling can be expensive
  - Horizontal scaling increases availability
- (BUT) Horizontal Scaling needs additional infrastructure:
  - Scaling Sets, Load Balancers etc.

# Azure Virtual Machines - Scenarios

In28 Minutes

| Scenario | Solution |
| --- | --- |
| **How can you automatically scale up and scale down VMs?** | VM Scale Sets |
| **How can you protect VMs from datacenter failures?** | Deploy them to multiple AZs (Scale Sets) |
| **How much availability do you get by deploying two or more VM instances in two or more AZs in same region?** | 99.99% |
| **How can you do disaster recovery for your VMs?** | Site Recovery |
| **How can you reduce costs for your VMs?** | AutoScaling(Elasticity), Reserved & Spot Instances, Right Region - Cost varies from region to region |
| **Will you be billed if you stop a VM?** | Yes. For Storage. |
| **Will two VMs of same size always cost the same?** | No. Price changes with time. Price also is different in different regions. |

# Managed Services

# Managed Services

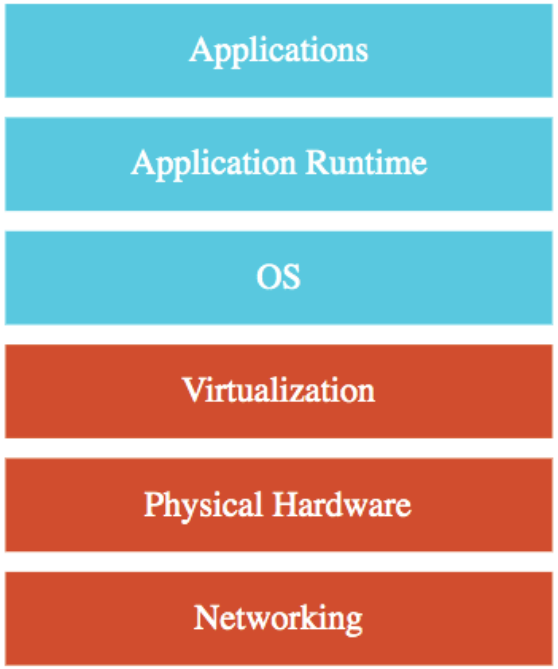
In28 Minutes

- Do you want to continue **running applications in the cloud**, the **same way you run them** in your **data center**?
- OR **are there OTHER approaches**?
- You should **understand some terminology** used with cloud services:
  - **IaaS** (Infrastructure as a Service)
  - **PaaS** (Platform as a Service)
  - **SaaS** (Software as a Service)
  - **Serverless**
- Let's get on a quick **journey** to understand these!

# IAAS (Infrastructure as a Service)

In28 Minutes

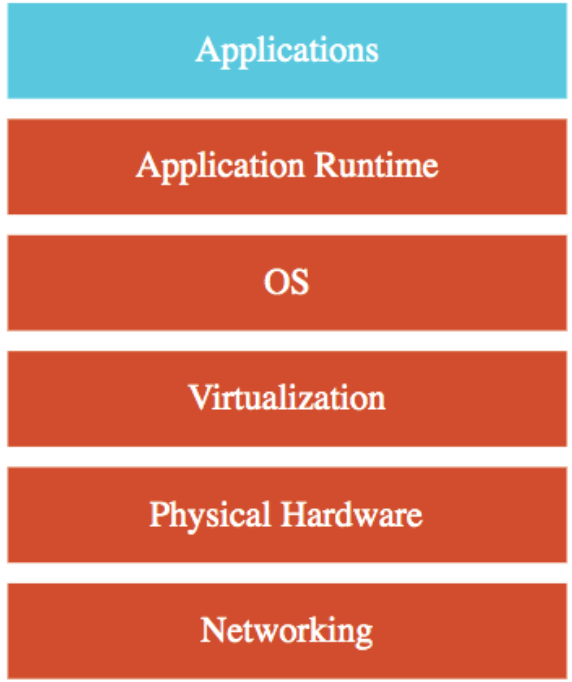
- Use **only infrastructure** from cloud provider
- **Example**: Using VM to deploy your applications or databases
- You are responsible for:
  - Application Code and Runtime
  - Configuring load balancing
  - Auto scaling
  - OS upgrades and patches
  - Availability
  - etc.. ( and a lot of things!)



# PAAS (Platform as a Service)

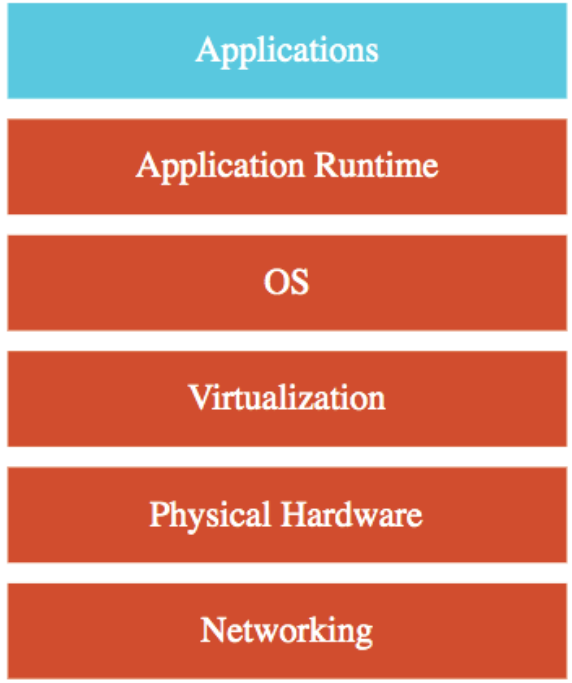
In28 Minutes

- Use a platform provided by cloud
- **Cloud provider** is responsible for:
  - OS (incl. upgrades and patches)
  - Application Runtime
  - Auto scaling, Availability & Load balancing etc..
- **You** are responsible for:
  - Configuration (of Application and Services)
  - Application code (if needed)
- Examples:
  - Azure App Service
  - Databases - Relational & NoSQL (Amazon RDS, Google Cloud SQL, Azure SQL Database etc)
  - Queues, AI, ML, Operations etc!



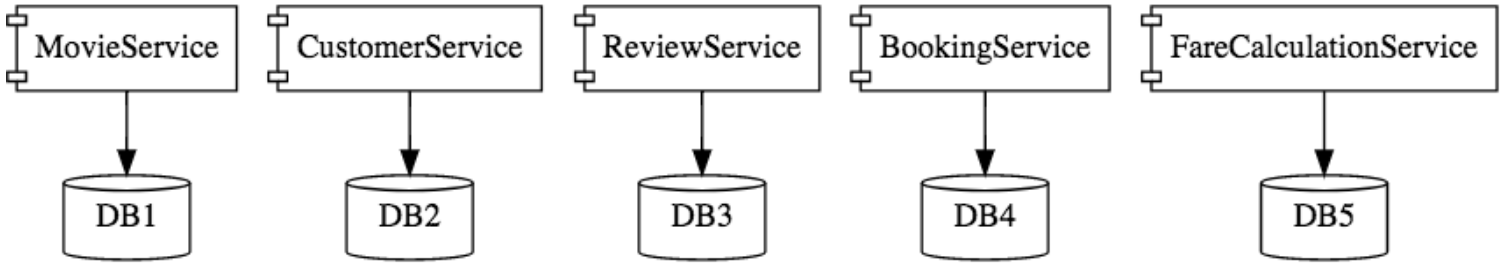
# Azure App Service

- Fully managed platform for building, deploying and scaling your web apps
  - Also supports REST APIs, and mobile back ends
- Natively supports .NET, .NET Core, Node.js, Java, Python and PHP
- Choose App Service plan: defines a set of compute resources for a web app
- Features:
  - Automated Deployment and management
  - Auto Scaling
  - Built in Load Balancing



# Microservices



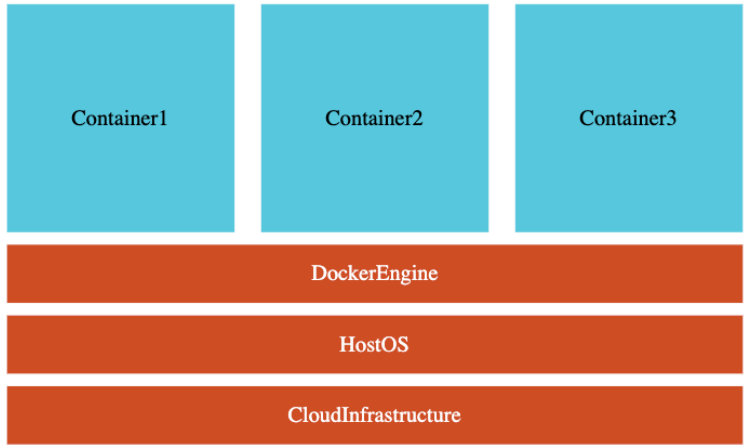



- Enterprises are heading towards microservices architectures
  - Build small focused microservices
  - **Flexibility to innovate** and build applications in different programming languages (Go, Java, Python, JavaScript, etc)
- BUT **deployments become complex**!
- How can we have **one way of deploying** Go, Java, Python or JavaScript .. microservices?
  - Enter **containers**!

# Containers - Docker

In28 Minutes

- Create **Docker images** for each microservice
- Docker image **has all needs of a microservice**:
  - Application Runtime (JDK or Python or NodeJS)
  - Application code and Dependencies
  - VMs virtualize Hardware while containers virtualize OS
  - Runs **the same way** on any infrastructure:
    - Your local machine
    - Corporate data center
    - Cloud
- Advantages
  - Docker containers are **light weight**
    - Compared to Virtual Machines as they do not have a Guest OS
  - Docker provides **isolation** for containers
  - Docker is **cloud neutral**



# Azure Container Instances

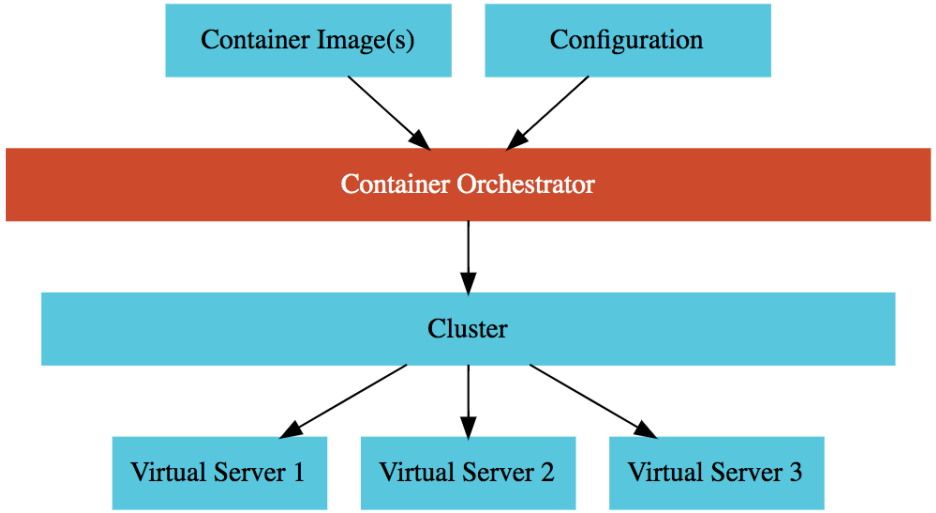


- Manage and run simple container based applications
- **You DO NOT** need to provision and manage VMs
- Start containers in seconds
- Azure App Service also supports deploying simple containers

Container Service

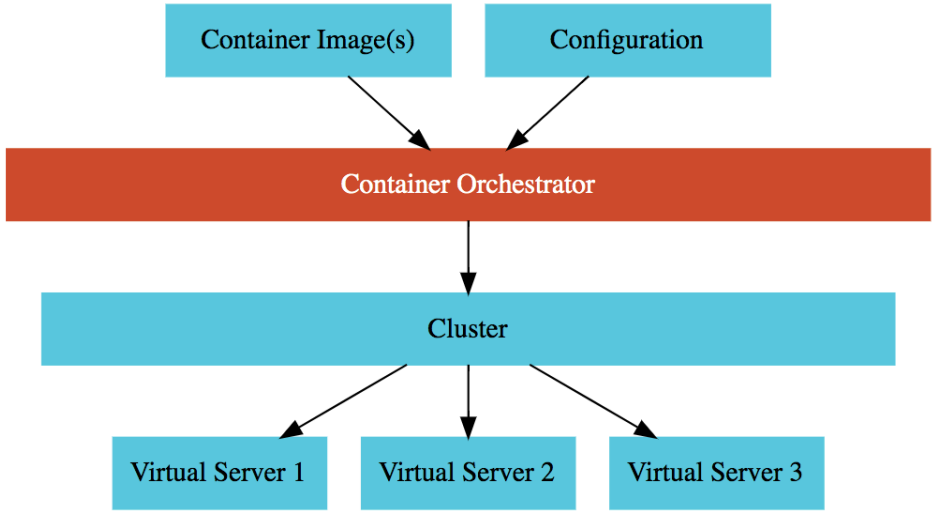
# Container Orchestration

- **Requirement** : I want 10 instances of Microservice A container, 15 instances of Microservice B container and ....
- Typical Features:
  - **Auto Scaling** - Scale containers based on demand
  - **Service Discovery** - Help microservices find one another
  - **Load Balancer** - Distribute load among multiple instances of a microservice
  - **Self Healing** - Do health checks and replace failing instances
  - **Zero Downtime Deployments** - Release new versions without downtime



# Container Orchestration - AKS and Service Fabric

- Using a Container Orchestrator:
  - 1: Create a Cluster
  - 2: Deploy & Orchestrate Microservices
- Azure Services:
  - Azure Kubernetes Service: Managed Kubernetes Service
  - Azure Service Fabric: Microsoft's container orchestrator



# Serverless

In28 Minutes

- What do we think about when we develop an application?
  - Where to deploy? What kind of server? What OS?
  - How do we take care of scaling and availability of the application?
- **What if you don't need to worry about servers and focus on your code?**
  - Enter **Serverless**
    - Remember: **Serverless does NOT mean "No Servers"**
- **Serverless for me:**
  - You **don't worry** about infrastructure (ZERO visibility into infrastructure)
    - Flexible scaling and automated high availability
  - Most Important: **Pay for use**
    - Ideally ZERO REQUESTS => ZERO COST
- **You focus on code** and the cloud managed service takes care of all that is needed to scale your code to serve millions of requests!
  - And you pay for requests and NOT servers!

# Azure Functions



Functions

- You don't worry about servers or scaling or availability
- You only worry about your code
- You pay for what you use
  - Number of requests
  - Duration of requests
  - Memory consumed
- Supports C#, Python, JavaScript, Typescript and Java

# SaaS (Software as a Service)

In28 Minutes

- **Centrally hosted software** (mostly on the cloud)
  - Offered on a subscription basis (pay-as-you-go)
  - Examples:
    - Email, calendaring & office tools (such as Outlook 365, Microsoft Office 365, Gmail, Google Docs)
    - Customer relationship management (CRM), enterprise resource planning (ERP) and document management tools
- **Cloud provider** is responsible for:
  - OS (incl. upgrades and patches)
  - Application Runtime
  - Auto scaling, Availability & Load balancing etc..
  - Application code and/or
  - Application Configuration (How much memory? How many instances? ..)
- **Customer** is responsible for:
  - Configuring the software!

# Shared responsibility model

# Azure Cloud Service Categories - Scenarios

In 28 Minutes

| Scenario | Solution |
|---|---|
| IaaS or PaaS or SaaS: Deploy Custom Application in Virtual Machines | IaaS |
| IaaS or PaaS or SaaS: Using Gmail | SaaS |
| IaaS or PaaS or SaaS: Using Azure App Service to deploy your app | PaaS |
| True or False: Customer is responsible for OS updates when using PaaS | False |
| True or False: Customer is responsible for Availability when using PaaS | False |
| True or False: In PaaS, customer has access to VM instances | False |
| True or False: In PaaS, customer can customize OS and install custom software | False |
| True or False: In PaaS, customer can configure auto scaling needs | True |
| True or False: In PaaS, customer can configure hardware needs (memory, cpu etc) | True |
| True or False: PaaS services only offer Compute services | False |

# Review - Azure Services for Compute

In28 Minutes

| Azure Service Name | Description |
|---|---|
| **Azure VMs** | Windows or Linux VMs (IaaS)<br>Use VMs when you need control over OS OR you want to run custom software<br>You handle Availability, Scalability, Load Balancing, Software/OS Updates ... |
| **Azure App Service** | PaaS. Deploy web apps, mobile back ends and RESTful APIs quickly.<br>Built-in Auto Scaling, Load Balancing |
| **Azure Container Instances** | PaaS (CaaS). Run isolated containers, without orchestration.<br>You DO NOT need to provision and manage VMs. Start containers in seconds. |
| **Azure Kubernetes Service** | PaaS (CaaS). Managed Kubernetes Service. Provides container orchestration. |
| **Azure Service Fabric** | PaaS (CaaS). Microsoft's container orchestrator.<br>Package, deploy, and manage scalable and reliable microservices<br>Run anywhere - on premises and in the cloud |
| **Azure Functions** | Serverless (FaaS) compute for event-driven apps |

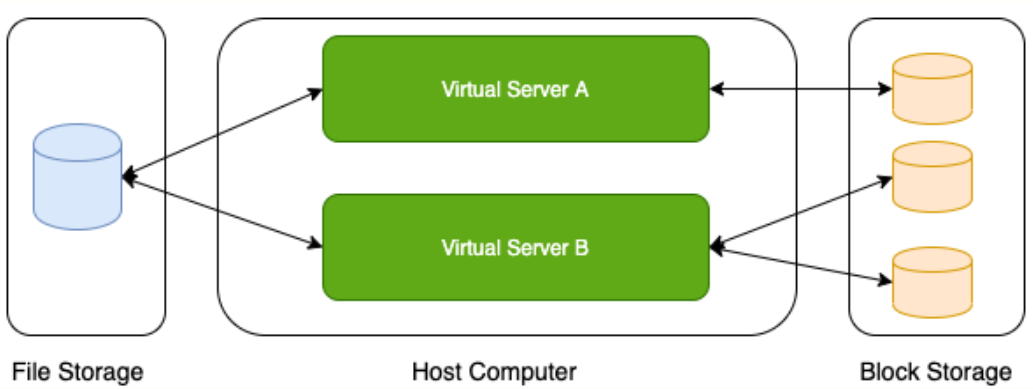
# Azure Compute Services - Scenarios

| Scenario | Solution |
| --- | --- |
| **You want to run function in response to events** | Azure Functions |
| **You want to deploy a Python application using a Managed Service** | Azure App Service |
| **You want to quickly deploy a container** | Azure Container Instances |
| **You want to setup a complex microservices architecture in Azure** | AKS or Service Fabric |
| **Your application needs customized OS and custom Software installed** | Azure VMs |

# Storage

# Storage Types - Block, File, Object, .....






- What is the type of storage of your hard disk?
  - **Block Storage**
- You've created a file share to share a set of files with your colleagues in a enterprise. What type of storage are you using?
  - **File Storage**
- You want to be able to upload/download objects using a REST API without mounting them onto your VM. What type of storage are you using?
  - **Object Storage**

# Azure Storage

In28 Minutes

- Managed Cloud Storage Solution
  - Highly available, durable and massively scalable (upto few PetaBytes)
- Core Storage Services:
  - **Azure Disks**: Block storage (hard disks) for Azure VMs
  - **Azure Files**: File shares for cloud and on-premises
  - **Azure Blobs**: Object store for text and binary data
  - **Azure Queues**: Decouple applications using messaging
  - **Azure Tables**: NoSQL store (Very Basic)
    - Prefer Azure Cosmos DB for NoSQL
- (PRE-REQUISITE) Storage Account is needed for Azure Files, Azure Blobs, Azure Queues and Azure Tables

Azure Storage

# Azure Storage - Data Redundancy

In28 Minutes

| Option | Redundancy | Discussion |
|---|---|---|
| **Locally redundant storage (LRS)** | Three synchronous copies in same data center | Least expensive and least availability |
| **Zone-redundant storage (ZRS)** | Three synchronous copies in three AZs in the primary region | |
| **Geo-redundant storage (GRS)** | LRS + Asynchronous copy to secondary region (three more copies using LRS) | |
| **Geo-zone-redundant storage (GZRS)** | ZRS + Asynchronous copy to secondary region (three more copies using LRS) | Most expensive and highest availability |

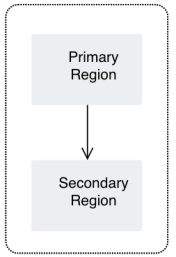
# Exploring Read-access storage redundancy options

In28 Minutes

- **Geo-redundant storage (GRS or GZRS)**: Replicates data to secondary regions
  - HOWEVER allows read/write access only after a failover
- **Read-access storage redundancy**: What if you need read access to data all the time from the secondary regions?
- **Two Options**:
  - **RA-GRS**: Read-access geo-redundant storage
  - **RA-GZRS**: Read-access geo-zone-redundant storage
- **Example URL Patterns**
  - **Primary**:myaccount.blob.core.windows.net
  - **Secondary**:myaccount-secondary.blob.core.windows.net

# Region pairs

- Data copies across regions => high availability + high durability
- Azure makes it easy to distribute data across regions (while retaining data in same geography) through **Region Pairs**
  - **Examples**: Central India & South India, East US & West US, North Europe (Ireland) & West Europe (Netherlands), ..
  - **Azure Storage Example**: If you use Geo-redundant storage (GRS) and choose region as East US
    - 3 copies stored in East US and 3 copies in the corresponding paired region - West US
    - Access data from primary region (East US)
    - Option to failover to secondary region (West US) if primary region is NOT available
- Region pairs have **very fast data connection**
- Azure tries to ensure that both regions (in a region pair) **do NOT have problems at the same time**
  - For Example: Software updates are done one region at a time



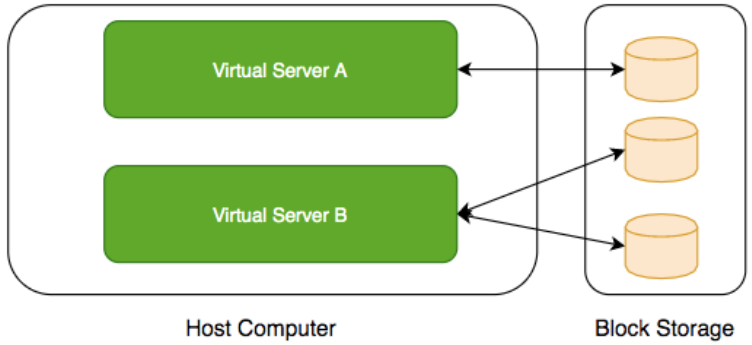
# Premium Storage Account: For High Performance

In28 Minutes

- **Standard General-Purpose Storage Accounts**: Recommended for most scenarios!
  - What we have looked at until now!
- **High Performance**: What if you need very high performance?
  - **Premium Storage Account**: Uses solid-state drives (SSDs) for low latency and high throughput
  - **Constraint**: Fewer Redundancy options (LRS, ZRS)
  - **Supported Premium Account Types**:
    - **Premium block blobs** - Blob Storage, Data Lake Storage
    - **Premium file shares**: Supporting both SMB and NFS file shares
    - **Premium page blobs**

# Block Storage

- Use case: Hard-disks attached to your computers
- Typically, ONE Block Storage device can be connected to ONE virtual server
- HOWEVER, you can connect multiple different block storage devices to one virtual server



# Azure Disks Storage

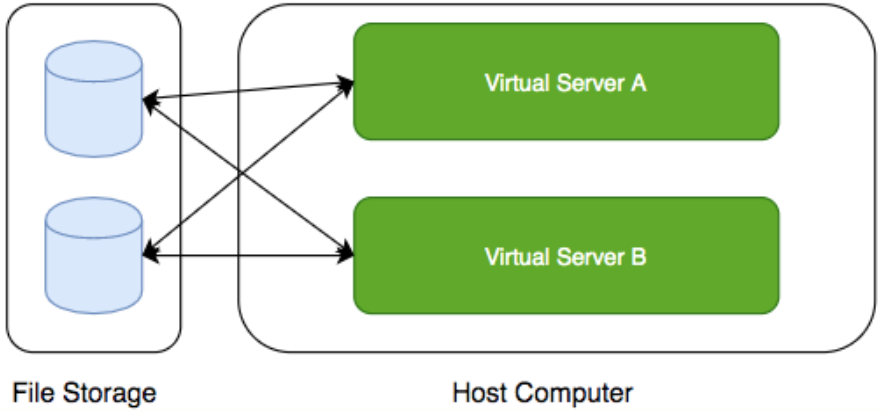
In28 Minutes

- **Disk storage**: Disks for Azure VMs
  - **Types**:
    - **Standard HDD**: Recommended for Backup, non-critical, infrequent access
    - **Standard SSD**: Recommended for Web servers, lightly used enterprise applications and dev/test environments
    - **Premium SSD disks**: Recommended for production and performance sensitive workloads
    - **Ultra disks (SSD)**: Recommended for IO-intensive workloads such as SAP HANA, top tier databases (for example, SQL, Oracle), and other transaction-heavy workloads
  - Premium and Ultra provide very high availability
- **Managed vs Unmanaged Disks**:
  - Managed Disks are easy to use:
    - Azure handles storage
    - High fault tolerance and availability
  - Unmanaged Disks are old and tricky (Avoid them if you can)
    - You need to manage storage and storage account
    - Disks stored in Containers (NOT Docker containers. Completely unrelated.)

Azure Storage

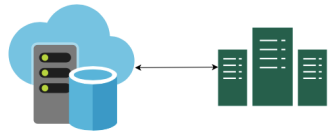
# Azure Files

- Media workflows need huge shared storage for things like video editing
- Enterprise users need a quick way to share files in a secure & organized way
- **Azure Files**:
  - Managed File Shares
  - Connect from multiple devices concurrently:
    - From cloud or on-premises
    - From different OS: Windows, Linux, and macOS
  - Supports Server Message Block (SMB) and Network File System (NFS) protocols
  - Usecase: Shared files between multiple VMs (example: configuration files)



# Azure File Sync





- **Windows file server**: Create file shares on-premises
- **Azure Files**: Create file shares on Azure
- Storing files in Azure Files is cheaper & easier to manage BUT Windows file server provides flexible connectivity options to on-premise apps and users
  - How about **having same connectivity to file shares for on-premises apps and resources** while storing them in Azure Files?
- **Azure File Sync**: File shares created in Azure Files. AND Retain flexibility and compatibility of Windows file server.
  - **Option**: Keep cache of frequently accessed files or have a full local copy
  - **Supports multiple protocols**: SMB, NFS, and FTPS
  - **Advantages**: Cheaper, easier to manage and can be used as cloud-side backup (Business continuity and disaster recovery)

# Azure Blob Storage

In28 Minutes

- **Azure Blob Storage**: Object storage in Azure
- **Structure**: Storage Account > Container(s) > Blob(s)
- Store massive volumes of unstructured data
  - **Store all file types** - text, binary, backup & archives:
    - Media files and archives, Application packages and logs
    - Backups of your databases or storage devices
- **Three Types of Blobs**
  - Block Blobs: Store text or binary files (videos, archives etc)
  - Append Blobs: Store log files (Ideal for append operations)
  - Page Blobs: Foundation for Azure IaaS Disks (512-byte pages up to 8 TB)
- **Azure Data Lake Storage Gen2**: Azure Blob Storage Enhanced
  - Designed for enterprise big data analytics (exabytes, hierarchical)
  - Low-cost, tiered storage, with high availability/disaster recovery

Azure Storage

# Azure Blob Storage - Access Tiers

In28 Minutes

- **Different kinds of data** can be stored in Blob Storage
  - Media files, website static content
  - Backups of your databases or storage devices
  - Long term archives
- **Huge variations**: In access patterns
- **Access tiers**: Can I pay a cheaper price for objects I access less frequently?
  - **Hot**: Store frequently accessed data
  - **Cool**: Infrequently accessed data stored for min. 30 days
  - **Cold**: Infrequently accessed data stored for min. 90 days
  - **Archive**: Rarely accessed data stored for min. 180 days

Azure Storage

# Azure Blob Storage - Access Tiers - 2

In28 Minutes

- **Complete Flexibility**: Change the access tiers of an object at any time to optimize cost and performance
- **Blob Level Configuration**: Access tiers can be set at **the blob level**, during or after upload
- **Storage Account Default Access Tier**: Can be Hot or Cool
  - (REMEMBER) The cold and archive access tiers aren't available as options for this setting
- **Archive Tier**: Lowest storage cost BUT Highest access cost
  - Access latency: In hours
  - To access: **Rehydrate** (Change access tier) OR
    - Copy to another blob with a changed access tier

Azure Storage

# Azure Queues and Tables

In28 Minutes

- **Azure Queues**: Decouple applications using messaging
- **Azure Tables**: NoSQL store (Very Basic)
  - Prefer Azure Cosmos DB for NoSQL

# Azure Storage Explorer

- **Azure Storage Explorer**: Manage Azure storage resources from desktop
  - **Free tool**: Supported on Windows, macOS, and Linux
    - **Integrates with**:
      - Azure Storage blobs, files, queues, and tables
      - Azure Data Lake Storage
      - Azure managed disks
  - **Features**: Upload, download files, manage permissions, ..
  - **Extensions available**: Data Factory extn - move data from AWS S3 to Azure Storage
  - Very similar to **Storage Explorer** and **Storage Browser** on Azure Portal
- (**Alternative**) **AzCopy**: Command-line utility
  - Copy files from local machine or other cloud storage to Azure Storage
  - (REMEMBER) Azure Storage Explorer uses AzCopy in the background
    - Use Azure Storage Explorer if you prefer a GUI
    - Use AzCopy if you like command line or you want to automate

Azure Storage

# Exploring Globally Unique Names in Azure

In28 Minutes

- **Do you know?** Storage account names are used as part of the URLs
  - **Blob Storage** - `https://<account-name>.blob.core.windows.net`
  - **Data Lake Storage Gen2** - `https://<account-name>.dfs.core.windows.net`
  - **Azure Files** - `https://<account-name>.file.core.windows.net`
- **Unique in Azure**: Storage account name must be unique within Azure
  - No two storage accounts can have the same name
- **Other Globally Unique Names**:
  - Azure SQL Database server names
  - Azure Cosmos DB account names
  - Azure App Service app names

# Azure Storage Services - Scenarios

In28 Minutes

| Scenario | Solution |
| --- | --- |
| **You need persistent storage for virtual machine disks** | Azure Disks |
| **You need to synchronize on-premises file shares with Azure, maintaining accessibility for on-premises applications** | Azure File Sync |
| **You need to store and analyze large-scale data for big data analytics** | Data Lake Storage |
| **You need high-performance storage with low latency and high throughput** | Premium Storage Account |
| **You need to store data that is very rarely accessed but must be retained for long periods. You want to keep costs as low as possible.** | Archive Storage |
| **Can you change access tier of an object at any time?** | Yes. You can **change access tiers** of an object **at any point in time**. |
| **Is it possible to create multiple storage accounts with same name in different resource groups?** | No. Storage account names are globally unique in Azure. |

# Database Fundamentals

# Databases Primer

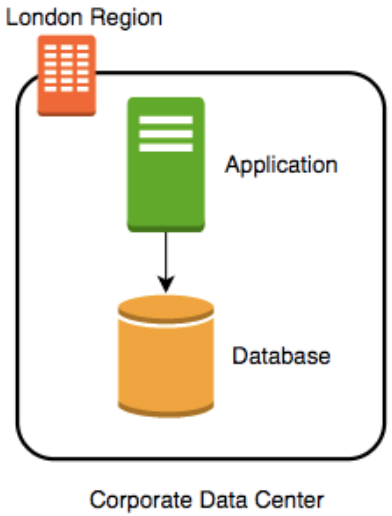
In28 Minutes

- Databases provide **organized** and **persistent** storage for your data
- To **choose between different database types**, we would need to understand:
  - Availability
  - Durability
  - RTO
  - RPO
  - Consistency
  - Transactions etc
- Let's get started on a **simple journey** to understand these

Database

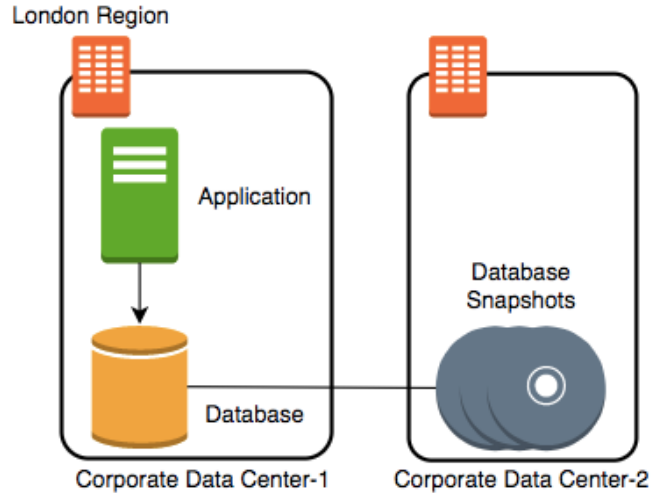
# Database - Getting Started

- Imagine a database deployed **in a data center in London**
- Let's consider some challenges:
  - **Challenge 1**: Your database will go down if the data center crashes or the server storage fails
  - **Challenge 2**: You will lose data if the database crashes



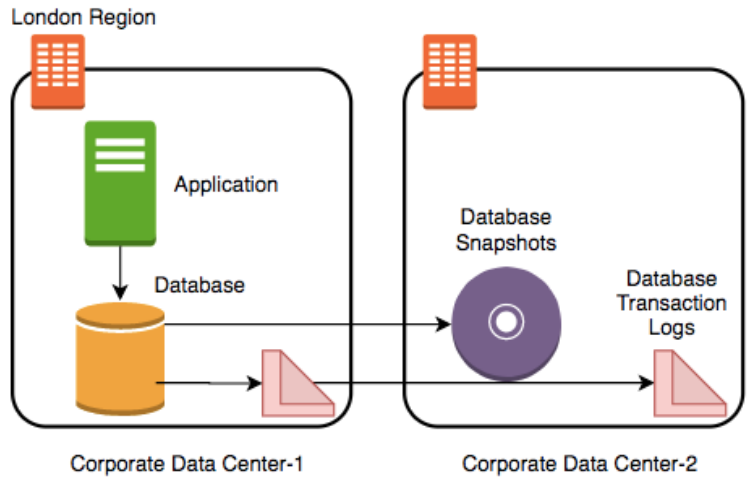
# Database - Snapshots

- Let's automate taking copy of the database (**take a snapshot**) every hour to another data center in London
- Let's consider some challenges:
  - **Challenge 1**: Your database will go down if the data center crashes
  - **Challenge 2** (PARTIALLY SOLVED): You will lose data if the database crashes
    - You can setup database from latest snapshot. But depending on when failure occurs you can lose up to an hour of data
  - **Challenge 3**(NEW): Database will be slow when you take snapshots



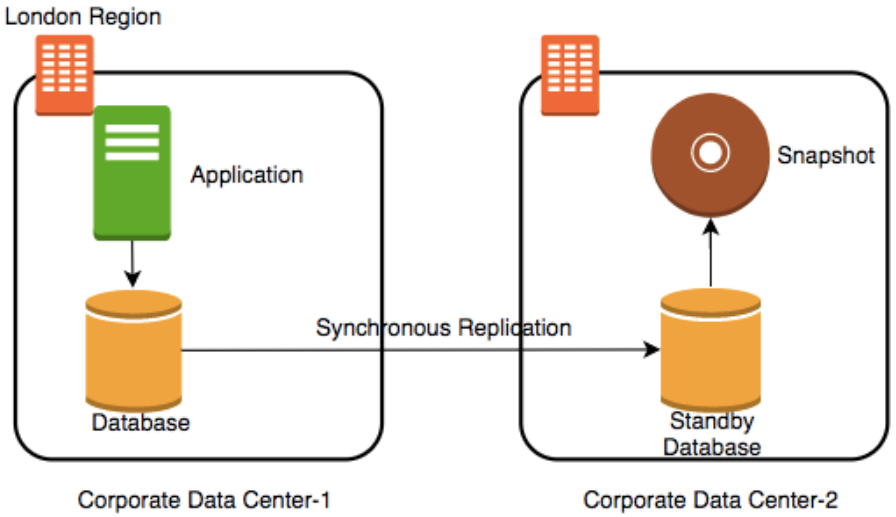
# Database - Transaction Logs

- Let's add **transaction logs** to database and create a **process to copy it over** to the second data center
- Let's consider some challenges:
  - **Challenge 1**: Your database will go down if the data center crashes
  - **Challenge 2** (SOLVED): You will lose data if the database crashes
    - You can setup database from latest snapshot and apply transaction logs
  - **Challenge 3**: Database will be slow when you take snapshots



# Database - Add a Standby

- Let's add a **standby database** in the second data center with replication
- Let's consider some challenges:
  - **Challenge 1** (SOLVED): Your database will go down if the data center crashes
    - You can switch to the standby database
  - **Challenge 2** (SOLVED): You will lose data if the database crashes
  - **Challenge 3** (SOLVED): Database will be slow when you take snapshots
    - Take snapshots from standby.
    - Applications connecting to master will get good performance always



# Availability and Durability

In28 Minutes

- **Availability**
  - Will I be able to access my data now and when I need it?
  - Percentage of time an application provides the operations expected of it
- **Durability**
  - Will my data be available after 10 or 100 or 1000 years?
- Examples of measuring availability and durability:
  - 4 9's - 99.99
  - 11 9's - 99.999999999
- Typically, an **availability of four 9's** is considered very good
- Typically, a **durability of eleven 9's** is considered very good

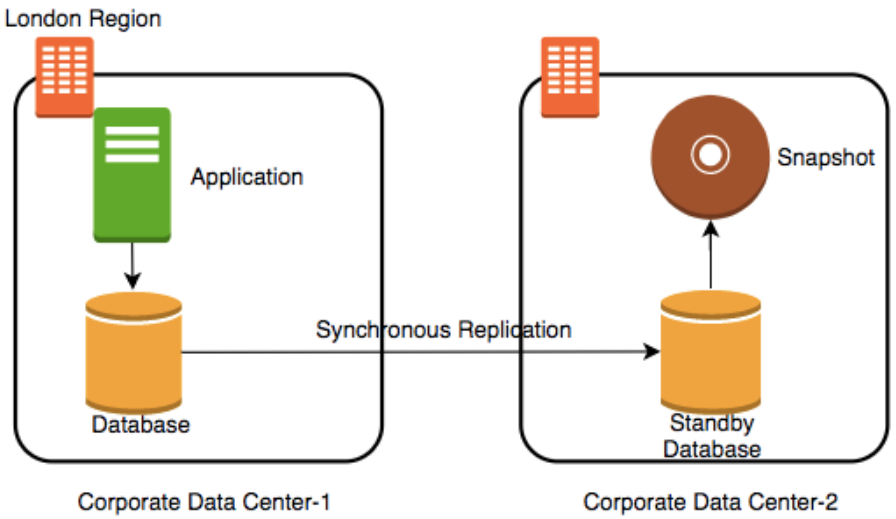
# Availability

In28 Minutes

| Availability | Downtime (in a month) | Comment |
|---|---|---|
| **99.95%** | 22 minutes | |
| **99.99% (4 9's)** | 4 and 1/2 minutes | Typically online apps aim for 99.99% (4 9's) availability |
| **99.999% (5 9's)** | 26 seconds | Achieving 5 9's availability is tough |

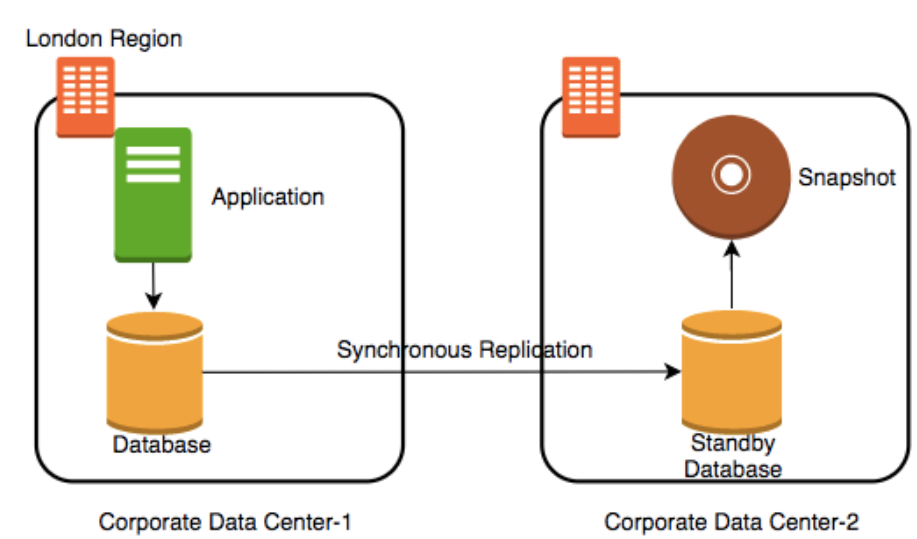
# Durability

- What does a **durability of 11 9's** mean?
  - If you **store one million files for ten million years**, you would expect to **lose one file**
- Why should durability be high?
  - Because **we hate losing data**
  - Once we lose data, it is gone



# Increasing Availability and Durability of Databases

- **Increasing Availability**:
  - Have multiple standbys available OR distribute the database
    - in multiple Zones
    - in multiple Regions
- **Increasing Durability**:
  - Multiple copies of data (standbys, snapshots, transaction logs and replicas)
    - in multiple Zones
    - in multiple Regions
- **Replicating data** comes with its own challenges!
  - We will talk about them a little later



# Database Terminology : RTO and RPO

In28 Minutes

- Imagine a **financial transaction being lost**
- Imagine a **trade being lost**
- Imagine a **stock exchange going down** for an hour
- **Typically** businesses are fine with some downtime but they hate losing data
- Availability and Durability are technical measures
- How do we measure **how quickly we can recover from failure**?
  - **RPO (Recovery Point Objective)**: Maximum acceptable period of data loss
  - **RTO (Recovery Time Objective)**: Maximum acceptable downtime
- Achieving **minimum RTO and RPO is expensive**
- **Trade-off** based on the criticality of the data

Database

# Question - RTO and RPO

In 28 Minutes

- You are running an application in VM instance storing its data on a persistent data storage. You are taking snapshots every 48 hours. If the VM instance crashes, you can manually bring it back up in 45 minutes from the snapshot. What is your RTO and RPO?
  - RTO - 45 minutes
  - RPO - 48 hours

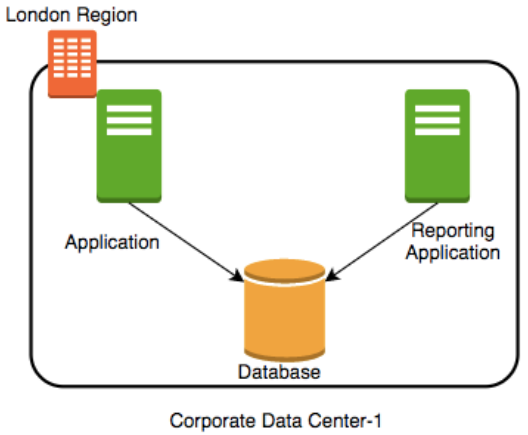
# Achieving RTO and RPO - Failover Examples

In28 Minutes

| Scenario | Solution |
| --- | --- |
| **Very small data loss (RPO - 1 minute)**<br>**Very small downtime (RTO - 5 minutes)** | **Hot standby** - Automatically synchronize data<br>Have a standby ready to pick up load<br>Use automatic failover from master to standby |
| **Very small data loss (RPO - 1 minute)**<br>**BUT I can tolerate some downtimes (RTO - 15 minutes)** | **Warm standby** - Automatically synchronize data<br>Have a standby with minimum infrastructure<br>Scale it up when a failure happens |
| **Data is critical (RPO - 1 minute) but I can tolerate downtime of a few hours (RTO - few hours)** | Create regular data **snapshots and transaction logs**<br>Create database from snapshots and transactions logs when a failure happens |
| **Data can be lost without a problem (for example: cached data)** | Failover to a completely new server |

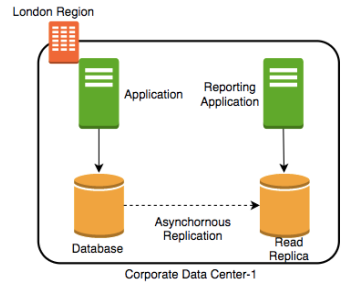
# (New Scenario) Reporting and Analytics Applications

- New reporting and analytics applications are being launched using the same database
  - These applications will ONLY read data
- Within a few days you see that the database performance is impacted
- How can we fix the problem?
  - **Vertically scale the database** - increase CPU and memory
  - **Create a database cluster (Distribute the database)** - Typically database clusters are expensive to setup
  - **Create read replicas** - Run read only applications against read replicas



# Consistency

- How do you ensure that data in multiple database instances (standbys and replicas) is updated simultaneously?
- **Strong consistency** - Synchronous replication to all replicas
  - Will be slow if you have multiple replicas or standbys
- **Eventual consistency** - Asynchronous replication. A little lag - few seconds - before the change is available in all replicas
  - In the intermediate period, different replicas might return different values
  - Used when scalability is more important than data integrity
  - Examples : Social Media Posts - Facebook status messages, Twitter tweets, Linked in posts etc
- **Read-after-Write consistency** - Inserts are immediately available
  - However, updates would have eventual consistency



# Database Categories

In 28 Minutes

- There are **several categories** of databases:
  - Relational (OLTP and OLAP), Document, Key Value, Graph, In Memory among others
- **Choosing type of database** for your use case is not easy. A few factors:
  - Do you want a **fixed schema**?
    - Do you want flexibility in defining and changing your schema? (schemaless)
  - What level of **transaction properties** do you need? (atomicity and consistency)
  - What kind of **latency** do you want? (seconds, milliseconds or microseconds)
  - **How many transactions** do you expect? (hundreds or thousands or millions of transactions per second)
  - **How much data** will be stored? (MBs or GBs or TBs or PBs)
  - and a lot more...

SQL Database

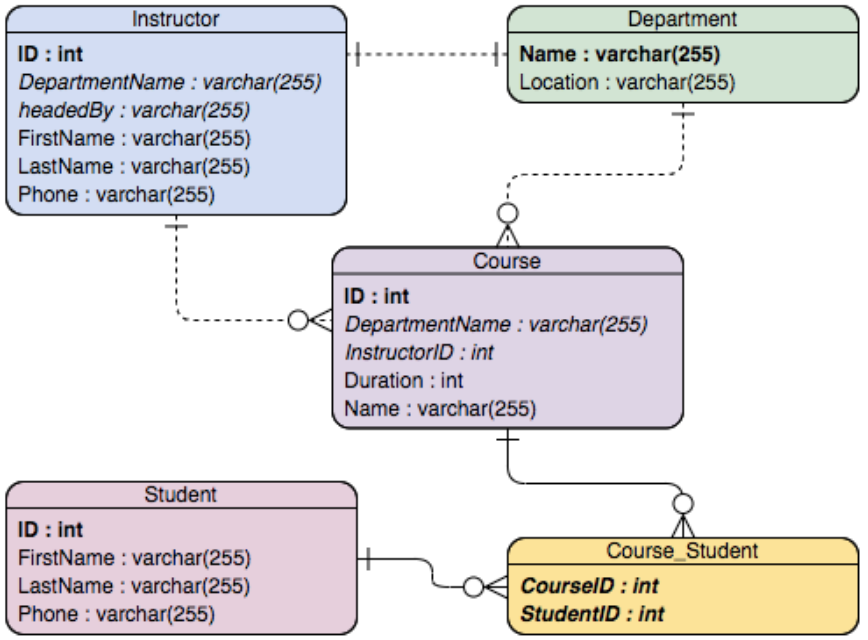

Cosmos DB


Azure Database PostgreSQL


Synapse Analytics

# Relational Databases

- This was the **only option** until a decade back!
- Most **popular (or unpopular)** type of databases
- **Predefined schema** with tables and relationships
- Very **strong transactional** capabilities
- Used for
  - OLTP (Online Transaction Processing) use cases and
  - OLAP (Online Analytics Processing) use cases



# Relational Database - OLTP (Online Transaction Processing)

In 28 Minutes

- Applications where **large number of users make large number of small transactions**
  - small data reads, updates and deletes
- **Use cases:**Most traditional applications - ERP, CRM, e-commerce, banking
- **Popular databases:**
  - MySQL, Oracle, SQL Server etc
- **Recommended Azure Managed Services:**
  - **Azure SQL Database**: Managed Microsoft SQL Server
  - **Azure Database for MySQL**: Managed MySQL
  - **Azure Database for PostgreSQL**: Managed PostgreSQL


SQL Database

Azure Database PostgreSQL

# Azure SQL Database

- **Fully Managed Service** for Microsoft SQL Server
- 99.99% availability
- **Built-in** high availability, automatic updates and backups
- Flexible and responsive serverless compute
- Hyperscale (up to 100 TB) storage


SQL Database

# Azure database for MySQL



- Fully managed, scalable **MySQL database**
- Supports 5.6, 5.7 and 8.0 community editions of MySQL
- 99.99% availability
  - Choose single zone or zone redundant high availability
- Automatic updates and backups
- Typically used as part of **LAMP (Linux, Apache, MySQL, PHP/Perl/Python)** stack


Azure Database MySQL

# Azure Database for PostgreSQL



- Fully managed, intelligent and scalable **PostgreSQL**
- 99.99% availability
  - Choose single zone or zone redundant high availability
- Automatic updates and backups
- **Single Server and Hyperscale Options**
  - Hyperscale: Scale to hundreds of nodes and execute queries across multiple nodes

Azure Database PostgreSQL

# Relational Database - OLAP (Online Analytics Processing)

In28 Minutes

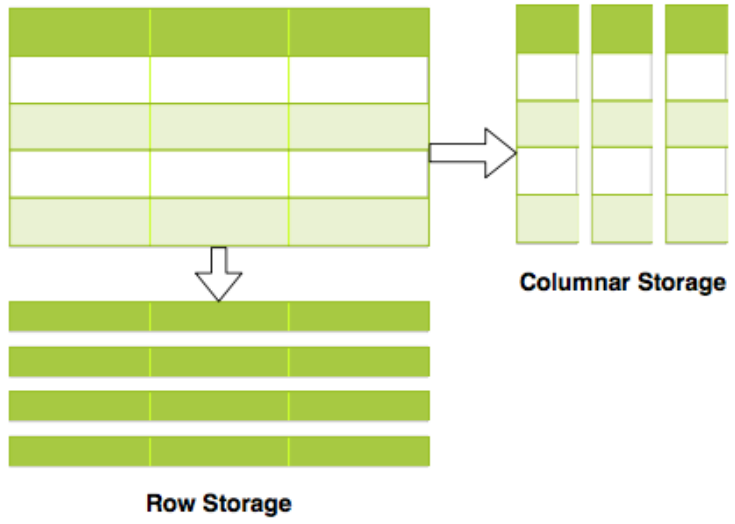
- Applications allowing users to **analyze petabytes of data**
  - **Examples** : Reporting applications, Data ware houses, Business intelligence applications, Analytics systems
  - **Sample application** : Decide insurance premiums analyzing data from last hundred years
  - Data is consolidated from multiple (transactional) databases
- Recommended Azure Managed Service
  - **Azure Synapse Analytics**: **Petabyte-scale** distributed data ware house
    - Provides a unified experience for developing end-to-end analytics solutions - Data integration + Enterprise data warehousing + Big data analytics
    - Enables MPP (massively parallel processing)
    - Run complex queries across petabytes of data
    - Earlier called Azure SQL Data Warehouse

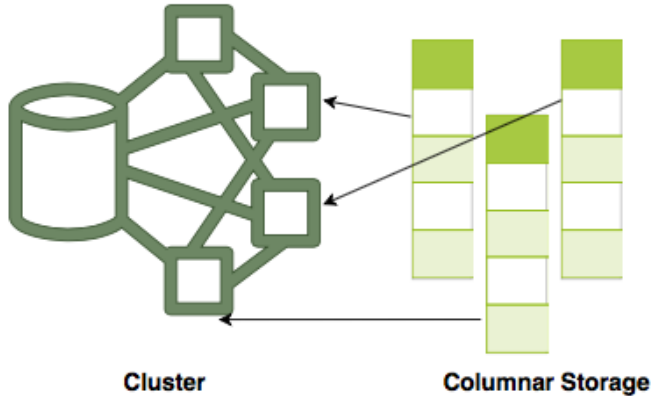
Synapse Analytics

# Relational Databases - OLAP vs OLTP

In28 Minutes

- OLAP and OLTP use **similar data structures**
- BUT **very different approach in how data is stored**
- **OLTP databases** use row storage
  - Each table row is stored together
  - Efficient for processing small transactions
- **OLAP databases** use columnar storage
  - Each table column is stored together
  - **High compression** - store petabytes of data efficiently
  - **Distribute data** - one table in multiple cluster nodes
  - **Execute single query across multiple nodes** - Complex queries can be executed efficiently



# NoSQL Databases

In28 Minutes

- **New approach** (actually NOT so new!) to building your databases
  - NoSQL = not only SQL
  - Flexible schema
    - Structure data **the way your application needs it**
    - Let the schema evolve with time
  - Horizontally scale to petabytes of data with millions of TPS
- **NOT a 100% accurate generalization** but a great starting point:
  - Typical NoSQL databases trade-off "Strong consistency and SQL features" to achieve "scalability and high-performance"
- **Azure Managed Service:**
  - Azure Cosmos DB

Cosmos DB

# Azure Cosmos DB



- **Fully managed NoSQL database service**
- **Global database**: Automatically replicates data across multiple Azure regions
  - Schemaless
  - Single-digit millisecond response times
  - 99.999-percent availability
  - Automatic scaling (serverless)
- Supports APIs for MongoDB (document), Cassandra (key/value) and Gremlin (graph)

# In-memory Databases

In28 Minutes

- **Retrieving data from memory is much faster than retrieving data from disk**
- In-memory databases like Redis deliver microsecond latency by storing **persistent data in memory**
- Recommended Azure Managed Service
  - **Azure Cache for Redis**
- **Use cases** : Caching, session management, gaming leader boards, geospatial applications

Cache for Redis

# Databases - Summary

In28 Minutes

| Database Type | Azure Services | Description |
|---|---|---|
| **Relational OLTP databases** | Azure SQL Database, Azure Database for MySQL, Azure Database for PostgreSQL etc. | Transactional usecases needing **predefined schema** and very **strong transactional** capabilities (Row storage) |
| **Relational OLAP databases** | Azure Synapse Analytics | Columnar storage with predefined schema. Datawarehousing & BigData workloads |
| **NoSQL Databases** | Azure Cosmos DB | Apps needing **quickly evolving** structure (**schema-less**)<br>MongoDB (document), Cassandra (key/value) and Gremlin (graph) |
| **In memory databases/caches** | Azure Cache for Redis | Applications needing **microsecond** responses |

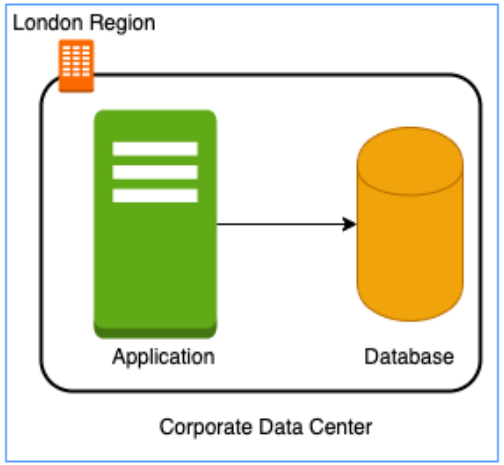
# Databases - Scenarios

| Scenario | Solution |
| --- | --- |
| **A start up with quickly evolving schema (table structure)** | Cosmos DB |
| **Single-digit millisecond response times for global application with millions of users** | Cosmos DB |
| **Transactional local database processing thousands of transactions per second** | Azure SQL Database OR Azure Database for MySQL OR Azure Database for PostgreSQL etc. |
| **Cache data (from database) for a web application** | Azure Cache for Redis |
| **Database for analytics processing of petabytes of data** | Azure Synapse Analytics |

# Networking

# Need for Virtual Network

- In a corporate network or an on-premises data center:
  - Can anyone on the internet **see the data exchange** between the application and the database?
    - **No**
  - Can anyone from internet **directly connect to your database**?
    - Typically **NO**.
    - You need to connect to your corporate network and then access your applications or databases.
- Corporate network provides a **secure internal network** protecting your resources, data and communication from external users
- How do you do create **your own private network** in the cloud?
  - Enter **Azure Virtual Network**



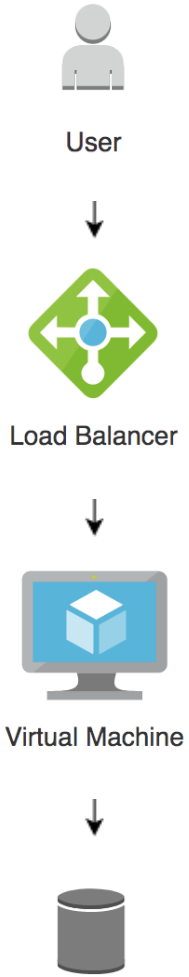
# Azure Virtual Network

- Your **own isolated network** in Azure
  - Network traffic within a Virtual Network is isolated (not visible) from all other Azure Virtual Networks
  - Each Virtual Network is created in a Region
- You **control all the traffic** coming in and going outside a Virtual Network
- **(Best Practice)** Create all your Azure resources (compute, storage, databases etc) **within a Virtual Network**
  - Secure resources from unauthorized access AND
  - Enable secure communication between your cloud resources

Virtual Network

# Need for Subnets

- Different resources are created on cloud
  - Databases, Compute (VMs) etc
- Each type of resource has **its own access needs**
- Load Balancers are accessible from internet (**public** resources)
- Databases or VM instances should NOT be accessible from internet
  - ONLY applications within your virtual network should be able to access them(**private** resources)
- How do you **separate public resources from private resources** inside a Virtual Network?
  - (Solution) **Create different subnets** for public and private resources
    - Resources in a public subnet **CAN** be accessed from internet
    - Resources in a private subnet **CANNOT** be accessed from internet
    - BUT resources in public subnet can talk to resources in private subnet



# Things to Remember - Virtual Network



- Every VM in a VNet is **assigned a private IP address**
  - You can assign a public IP address and make it static as well!
- VMs in the same VNet **can communicate** using private IP addresses
  - Even if they are in different subnets
- **Network peering** can be use to connect resources in different Virtual Networks
  - Peered Virtual Networks can be in different regions

# Azure network security

# Azure DDoS

In28 Minutes

- **(DDoS) attack**: Large scale attacks to bring your apps down
  - Result: App goes down or become slow. Huge bill because of unlimited auto scaling.
- **Two Azure DDoS offerings**:
  - DDoS Protection **Basic**: Protects against common network layer attacks
    - Intelligently identifies and blocks DDoS attacks
    - Enabled by default
    - No extra cost
  - DDoS Protection **Standard**:
    - Mitigates 60 different DDoS attack types
    - Provides attack analytics, metrics, alerting and reporting
    - Get quick support from DDoS Protection Rapid Response (DRR) team
    - Get a Cost guarantee ( Receive service credit if DDoS attack results in scale-out)
    - Enable it on the Azure virtual network
    - DDoS Protection Standard + Web Application Firewall = Powerful combination that protects at:
      - Network layer (Layer 3 and 4, Azure DDoS Protection Standard)
      - Application layer (Layer 7, WAF)

DDoS Plans

# Azure Firewall

In 28 Minutes

- **Managed network security service** to control traffic in and out of a Azure Virtual Network
  - Stateful: Once traffic in is allowed, traffic out is automatically allowed
  - Centralized Configuration: With one Azure firewall, you can control traffic to multiple virtual networks (having hundreds of resources) across multiple subscriptions
    - Example : If your enterprise has 10 virtual networks (across multiple subscriptions) with 100 VMs, you can control traffic with one Azure Firewall
  - Integrates with Azure Monitor: Provides logging and analytics
- **(REMEMBER) Web application firewall (WAF)**
  - Restrict traffic into web applications
    - OWASP etc
  - Supported by Azure Application Gateway, Azure Content Delivery Network

Firewalls

# Network Security Groups (NSG)

In28 Minutes

- **Azure Firewall is an external firewall** - outside your Virtual Network
  - **Network Security Group (NSG)** is like a internal firewall inside your Virtual Network right before your resources

NSG

- **Multiple inbound and outbound security rules:**
  - Allow or block traffic based on source/destination IP address, protocol and port
  - Restrict traffic between resources such as virtual machines and subnets
  - Attached with subnets and network interfaces
- **Usecases** : Allow access to web server only on port 80 and port 443 (HTTP/HTTPS)
  - Restrict database access only to web servers. Do NOT allow direct access to database from outside world/other servers.
  - Restrict outbound traffic from VMs to download software packages and system updates

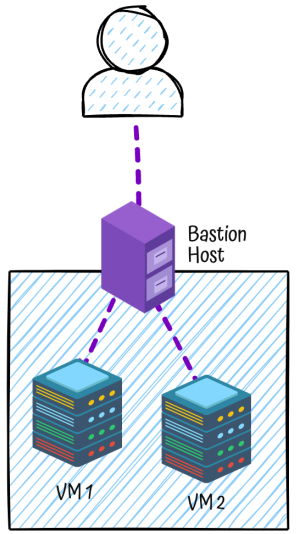
# Azure Private Link and Private Endpoint

In28 Minutes

- **Let's consider a use case:**
  - A web application is running on a VM deployed to a subnet in a VNet
  - Web application stores data in a SQL Database (An Azure Managed Service)
  - Need: All communication needs to be private (using private IP address)
- **SOLUTION**: Setup **private link** and connect using **private endpoint**
- **Azure Private Link**: Enables access to Azure PaaS Services (Azure Storage, Azure Cosmos DB, Azure SQL Database, ..) from resources in your VNet using private endpoints
  - All data that flows from a VM to SQL Database is isolated from the internet and stays on the Microsoft back end

# Bastion Host - What is it?

- **Bastion Host**: A special-purpose server designed to provide secure access to a private network from an external network
- **Secure Access**: Acts as a gateway, allowing secure access to internal resources
- **Monitoring**: Often equipped with monitoring and logging to track access and activity
- **Bastion Host in Major Cloud Platforms**:
  - **AWS**: AWS Bastion Host
  - **Azure**: Azure Bastion
  - **Google Cloud**: Google Cloud IAP (Identity-Aware Proxy)



# Azure Networking - Scenarios

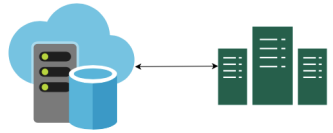
| Scenario | Solution |
| --- | --- |
| **You need to create a secure, isolated network in the cloud, similar to your corporate network** | Azure Virtual Network |
| **You want to connect resources in different Virtual Networks, potentially in different regions** | Network Peering |
| **You need protection against DDoS attacks for your applications** | Azure DDoS Protection (Basic or Standard) |
| **You want a managed network security service to control traffic across multiple virtual networks and subscriptions** | Azure Firewall |
| **You need to restrict traffic within your Virtual Network using internal firewalls** | Network Security Groups (NSGs) |
| **You need private access to Azure PaaS services from within your Virtual Network** | Azure Private Link and Private Endpoint |

# Hybrid Cloud

# Cloud Computing: Public vs Private vs Hybrid clouds

In 28 Minutes

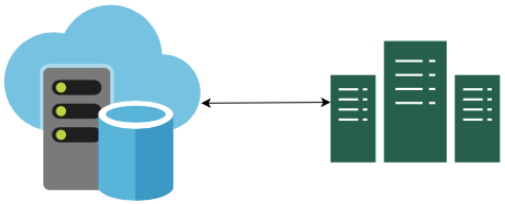
- Cloud Computing
  - Public Cloud
    - You host everything in the cloud (You DO NOT need a data center anymore)
      - No Capital Expenditure required
    - Hardware resources are owned by Azure (Microsoft)
      - Hardware failures and security of the data center are managed by Azure (Microsoft)
    - Summary: Hardware owned by Azure and shared between multiple tenants
      - Tenants: Customers who rent infrastructure (You, Me and other enterprises)
  - Private Cloud
    - You host everything in your own data center
      - Needs Capital Expenditure
      - Incur staffing and maintenance expenses for infrastructure
    - Delivers higher level of security and privacy
  - Hybrid Cloud :
    - Combination of both (Public & Private)
      - Use Public Cloud for some workloads and Private cloud for others
      - Example: Connecting an on-premise app to Azure Cosmos DB
    - Provides you with flexibility: Go on-premises or cloud based on specific requirement



# Hybrid Cloud: Connecting Azure with on-premises

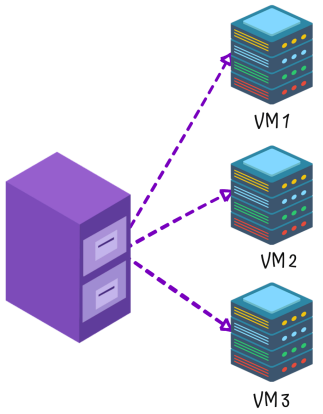


- **Options**: VPN and Azure ExpressRoute
  - **Azure VPN**: Encrypted connection from on-premises to Azure over internet
    - **Internet Based**: Encrypted communication over Internet (public)
    - **1: Point-to-site VPN**: From a computer to Azure
    - **2: Site-to-site VPN**: From your on-premises VPN device or gateway to the Azure VPN gateway in a virtual network
      - Needs VPN device or gateway on-premises
      - Need Azure VPN gateway in the Azure Virtual Network
  - **Azure ExpressRoute**: Private connectivity to Azure VNet
    - **Does NOT use internet**: Traffic does NOT go over internet
    - Provides very high bandwidth and very high security (private connection)
    - **No encryption**: Traffic is NOT encrypted by the connection



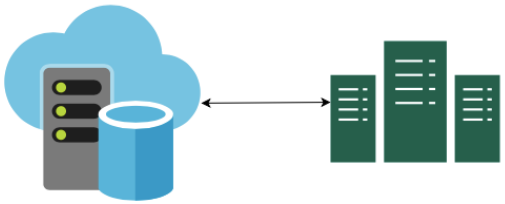
# VMWare - What is it?

- **VMWare**: A leading provider of virtualization software
- **Virtualization**: Allows multiple virtual machines (VMs) to run on a single physical server
- **Key Features**:
  - **Hypervisor**: Software that creates & manages VMs (e.g., VMware ESXi)
  - **Resource Optimization**: Efficiently uses hardware resources
  - **Scalability**: Easily create, modify, and scale VMs as needed
  - **Isolation**: Ensures each VM operates independently, without affecting others
  - **Cloud Support**: VMWare solutions are supported in major cloud platforms, enabling seamless migration to the cloud
    - AWS for VMware, Azure VMware Solution, Google Cloud VMware Engine



# Azure Arc

- **Consider a use case:**
  - Let's say I have Kubernetes deployments in multiple clouds and on-premises
  - Managing these independently has a number of challenges
  - I want to manage these from a centralized location
- **Azure Specific Solution for Hybrid Cloud**: Azure Arc
- Manage multi cloud and on-premise infrastructure from one place
- Supports centralized management of: VMware resources, Kubernetes clusters, SQL Server instances, on-premise physical and virtual machines



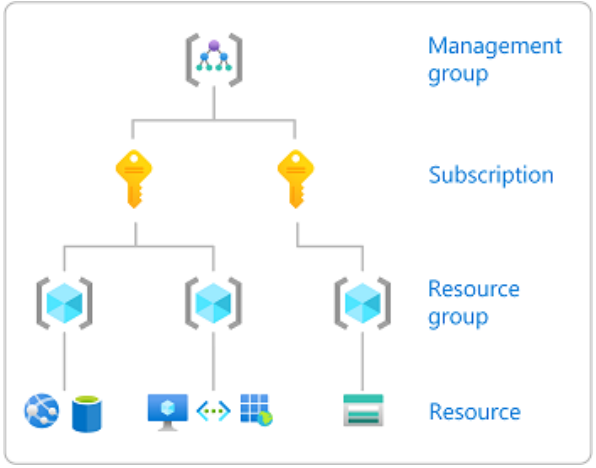
# Hybrid Cloud - Scenarios

| Scenario | Solution |
| --- | --- |
| **Type of cloud: You want to eliminate the need for a data center and use cloud infrastructure** | Public Cloud |
| **Type of cloud: You need dedicated infrastructure inside your data center** | Private Cloud |
| **Type of cloud: You need to connect an on-premise application to Azure services like Cosmos DB** | Hybrid Cloud |
| **You need an encrypted connection from on-premises to Azure over the internet** | Site-to-site VPN |
| **You need private, high-bandwidth connectivity to Azure without using the internet** | Azure ExpressRoute |
| **You have Kubernetes deployments across multiple clouds and on-premises and need centralized management** | Azure Arc |
| **You need centralized management for VMware resources, Kubernetes clusters, SQL Server instances, and physical/virtual machines** | Azure Arc |

# Organizing and Managing Azure Resources

# Azure Resource Hierarchy

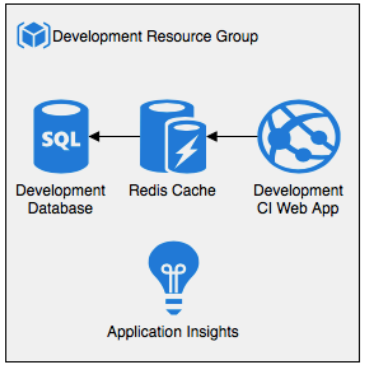
- **Hierarchy**: Management Group(s) > Subscription (s) > Resource Group (s) > Resources
  - **Resources**: VMs, Storage, Databases
  - **Resource groups**: Organize resources by grouping them into Resource groups
  - **Subscriptions**: Manage costs for resources provisioned for different teams or different projects or different business units
  - **Management groups**: Centralized management for access, policy, and compliance across multiple subscriptions
- **Remember**:
  - No hierarchy in resource groups BUT management groups can have a hierarchy

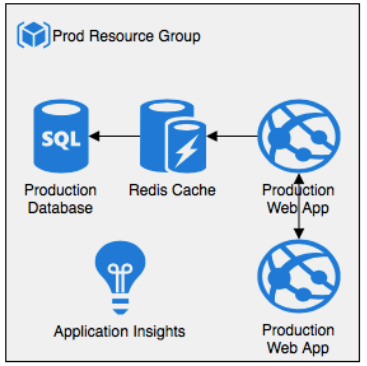



(*https://docs.microsoft.com/*)

# Resource Groups

- **Resource Group**: Logical container for resources
  - Associated with a single subscription
  - Can have multiple resources
    - (REMEMBER) A resource can be associated with one and only one resource group
  - Can have resources from multiple regions
  - Deleting it deletes all resources under it
- Tags assigned to resource group are not automatically applied to resources
  - HOWEVER, Permissions/Roles assigned to user at the resource group level are inherited by all resources in the group
- Resource Groups (like Management Groups) are free



# Subscriptions

In28 Minutes

- You need a Subscription to create resources in Azure
  - Subscription links Azure Account to its resources
- An Azure Account can have multiple subscriptions and multiple account administrators
- **When do you create a new subscription?**
  - I want to manage different access-management policies for different environments:
    - Create different subscriptions for different environments
    - Manage distinct Azure subscription policies for each environment
  - I want to manage costs across different departments of an organization:
    - Create different subscriptions for different departments
    - Create separate billing reports and invoices for each subscription (or department) and manage costs
  - I'm exceeding the limits available per subscription
    - Example: VMs per subscription - 25,000 per region

Subscriptions

# Subscriptions - Remember

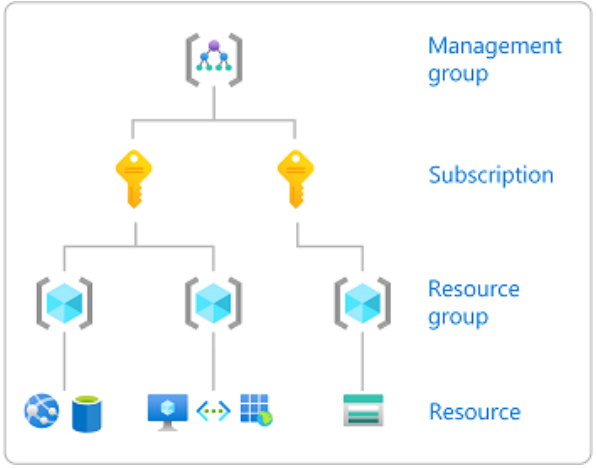
In28 Minutes

- Two Subscriptions **CANNOT be merged** into one
  - HOWEVER, you can move resources from one to another (ex: VMs)
  - You can also transfer ownership of a subscription (Needs owner role)
- If Subscription expires:
  - You will NOT be able to create new resources in the subscription
  - BUT you can continue to access the data stored
- Each subscription is associated with quotas:
  - You can raise a support request to increase some of the quotas
- You can convert a **Free Trial** to a **Pay as you go** subscription
- **Spending limit**: Prevents spending over your credit amount
  - Azure free account (spending limit: $200) or credit subscription types have default spending limits
  - You can't change spending limit BUT you can remove it

Subscriptions

# Management Groups

- Allows you to manage access, policies, and compliance across multiple subscriptions
  - Group subscriptions into **Management Groups**
  - All subscriptions & resources under a Management Group inherit all constraints applied to it
- (REMEMBER) You can create a hierarchy of management groups
- (REMEMBER) All subscriptions in a management group should be associated with the same Azure AD tenant

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# Creating a Naming and Tagging Strategy

In28 Minutes

- **Managing Thousands of Resources**: Enterprises typically have thousands of cloud resources
- **Questions to Address**:
  - Who owns these resources?
  - Who tracks them?
  - Who is responsible for the costs?

# Creating a Naming and Tagging Strategy - 2



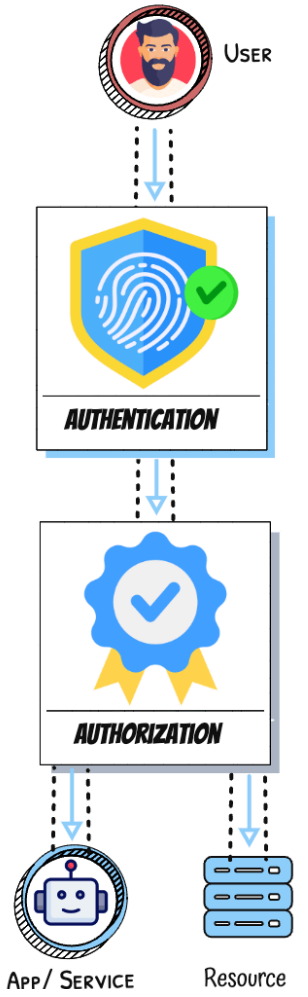
- **1: Naming Pattern**: Have a simple and consistent naming pattern
- **2: Assign Multiple Tags**: Assign tags to identify
  - Business unit, Application, Workload, Environment
  - Criticality level
- **Why?**: Helps in quickly locating and managing resources
- **Implementation**:
  - **ARM templates**: Use ARM templates to assign tags
  - **Azure Policy**: Utilize Azure Policy to enforce tagging rules and conventions

# Core Azure identity services

# Identity Management - What is it?

In28 Minutes

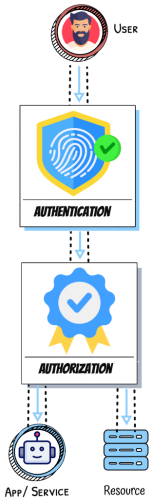
- **Diverse Resources**: You have cloud resources and internal/external applications
- **Varied Identities**: Both human and non-human identities need access to resources and perform actions
  - **Example Actions**: Launching, stopping, starting, or terminating a virtual server; performing actions through an internal application
- **User Identification**: How do you identify users?
- **User Permissions**: How do you configure what resources they can access? What actions they can perform?
- **Microsoft Entra ID** (formerly Azure Active Directory): Provides identity and access management services in Azure



# Identity Management - Key Things to Know

In28 Minutes

- **Authentication**: Is it the right user?
- **Authorization**: Do they have the right access?
- **Challenge**: Each app/service need to authenticate & authorize users
- **Localized Solutions?**: Would it be efficient for each app and service to store their own user details (including credentials)?
- **Centralized identity provider**: What if we can store the user details (including credentials) in a centralized way?
- **SSO (Single Sign-On)**: What if you can authenticate once and access multiple apps and services?



# Active Directory: What is it?

In28 Minutes

- **Active Directory**: Very popular Microsoft's proprietary directory service
  - **Authentication and Authorization**: Define users, credentials and their access rights
  - **Supports groups**: Manage user permissions and access through group policies
  - **On-premises**: Primarily used in on-premises environments for centralized identity and access management
- **Active Directory Federation Services (AD FS)**: Enables SSO
  - **Single Sign-On (SSO)**: Enables logging into multiple apps and services with the same credentials
  - **Convenience**: Simplifies user experience by reducing the need to remember multiple passwords

Users

# Microsoft Entra ID: What is it?

In 28 Minutes

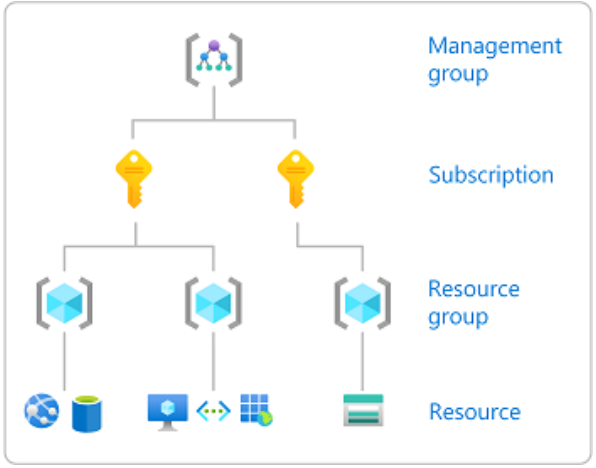
- **Microsoft Entra ID**: Active Directory Service in Azure
- **Features**:
  - **Authentication and Authorization in Azure**: Control internal/external users and access to applications and Azure resources
  - **Microsoft Entra MFA**: Enable MFA - Multi Factor Authentication (Use 2 of 3 authentication methods)
    - Something you know, typically a password.
    - Something you have, trusted device
    - Something you are, fingerprint or face scan
  - **Microsoft Entra self-service password reset**: Global Administrators can enable the feature to allow users to reset passwords by themselves
  - **SSO**: Enable applications to use Single Sign On

Users

# Role-Based Access Control (RBAC)

In28 Minutes

- **Configure Authorization**: Which resources does a user have access to and what can she do with them?
- **Role assignment has 3 parts**:
  - Who? (principal)
  - What Permissions? (role)
  - What Scope? (resource OR resource group OR subscription OR management group)
- **Example**: Give permissions across multiple VMs
  - Create VMs in the same resource group
  - Assign role at resource group level

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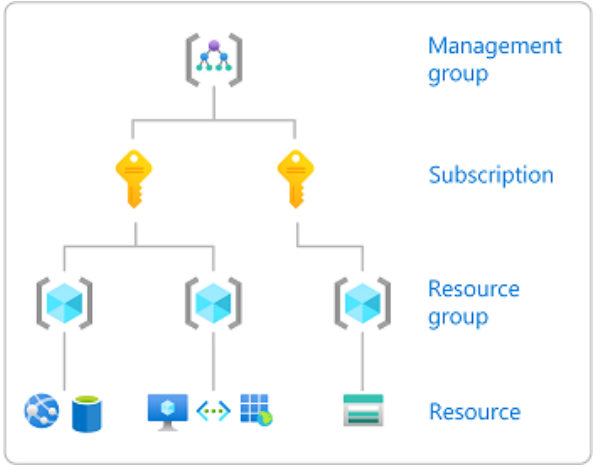
# Role-Based Access Control (RBAC) - Multiple Levels

In 28 Minutes

- RBAC Scope can be
  - Resource OR
  - Resource Group OR
  - Subscription OR
  - Management Group
- **Recommended Approach**: Azure role-based access control (Azure RBAC) assignment at the management group level
  - **Why?**: All subscriptions, resource groups, and resources underneath that management group would also inherit those permissions
  - **Advantage**: Simplified centralized access control

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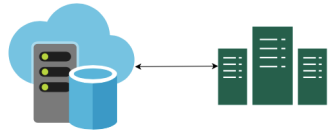
# Microsoft Entra Connect: What is it?

In28 Minutes

- **Microsoft Entra Connect**: Synchronize on-premises Active Directory with Microsoft Entra ID
- **User Details Synchronization**: Sync all user details, including passwords
- **Unified Identity**: Maintain a consistent identity across on-premises and cloud environments
- **Seamless Integration**: Ensures smooth interoperability between on-premises and cloud directories
- **Hybrid Identity**: Supports hybrid identity solutions, enabling access to both on-premises and cloud resources



# Exploring Microsoft Entra Domain Services



- **Active Directory (AD)**: Microsoft's very popular proprietary directory service
- **Microsoft Entra ID**: Managed Active Directory Service in Azure
- Microsoft Entra ID is a **toned down version** of AD (works very differently)
  - Microsoft Entra ID (flat structure) vs AD (hierarchical with organizational units - OUs and group policy objects - GPOs)
  - Microsoft Entra ID (Web Based protocols - OAuth, SAML, Open ID) vs AD (Kerberos, LDAP, NTLM)
- What if you want use managed domain services (Domain joining, group policy, LDAP, and Kerberos authentication) in Azure?
  - Use Microsoft Entra Domain Services

Users

# Exploring Microsoft Entra Conditional Access

In 28 Minutes

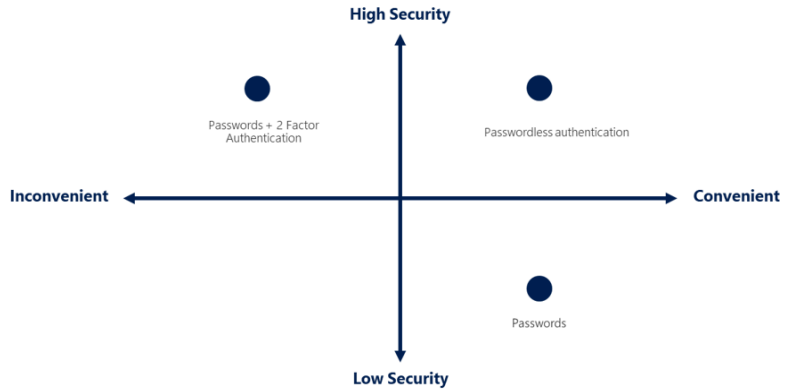
- When a user tries to authenticate, there are **three important signals**:
  - WHO is the user? (Administrator or Super User or User)
  - WHERE is she? (Which location? Is that a normal location for that user?)
  - WHAT device is she using? (Is this the device she usually logs in from?)
- **Can we build intelligence** based on this information?
  - If the user is an administrator, mandate MFA
  - If the user is logging in from unapproved devices, deny access
  - If a user is logging in from a previously known location using a previously used device, allow access without MFA
  - If a user is logging in from an unknown or unexpected location (different country, for example), mandate MFA or even deny access
- **Conditional Access**: Granular MFA experience

Conditional Access

# Passwordless authentication for Microsoft Entra ID

In28 Minutes

- **Complex security frustrates users:** MFA - User needs to remember passwords & have a security device
- How about simplifying security by going passwordless?
  - **Microsoft Entra ID - three options:**
    - **Windows Hello for Business:** Credentials tied to PC (For enterprise users who always perform tasks from their own PCs)
    - **Microsoft Authenticator app:** Uses employee's phone for authentication (iOS or Android phone)
    - **FIDO2(Fast IDentity Online) security keys**
      - **FIDO** - open standard for passwordless authentication
      - **FIDO2** - enables users to use common devices to authenticate to online services (mobile and desktop)



# Microsoft Entra ID & Azure Subscriptions - Remember

In 28 Minutes

- Subscription has a **trust relationship** with Microsoft Entra ID
  - Trusts Microsoft Entra ID to authenticate users, services, and devices
  - Multiple subscriptions can trust the same Microsoft Entra ID directory
  - However, each subscription can only trust only one directory
- **You can transfer** an Azure subscription to a different Microsoft Entra ID directory
- **When an Azure subscription expires:**
  - Associated Microsoft Entra ID tenant is not deleted
  - You can link it with a different subscription

Active Directory

Subscriptions

# More Azure Security

# Microsoft Defender for Cloud




- **Cloud security posture management (CSPM)**: Automate identification & remediation of security risks of your cloud configuration
- **Cloud workload protection (CWP)**: Continuously monitor and fix threats to workloads deployed in the cloud
- **Microsoft Defender for Cloud**: Azure's solution for CSPM and CWP
  - Formerly called Azure Security Center
  - Protect your multicloud and hybrid cloud environments

# Microsoft Defender for Cloud - Features




- **Continuous assessment** - Understand your current security posture
  - Provides a **secure score** - higher the better
- **Secure** - Harden all connected resources and services
  - Provides recommendations to improve your security posture
  - Automated fixes for many recommendations ("Fix" button)
- **Defend** - Detect and resolve threats to resources and services
  - Detects threats to your resources and workloads
  - Get immediately alerted by e-mail and IT Service Management solutions

# Exploring Just-in-Time (JIT) VM Access



- **Security Challenge**: Open management ports, like RDP or SSH, are potential targets for attacks
- **Our Goal**: Reduce the attack surface of your virtual machines
- **Block Inbound Traffic**: Prevent unwanted inbound traffic to your VMs
- **JIT VM Access**: Enable Just-in-Time (JIT) VM Access
  - **User Access Verification**: When access is requested, Microsoft Defender for Cloud verifies if the user has the appropriate permissions
  - **Dynamic Configuration by Defender for Cloud**: Network Security Groups (NSGs) and Azure Firewall are configured to allow inbound traffic with constraints:
    - Permit access to the specified ports
    - Restrict access to the relevant IP address
    - Grant access for a specified amount of time

# Security is Complex - CSPM vs SIEM vs SOAR

In 28 Minutes

- **Cloud Security Posture Management (CSPM)**: Find cloud misconfigurations by evaluating configurations automatically and continuously
  - **Best Practices**: Check Adherence to best practices and compliance rules
- **Security Information and Event Management (SIEM)**: Collect and analyze log data from various sources to identify potential threats
- **Security Automation, Orchestration, and Response (SOAR)**: Prioritizes alerts based on threat levels
  - Automate responses to threats, when possible

# Microsoft Sentinel - SIEM & SOAR

In 28 Minutes

- **Comprehensive SIEM and SOAR Solution**: Microsoft Sentinel provides a powerful, cloud-native SIEM & SOAR solution
  - SIEM: Security information and event management
  - SOAR: security orchestration, automation, and response
- **Centralized Security Dashboard**: Provides Bird's-eye security view across your enterprise
- **Modern SOC**: Modernize your Security Operations Center (SOC) with advanced threat detection, investigation, and response capabilities

# Microsoft Sentinel - SIEM & SOAR - 2



- **Scalable and Flexible**: Elastically scale as your organization grows, with no need for on-premises infrastructure.
- **Event Storage**: Store events in Azure Monitor Log Analytics workspace or Azure Storage Account
- **Automation and Playbooks**:
  - **Automated Response**: Automatically fix issues with built-in automation capabilities
  - **Playbooks**: Use playbooks to automate and orchestrate response actions

# Azure Key Vault

In28 Minutes

- **Securely store and access secrets**
  - Examples: API keys, passwords, certificates, or cryptographic keys
- Provides access monitoring and access control for secrets
- (Best Practice) Do NOT store secrets or passwords (example, database passwords) in your application code or configuration
  - Use Azure Key Vault

# Zero Trust

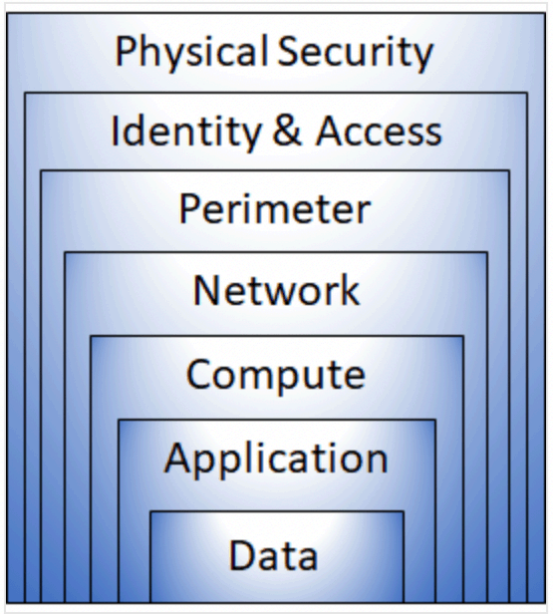
In 28 Minutes

- Work (and employees) are increasingly going remote AND
- Intensity and sophistication of cyber-attacks is growing everyday
- **How can enterprises prepare for this new reality?**
  - **Zero Trust**: Microsoft's modern security strategy
  - **Zero Trust Principles**:
    - **Verify explicitly**: Use all info - identity, location, device, resource, data classification, time
    - Use **least privilege access**
    - **Assume breach**
  - **A few best practices**:
    - Apply zero trust: Human & non-human identities, networks, microservices, virtual machines, and workloads
    - End-to-end encryption
    - Continuous monitoring
    - Continuous updates to devices
    - Automated threat detection and response

# Security Best Practice - Defense in Depth

In28 Minutes

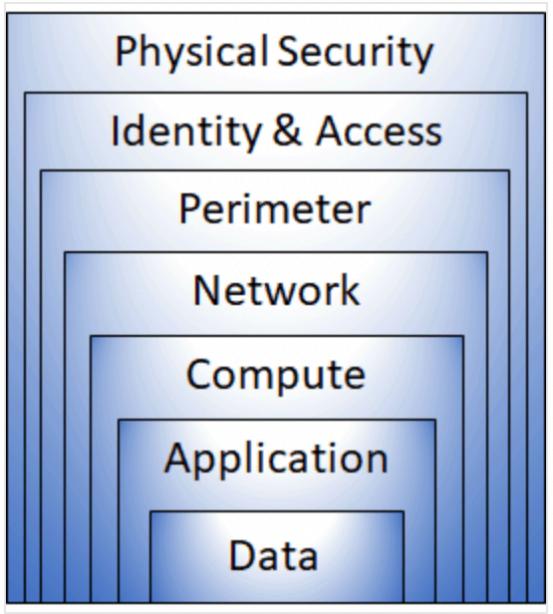
- **A chain is only as strong as its weakest link** - Secure at all levels
- **Physical security**: Control access to physical infrastructure (Microsoft's Responsibility)
- **Identity and access**: Proper Identities with RBAC. Use SSO & MFA.
- **Perimeter**: Azure DDoS Protection + Azure Firewall
- **Network**: Limit network connectivity. Restrict internet access (inbound and outbound).
  - Restrict communication between resources



# Security Best Practice - Defense in Depth - 2

In28 Minutes

- **Compute**:Secure access to virtual machines
  - Implement endpoint protection
  - Ensure that OS and software patches are applied
- **Application**: Think of security from day one!
  - Implement security best practices depending on language and framework
  - Store secrets in Azure Key Vault
- **Data**: Encrypt data at rest and in transit
- **Best Practice**: Implement security at all levels!



# Azure management tools

# Azure Support Plans

In28 Minutes

- **Plans**: Basic, Developer, Standard, Professional Direct (ProDirect)
  - **Earlier plans** - Premier, Professional Direct, Standard and Basic


- **Features supported for ALL plans**
  - Billing and subscription management support
  - Ability to submit as many support tickets as you need
  - Azure Advisor (Automated Azure best practices)
  - Azure health status and notifications
  - 24/7 self-help resources:
    - Documentation and community support (Forums - MSDN, StackOverflow)
- **Supported by Professional Direct ONLY**
  - Support API (Create support tickets programmatically)
  - ProDirect delivery managers: Get proactive guidance. Request for service reviews and advisory consultation.
  - Webinars led by Azure engineers

# Azure Support Plans - Comparison

In 28 Minutes

| Feature | Basic | Developer | Standard | Professional Direct |
|---|---|---|---|---|
| **Price** | FREE | $ | $$ | $$$$$$ |
| **Scope** | All | Trial and non-production environments | Production environments | Business-critical applications |
| **Email & Phone support** | NOT APPLICABLE | During business hours by email only | 24 X 7 | 24 X 7 |
| **Response time SLA** | NOT APPLICABLE | Sev C:8 hours | Sev C:8 hours, Sev B:4 hours, Sev A: 1 hour | Sev C:4 hours, Sev B:2 hours, Sev A: 1 hour |
| **Architecture Support** | NA | General guidance | General guidance | Guidance from a pool of ProDirect delivery managers |

# Azure Advisor

In28 Minutes

- **Automated recommendations** to improve reliability, security & performance, achieve operational excellence & reduce costs
  - Take immediate actions or schedule or dismiss
  - Supports notifications for new recommendations
  - Filter recommendations by subscriptions, resource groups or service
  - Step-by-step guidance and quick actions for fast remediation
  - Gives you a **total score**: Score improves as you take remedial actions
  - **Example Recommendations**:
    - Reliability: Protect your VM data from accidental deletion (Identify VMs where backup isn't enabled)
    - Reliability: Create Azure Service Health alerts to be notified when Azure problems affect you
    - Cost optimization: Optimize VM spend by resizing or shutting down underutilized instances
    - Cost optimization: Optimize spend for MySQL, and PostgreSQL servers by right-sizing
    - Cost optimization: Delete unassociated public IP addresses to save money
    - Cost optimization: Use lifecycle management

# Azure Monitor

In28 Minutes

- **Gather, analyze and visualize logs and metrics:**
  - From Azure and on premise resources
  - Monitor resources across multiple subscriptions
  - Proactively identify issues and trigger alerts/automated actions
  - Things you can do with Azure Monitor:
    - **Application Insights**: Detect & diagnose application issues
    - **VM insights**: Monitor performance & health of your VMs and VM scale sets
    - **Container insights**: Monitor performance of container workloads (AKS, ACI etc)
    - **Log Analytics**: Trouble shoot issues using monitoring data extracted from logs
    - **Create smart alerts** (SMS, emails etc) and attempt to automatically take corrective action
      - Automatically send an alert if an Azure VM is stopped
      - Trigger alerts based on data in an Azure Log Analytics workspace
      - Auto scale based on thresholds
    - Create visualizations with Azure dashboards
    - Collect data from monitored resources using Azure Monitor Metrics
    - Monitor Azure Active Directory logs

# Exploring Azure Log Analytics

- **Azure Monitor Logs**: Collects log and performance data from monitored resources
  - **Where is the data stored?**: Log Analytics workspace
    - You can use a single workspace for all your data collection
    - OR you can create multiple workspaces based on your location, access and retention needs
  - **Where does the data come from?**: Azure Monitor and other Azure services, such as Microsoft Sentinel and Microsoft Defender for Cloud
- **Azure Log Analytics**: Write and run log queries on the data
  - **Example 1**: Aggregating logs from multiple VMs
  - **Example 2**: Analyzing logs from Microsoft Sentinel

# Reliability and Predictability in the Cloud

In 28 Minutes

- **Reliability**: Ensuring continuous operation & automatic recovery from failures
  - **Multi-region Deployment**: Deploy apps in multiple regions and zones
  - **Automatic Recovery**: Initiate automatic recovery actions in case of failures
- **Predictability**: Ensuring consistent performance and costs
  - **Performance Predictability**:
    - **Autoscaling**: Automatically adjust resources based on demand
    - **Load Balancing**: Distribute traffic evenly across multiple servers
  - **Cost Predictability**:
    - **Cost Estimation Tools**: Use tools like Total Cost of Ownership (TCO) and Pricing Calculator to estimate cloud spending
    - **Resource Monitoring**: Utilize Azure Monitor to track resource usage in real time

# Azure Service Health




- **Personalized alerts and guidance** for Azure service issues
  - Personalized based on your Azure usage - subscriptions, services and regions
  - Notifies about Azure service incidents & planned maintenance
    - Best place to know about outages, issues and planned maintenance
  - **Best Practice**: Set up Service Health alerts
    - Get notified about service issues
    - Channels: email, SMS, push notification, webhook etc
- **Hierarchy**: Azure Status > Azure Service Health > Azure Resource Health
  - Azure Status: Global view of the health of Azure services and regions
  - Azure Service Health : Personalized dashboard based on your Azure usage
  - Azure Resource Health : Provides information about the health of your individual cloud resources such as a specific virtual machine instance
- Azure service health **can only inform** (CANNOT prevent failure)

# Azure Management Services - Scenarios

In 28 Minutes

| Scenario | Solution |
|---|---|
| **Get details of upcoming planned outages for services you are making use of** | Azure Service Health |
| **Get details of services which will be decommissioned based on your Azure usage** | Azure Service Health |
| **Get alerts for new recommendations to improve reliability, security and performance, achieve operational excellence and reduce costs** | Azure Advisor |
| **Set up alerts for incidents & planned outages for services you are making use of** | Azure Service Health |
| **Set up alerts for issues specific to your resources - VM goes down or Database goes down or Autoscaling is triggered** | Azure Monitor |
| **Solve your application related issues** | Azure Monitor (Application Insights) |

# Azure Management Services - Scenarios - 2

In28 Minutes

| Scenario | Solution |
|---|---|
| Get suggestions on how to reduce costs of your Azure resources | Azure Advisor |
| Get suggestions on how to improve reliability of your Azure resources | Azure Advisor |
| Get suggestions on how to improve security of your Azure resources | Azure Advisor |
| You want to find out if you are adhering to recommended Azure best practices | Azure Advisor |
| Track performance of a specific database or a VM instance | Azure Monitor |
| Gather metrics that are tailored for your application | Azure Monitor |

# Azure governance features

# Azure Policy

In28 Minutes

- **How do you ensure that resources stay compliant with your policies?**
  - Create, assign, and manage policies
    - Automatically ensure that resources stay compliant with defined standards and SLAs
  - Manage compliance of resources across multiple subscriptions
  - Assigned to a management group, a single subscription, or a resource group
- **Initiatives**: Group of policies
  - Azure provides some predefined initiatives:
    - Azure Security Benchmark, UK OFFICIAL and UK NHS, HIPAA etc
    - View them under `Policy> Authoring > Definitions`
- **Compliance dashboard**: Aggregated view of the overall compliance with options to drill down to specific resource/policy
- **Use cases**: Governance for resource consistency, regulatory compliance, security, cost, and management

# Azure Policy - Examples and more..

In28 Minutes

- **Examples:**
  - Only allow creation of VMs of specific sizes
  - Only allow creation of resources in a specific region
  - Automatically tag all resources in a resource group with the same tags as that of the resource group
  - MFA should be mandatory for certain types of accounts
- Existing non-compliant resources will be marked as non-compliant
  - But they will continue to work as is
- Policy evaluation is **NOT immediate**
  - Approx: once every hour

# Azure Blueprints

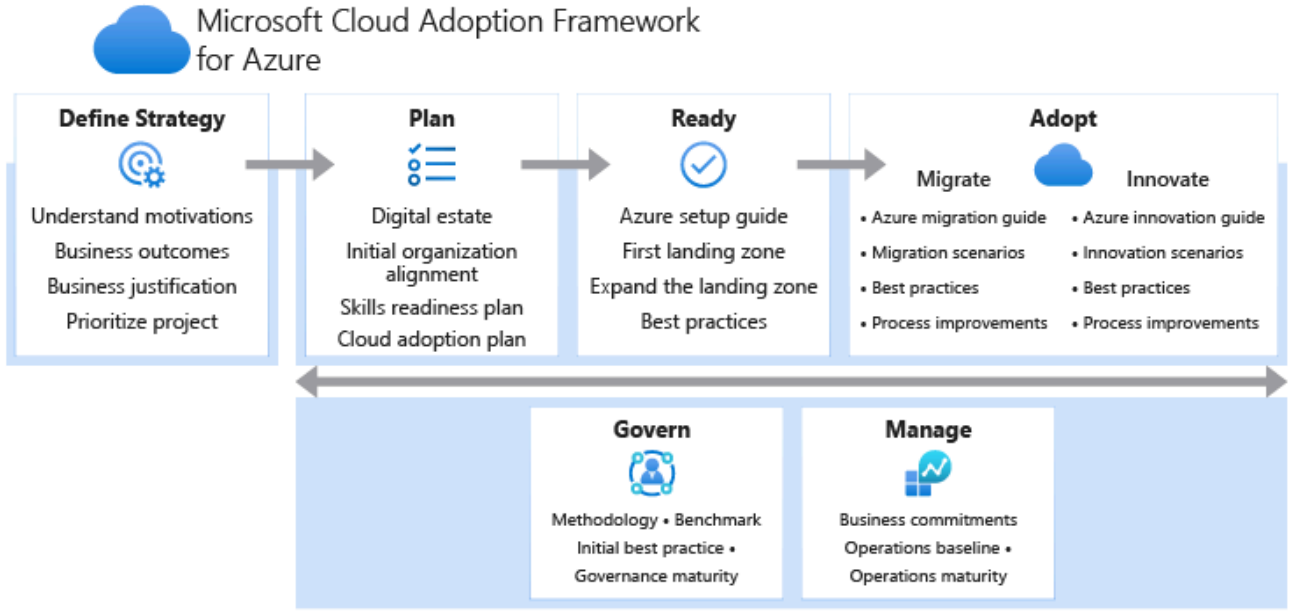
In28 Minutes

- **Azure Blueprint** = One or more of (Policy + Role + ARM template + Resource Group) configurations
  - Different pre-built blueprints available
    - Australian Government, UK OFFICIAL, Azure Security Benchmark, Basic Networking, Common Policies (Set of popular policies to apply to a subscription), FedRAMP, HIPAA etc

Blueprints

- **Your architecture team can create blueprints** adhering to your organization's standards, patterns, and requirements
  - And your teams use the blueprints to create Azure resources
    - Blueprints can be assigned to individual subscriptions
    - Blueprints can be used to set up resource groups within subscriptions
  - Helps teams to quickly set up environments adhering to organizational standards
    - You can even setup an automated CI/CD pipeline

# Cloud Adoption Framework for Azure




(*https://docs.microsoft.com/*)

# Resource Locks

In28 Minutes

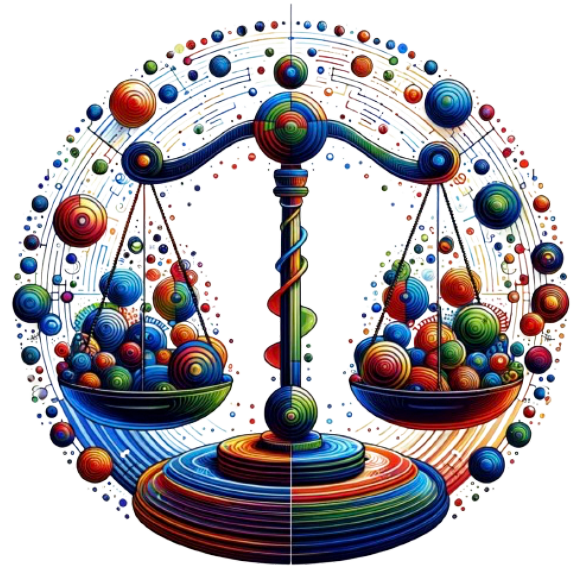
- **Prevent accidental deletion/modification** of resources:
  - **Applicable at multiple levels**: subscription, resource group, or resource
    - Azure Resource inherits locks from its resource group and subscriptions
  - Two options: CanNotDelete and ReadOnly
  - Locked resource should be unlocked before it can be changed (even by owners)
- **Two Options**:
  - ReadOnlyLock : Authorized users can read BUT they can't delete or update the resource
  - CannotDelete : Authorized users can read and modify BUT they can't delete the resource
- **Example** : If a Resource Group has a Delete Lock, then administrator can first remove DELETE lock before she can delete the resources
- You can have multiple locks at different levels

Resource Groups

Subscriptions

# The Need for Data Governance

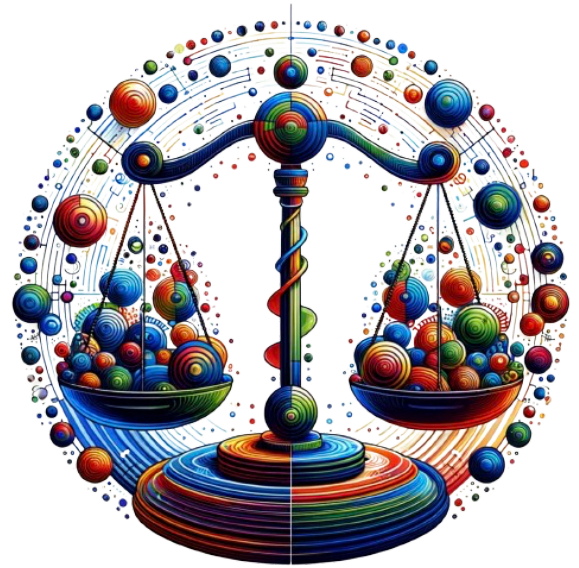
- **Data Proliferation**: Exponential growth of data makes managing and securing data increasingly challenging
- **Regulatory Compliance**: Compliance with regulations - GDPR, HIPAA, .. is crucial to avoid penalties
- **Data Security**: Protecting sensitive data from breaches and unauthorized access is critical
- **Data Quality**: Having high-quality data is important to provide accurate analytics and business decisions
- **Data Lineage and Auditing**: Track the origin, movement, and transformation of data to ensure its integrity and transparency



# Microsoft Purview: Unified Data Governance in Azure

In 28 Minutes

- **Unified Data Governance**: Microsoft Purview provides a comprehensive platform for data governance
- **Data Discovery and Classification**: Automatically discover and classify sensitive data in on-premises, multi-cloud, and SaaS environments
- **Data Catalog**: Build a data catalog that allows users to easily find, understand, and consume data
- **Data Access Policies**: Implement and enforce data access policies to ensure data privacy and security
- **Integration**: Seamlessly integrates with Microsoft 365, Azure, ... to provide a unified governance experience



# Privacy and Compliance

# Azure - Privacy & Information Protection

In28 Minutes

| Service/Documentation | Description |
|---|---|
| **Microsoft Privacy Statement** | Explains the personal data Microsoft processes, how Microsoft processes it, and for what purposes. |
| **Product Terms Site** | Terms and conditions for software and online services products. |
| **Data Protection Addendum** | Your and Microsoft's obligations with respect to the processing and security of Customer Data and Personal Data in connection with Azure<br>Search for DPA at ***https://www.microsoft.com/licensing/docs***.<br>Covers Data transfer, Data retention, Data deletion and Data Security |
| **Azure Information Protection** | Classify and protect your documents and emails<br>Add labels indicating what kind of protection/encryption you want<br>Uses Azure Rights Management (Azure RMS) - Integrates with Office 365, Azure Active Directory etc<br>Protection stays with the documents and emails independent of the location, networks, file servers, and applications |

# Compliance & Azure - Compliance Hub & more...

In28 Minutes

- **What is Compliance?**
  - Depending on the domain of your enterprise, you need to adhere to several industry and security standards (in addition to corporate and regulatory policies)
- You are using services provided by Azure and storing data in Azure
- What standards & regulations does Azure services adhere to?
  - **Service Trust Portal**: ***https://servicetrust.microsoft.com***
- How does Azure help you with compliance?
  - **Azure Compliance Hub**: ***https://docs.microsoft.com/en-us/azure/compliance/***
    - **Azure Security and Compliance Blueprints** - Easily create environments compliant with different standards - ISO:27001, PCI DSS etc
  - **Azure Compliance Manager**: Part of Service Trust Portal
    - Automates complete compliance lifecycle: Manage Risks, Implement Controls, Check compliance against regulations and standards,Reporting to Auditors

Compliance

# Compliance & Azure - Important Standards to Remember

In 28 Minutes

- **90+ Azure compliance offerings can be grouped into four segments:** Global, US government, industry specific, and region/country specific
  - 50+ compliance offerings specific to global regions and countries (the US, the European Union, Germany, etc.)
  - 35+ compliance offerings specific to the needs of key industries ( health, government, finance etc)
  - Important Standards to Remember:
    - International Organization for Standardization (ISO): ISO:27001 (Security controls), ISO:27017(Security controls for use of cloud services), ISO:27701 (privacy standard), ISO:27018 (privacy on cloud)
    - Service Organization Compliance (SOC): SOC-1 (Auditing standard), SOC-2 (Assessment of service provider controls)
    - General Data Protection Regulation (GDPR): Strengthens personal data protection in Europe
    - Health Insurance Portability & Accountability Act (HIPAA): Data privacy & security requirements for organizations handling PHI
    - Payment Card Industry - Data Security Standards (PCI-DSS)

Compliance

# Azure & Compliance - A Quick Summary

In28 Minutes

| Service | Description |
| --- | --- |
| **Service Trust Portal** | Independent audit reports for Microsoft's Cloud services<br>***https://servicetrust.microsoft.com*** |
| **Azure Compliance Hub** | Compliance offerings in Azure<br>***https://docs.microsoft.com/en-us/azure/compliance/***<br>Offers blueprints to simplify your compliance implementations |
| **Azure Compliance Manager** | Manage your organization's compliance requirements<br>Part of Service Trust Portal |

# Azure Sovereign Regions

In 28 Minutes

| Service | Detail |
|---|---|
| **Azure global** | What we are using until now! |
| **Azure Government** | Cloud environment specifically built to meet compliance and security requirements for US government<br>Examples: FedRAMP (Federal Risk and Authorization Management Program), NIST (National Institute of Standards and Technology), ITAR (International Traffic in Arms Regulations), IRS 1075 (Internal Revenue Service), DoD (U.S. Department of Defense) L4, and CJIS (Criminal Justice Information Services)<br>Uses physically isolated data centers and networks located in US<br>Only US government entities and contractors are eligible to use Azure Government services |
| **Azure China** | Physically separated instance of cloud services located in China<br>Operated by **21Vianet** (Azure China)<br>Complies with regulation in China (China Telecommunication Regulation) |
| **Azure Germany** | Physically isolated instance of Microsoft Azure in Germany. No longer accepting customers! |

# Azure cost management - planning and managing costs

# Consumption-based vs Fixed-price Pricing Models

In28 Minutes

- **Consumption-based** - You are billed for only what you use
  - Example: Azure Functions - You pay for no of invocations!
- **Fixed-price** - You are billed for instances irrespective of whether they are used or not
  - Example: You provision a VM instance
    - You pay for its lifetime irrespective of whether you use it or NOT
  - Example: App Service - You choose App Service plan (Basic, Standard or Premium plans)
    - You are billed irrespective of whether you use it or not

# Expenditure Models: CapEx vs OpEx



- **Capital Expenditure (CapEx)**: Money spent to buy infrastructure
  - Additional cost to maintain infrastructure with time
  - You might need a team to manage the infrastructure
  - Example: Deploying your own data center with physical servers
  - Example: Purchasing Azure Reserved VM Instances
  - Example: Leasing Software
- **Operational Expenditure (OpEx)**: Money spent to use a service or a product
  - Zero upfront costs
  - You Pay for services as you use them (Pay-as-you-go model)
  - Example: Provisioning VMs as you need them
  - Example: Using Azure Functions and paying for invocations

# Total Cost of Ownership (TCO) calculator




- **Estimate the cost savings** you get by migrating your workloads to Azure
- **1: Define your workloads**: Enter the details of your on-premises workloads
  - Servers, Databases, Storage, Networking details
- **2:Adjust assumptions**: Customize Electricity costs, Storage costs, IT labour costs, Hardware costs, Software costs etc
- **3:View report**: Side-by-side comparison of the cost breakdown

# Pricing calculator

- **Estimate the costs for Azure services**
- Example Services that you can estimate costs for:
  - Virtual Machines
  - Storage Accounts
  - Azure SQL Database
  - App Service
  - Azure Cosmos DB
  - Azure Kubernetes Service (AKS)
  - Azure Functions
- Ideal place to explore and learn important factors about different Azure services

# How is cost decided?

In28 Minutes

| Factor | Details |
| --- | --- |
| **Resource type and configuration** | How much memory? How much CPU? Which access tier? |
| **Usage meters** | How long was your VM running for? How much ingress and How much egress?<br>How many invocations of an Azure function? |
| **Azure subscription type** | Free trial vs Pay as you go vs Enterprise Agreement |
| **Azure Marketplace** | Vendors decide pricing on Azure Marketplace |
| **Which Region?** | Price varies from Region to Region |
| **Data transfer** | Ingress and Egress<br>Inbound data from on-premises to Azure is free<br>Outbound data from Azure to On-Premises is NOT free<br>Data traffic between Azure Services in the same region/AZ is free |
| **Reserved or Not** | Some services offer reservations ahead of time |

# Azure Cost Management

In28 Minutes

- **Setup and manage your account**
  - Configure subscriptions, manage invoices and payment methods
- **Analyze and optimize cloud costs**
  - Break down and analyze costs to get a deeper understanding of cost and usage patterns
- **Control and optimize costs**
  - Setup Budget and Cost Alerts

Cost Management

# Managing Costs - Best Practices

In28 Minutes

- Estimate costs before you deploy (Pricing Calculator)
  - Calculate TCO
- Group resources based on cost ownership
  - Subscriptions, Resource Groups, Tags
- Use Cost Management features
  - Cost analysis
  - Budgets and Cost alerts
  - Advisor recommendations
- Stop Resources when you don't need them
  - (Remember) You pay for active resources
    - Even if you stop a VM, hard disks and data are still stored. You need to pay for storage.
- Use Managed Services (PaaS >>> IaaS)
- Reserve VMs for 1 or 3 years (Azure Reservations)

Cost Management

# Requesting a Credit from Microsoft

- **Service Level Agreement (SLA)**: Describe Microsoft's commitments for uptime and connectivity for Azure Services
  - **Example**: Single VM with Premium SSD or Ultra Disk: 99.9% Availability
- What happens when Microsoft does not meet the SLA?
  - **Very Rare**: Rare when Microsoft does not meet its SLA
  - **What Should You Do?**: Submit a support ticket with a completed credit request form
- **Details Needed**: Provide details like customer tenant ID and proof of service impact

# Understanding Costs in Azure - Scenarios

In28 Minutes

| Scenario | Solution |
| --- | --- |
| **Fixed-price or Consumption-based: You are using Azure Functions and want to pay for the number of invocations** | Consumption-based pricing |
| **OpEx or CapEx: You are deploying your own data center with physical servers** | Capital Expenditure (CapEx) |
| **OpEx or CapEx: You are using Azure Functions and paying for invocations** | Operational Expenditure (OpEx) |
| **You want to estimate cost savings when you migrate to Azure** | Use the TCO calculator |
| **You need to estimate costs for Virtual Machines, Storage Accounts, Azure SQL Database, etc.** | Use the Pricing Calculator |
| **You want to break down and analyze last month costs in Azure** | Use Azure Cost Management |
| **You need to control and optimize costs with budgets and cost alerts** | Use Azure Cost |

# More Azure

# Tags

- **Identify applications, environments or business units** that a specific resource is associated with
  - **Report and track costs** for a group of resources by assigning them with the same tag
  - **Group resources** based on their SLA, security or compliance requirements
- **Best Practice**: Identify mandatory tags that all resources should have and enforce it using Azure Policy
  - Example: Environment, BusinessUnit, Priority
- **Tags for Resources** are not inherited by default from their Resource Group

Tags

# Azure Virtual Desktop: Cloud Based Virtual Desktop

In 28 Minutes

- **Azure Virtual Desktop**: Desktop & application virtualization service
- **Windows Operating Systems**: Provides cloud-hosted Windows experiences (Windows 11, Windows 10, Windows Server 2022, 2019, 2016, etc.)
- **Ultimate Device Compatibility**: Accessible from almost any device and operating system, offering flexibility for users.
- **Integration**: Seamlessly integrates with Microsoft Entra ID for role-based access control(RBAC)

# Azure Virtual Desktop: Advantages

In28 Minutes

- **Multi-Session Deployment**: Enables multiple concurrent users on a single VM, cutting costs
  - Efficient use of resources
- **Cost Efficiency**: Pay only for the resources you use, optimizing expenditure
- **Enhanced Security**: Ensures data and applications are securely stored in the cloud, leaving nothing on the user's local machine

# Azure Marketplace

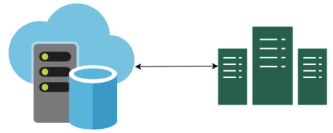


- Discover, try, and deploy the cloud software you want
  - ***https://azuremarketplace.microsoft.com***
- **Customized and certified solutions** optimized for Azure, provided by Microsoft partners and other software vendors
- Provision **end-to-end solutions** (applications and services)
- Solutions under a variety of categories
  - Compute, Containers, Databases, Developer Tools, DevOps etc
- Run Wordpress, RabbitMQ, CouchDB etc
- Flexible **Hourly Billing**

# Azure Migrate



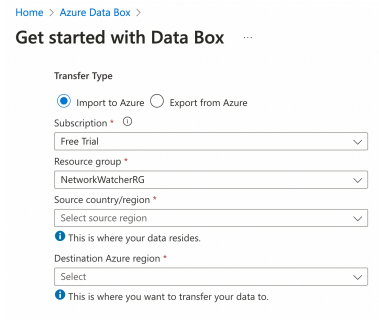
- **Azure Migrate**: Central hub to manage your Azure migration
- A host of tools are offered under the umbrella of Azure Migrate
- **1: Azure Migrate - Discovery and assessment**: Assess migration for on-premises servers, applications, and data
- **2: Azure Migrate: Server Migration**: Migrate your VMs (from your data center and other clouds) to Azure
- **3: Azure Database Migration Service**: Migrate databases to Azure
- **4: Web app migration assistant** : Migrate web apps to Azure App Service
- **5: Azure Data Box**: Offline data transfer to Azure



# Azure Data Box: Physical migration to Azure

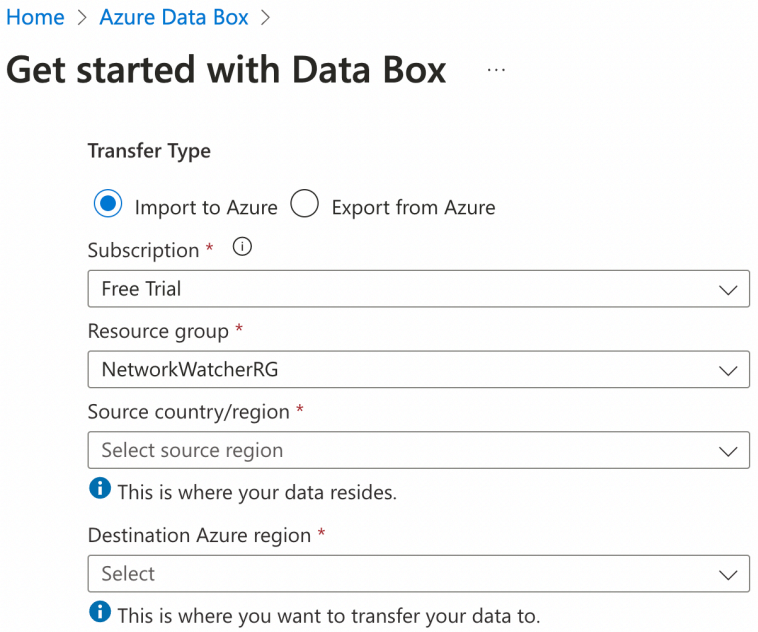
In28 Minutes

- **Migrate Huge Volumes of Data**: What if you need to move tens of Terabytes of data quickly to Azure?
- **Online transfer insufficient**: What if online data transfer is too slow?
- **Azure Data Box**: Physical migration service
  - Recommended to transfer data sizes larger than 40 TBs
- **STEPS**:
  - **1**: Order the Data Box device via the Azure portal
  - **2**: Copy data into it
  - **3**: Return it back to Microsoft
  - **4**: Data automatically uploaded once Microsoft receives the Data Box back



# Azure Data Box Products: Provide Flexibility

- **Variety of Products**: Move large amounts of data offline to Azure
- **Data Box Disk**: 8-TB SSD. Comes in packs of 5 for a total of 40 TB.
- **Data Box**: 100-TB capacity
- **Data Box Heavy**: Designed to lift 1 PB of data to the cloud



# Azure DNS - What does it do?

- **Steps**: What would be the steps in setting up a website with a domain name (for example, in28minutes.com)?
  - **Step I** : Buy the domain name in28minutes.com (Domain Registrar)
  - **Step II** : Setup your website content (Website Hosting)
  - **Step III** : Route requests to in28minutes.com to the my website host server (DNS)
- **Azure DNS**: Helps you route requests to in28minutes.com to my website host server (Step III)
  - Setup your DNS routing for in28minutes.com

# Azure DNS - How does it work?

- **Configure Records**: Where should traffic be routed for in28minutes.com?
  - Route api.in28minutes.com to the IP address of api server
  - Route static.in28minutes.com to the IP address of http server
  - Route email (ranga@in28minutes.com) to the mail server(mail.in28minutes.com)
- **TTL**: Each record is associated with a TTL (Time To Live)
  - How long is your mapping cached at the routers and the client?

# Content Delivery Network - What is it?

In 28 Minutes

- **Slow Load Times**: Users experience slow load times when accessing content hosted far from their location
- **Global Audience**: How to deliver content quickly to your global audience?
- **Content Delivery Network (CDN)**: System of distributed servers that deliver content to users based on their geographic location
  - **Global Distribution**: Servers (edge locations) are spread across multiple geographic locations
  - **Caching**: Stores copies of content closer to end-users to reduce latency

# Azure Front Door - What is it?

In28 Minutes

- **Azure Front Door**: Microsoft's modern cloud Content Delivery Network (CDN)
- **Fast, reliable, and secure access**: For your end users to your applications' static and dynamic web content across the globe
- **Uses Microsoft's global edge network**: Delivers your content to hundreds of global and local points of presence (PoPs) distributed around the world

# DevOps

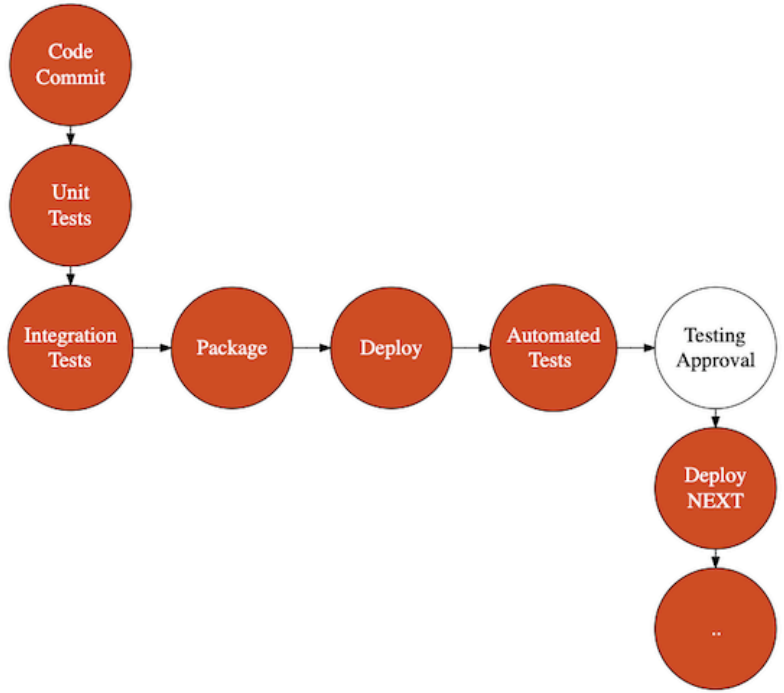
# DevOps




- Getting Better at "**Three Elements of Great Software Teams**"
  - Communication - Get teams together
  - Feedback - Earlier you find a problem, easier it is to fix
  - Automation - Automate testing, infrastructure provisioning, deployment, and monitoring

# DevOps - CI, CD

- **Continuous Integration**
  - Continuously run your tests and packaging
- **Continuous Deployment**
  - Continuously deploy to test environments
- **Continuous Delivery**
  - Continuously deploy to production



# Azure DevOps - CI, CD Tools

In28 Minutes

- **Azure Repos** - Private source control (Git)
  - Alternative: GitHub - Public and Private Source Control
- **Azure Pipelines** - Orchestrate CI/CD pipelines
  - Alternative: GitHub Actions
- **Azure Boards** - Scrum, Agile and Kanban boards
- **Azure Artifacts** - Artifact repository to store artifacts
- **Azure Test Plans** - Automation Test tool to check software quality
  - Integrate it into your CI/CD pipelines

Azure DevOps

# DevOps - IAAC




- **Treat infrastructure the same way as application code**
  - Track your infrastructure changes over time (version control)
  - Bring repeatability into your infrastructure
  - **1: Infrastructure Provisioning**
    - Provisioning compute, database, storage and networking
    - Open source cloud neutral - Terraform
    - Azure Service - Azure Resource Manager Templates (can also use Powershell or Azure CLI automation)
  - **2: Configuration Management**
    - Install right software and tools on the provisioned resources
    - Open Source Tools - Chef, Puppet, Ansible

# Azure Resource Manager (ARM) templates - Introduction

In 28 Minutes

- **Lets consider an example:**
  - I would want to create a new VNet with two subnets
  - I want to provision a Load Balancer, Scale Set with 5 VM instances and an Azure Cosmos DB database in the subnet
  - I would want to setup the right network security groups
- AND I would want to create 4 environments
  - Dev, QA, Stage and Production!
- **Azure Resource Manager (ARM) templates** can help you do all these with a simple (actually NOT so simple) script!

# Azure Resource Manager (ARM) templates - Advantages

In 28 Minutes

- Define resources in a JSON file - **ARM template**
- **Advantages:**
  - Avoid configuration drift
  - Avoid mistakes with manual configuration
  - Think of it as version control for your environments
- **Declarative approach** to Infrastructure as Code:
  - Understands dependencies and creates them in the right order
  - Parallelizes creation of resources when possible
  - Automatically rollback in case of failures
  - PowerShell and Bash scripts can also be used for IaaC
    - But they need step by step instructions
      - 1: Do this
      - 2: Do that..
    - And they don't handle failures very well

# ARM Templates - JSON can be verbose

In28 Minutes

```
{
  "$schema": "https://schema.management.azure.com/schemas/2019-04-01/deploymentTemplate.json#",
  "contentVersion": "1.0.0.0",
  "parameters": {
    "location": {
      "type": "string",
      "defaultValue": "[resourceGroup().location]"
    },
    "storageAccountName": {
      "type": "string",
      "defaultValue": "[format('toylaunch{0}', uniqueString(resourceGroup().id))]"
    }
  },
  "resources": [
    {
      "type": "Microsoft.Storage/storageAccounts",
      "apiVersion": "2023-04-01",
      "name": "[parameters('storageAccountName')]",
      "location": "[parameters('location')]",
      "sku": {
        "name": "Standard_LRS"
      },
      "kind": "StorageV2",
      "properties": {
        "accessTier": "Hot"
      }
    }
  ]
}
```

# Bicep - What is it?

In 28 Minutes

- **Lets consider an example:**
  - I would want to create a new VNet with two subnets
  - I want to provision a Load Balancer, Scale Set with 5 VM instances and an Azure Cosmos DB database in the subnet
  - I would want to setup the right network security groups
- AND I would want to create 4 environments
  - Dev, QA, Stage and Production!
- AND I don't want the verbosity of JSON ARM Templates
- **Bicep**: Domain-specific language (DSL) that uses declarative syntax to deploy Azure resources

# Bicep - An example file

In28 Minutes

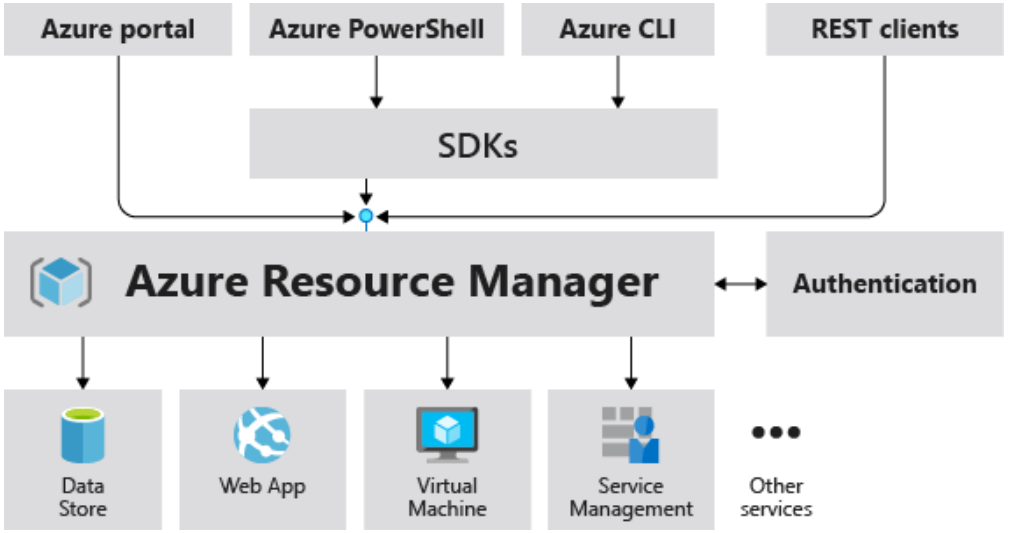
```
param location string = resourceGroup().location
param storageAccountName string = 'toylaunch${uniqueString(resourceGroup().id)}'

resource storageAccount 'Microsoft.Storage/storageAccounts@2023-04-01' = {
  name: storageAccountName
  location: location
  sku: {
    name: 'Standard_LRS'
  }
  kind: 'StorageV2'
  properties: {
    accessTier: 'Hot'
  }
}
```

- **Advantages**:
  - Concise syntax
  - Support for code reuse
  - First-class authoring experience

# Azure Resource Manager






(*https://docs.microsoft.com/*)

- Deployment and management service for Azure
- All actions to any resource in Azure **go through ARM**
  - Irrespective of where you are performing it from
    - Azure portal OR Powershell OR CLI or ARM template or ...

# Azure Portal, PowerShell, CLI, Cloud Shell, & Mobile App

In28 Minutes

| Tool | Details |
|---|---|
| **Azure Portal** | Web-based user interface. Great to get started BUT NO automation possible.<br>Runs in all modern desktop and tablet browsers |
| **Azure Mobile App** | iOS and Android Apps (subset of features). Convenience of managing from anywhere. |
| **Azure PowerShell** | Execute cmdlets (sequence of commands) and create scripts (PowerShell script)<br>Recommended for teams familiar with Windows administration<br>Cross-platform (Windows, Linux, and macOS) |
| **Azure CLI** | Similar to Azure PowerShell BUT uses a different syntax (Bash Scripts)<br>Recommended for teams familiar with Linux administration (and Bash Scripts)<br>Cross-platform (Windows, Linux, and macOS) |
| **Azure Cloud Shell** | Free Browser based interactive shell (Access from Azure Portal)<br>Common Azure tools pre-installed and configured to use with your account<br>Supports both PowerShell and CLI (bash)<br>Runs in all modern desktop and tablet browsers |

# Scenarios - Azure Portal, PowerShell, CLI ....

In28 Minutes

| Scenario | Solution |
| --- | --- |
| **Can you run PowerShell scripts using Azure CLI?** | No. You can use either Azure Shell or Azure PowerShell. |
| **Which OS can Azure CLI, PowerShell, Cloud Shell and portal run on?** | Windows, Linux and Mac |
| **Where can Azure Cloud shell be accessed from?** | Browser-based shell - Access from desktops (Windows, Mac, ChromeOS, Linux), mobile, tablet. |
| **Tool to analyze costs and run reports during a cost review meeting** | Azure portal or Azure mobile app |
| **Tool for one time testing, management, and administrative actions (Ex: create a VM or create a group of resources)** | Azure PowerShell, Azure CLI, Azure portal or Azure mobile app |
| **Repeatedly set up resources across multiple environments** | ARM templates |

# DevTest Labs

In28 Minutes

- **Quickly provision development and test environments**
  - Build Windows and Linux environments
  - Uses ARM templates: can be used to deploy anything in Azure
    - Compute - VMs etc
    - Storage
    - Databases ...
- Can be **integrated into your CI/CD pipelines**
  - Set automated shutdowns to minimise costs
- **Usecases:**
  - Quickly test your application with an old version of software or OS
  - Setup a quick load test environment for your app
  - Quickly provision 100 VMs for testing a specific scenario
  - Quickly provision environments for training and demos

DevTest Labs

# Quick Review

# Compute

| Azure Service Name | Description |
|---|---|
| **Azure VMs** | Windows or Linux VMs (IaaS)<br>Use VMs when you need control over OS OR you want to run custom software |
| **Azure VM Scale Sets** | Scaling for Azure VMs |
| **Azure Load Balancer** | Balance load to multiple instances of an application or a service.<br>Typically listed in Networking category. |
| **Azure App Service** | PaaS. Deploy web apps, mobile back ends and RESTful APIs quickly. |
| **Azure Container Instances** | Run isolated containers, without orchestration.<br>You DO NOT need to provision and manage VMs. Start containers in seconds. |
| **Azure Kubernetes Service** | Managed Kubernetes Service. Provides container orchestration. |
| **Azure Service Fabric** | Microsoft's container orchestrator for cloud and on-premises.<br>Package, deploy, and manage scalable and reliable microservices |
| **Azure Functions** | Serverless compute for event-driven apps |

# Networking

| Azure Service Name | Description |
|---|---|
| **Azure Virtual Network** | Create your own private network in the cloud |
| **Azure Firewall** | Stateful firewall to protect resources in your Azure Virtual Network |
| **Azure DDoS Protection** | Protects Azure-hosted applications from DDOS attacks |
| **Azure ExpressRoute** | Dedicated private connection from Azure to on-premises |
| **Azure VPN Gateway** | Encrypt traffic between virtual network & on-premises<br>Traffic goes over Internet (public). |
| **Azure DNS** | Manage your DNS records<br>Map Domain Name to IP Address |
| **Azure Content Delivery Network** | Cache content on edge servers (POPs) located around the world<br>Minimize latency to global users |

# Storage

| Service | Description |
| --- | --- |
| **Azure Disk storage** | Store disks attached to VMs. |
| **Azure Blob storage** | Store unstructured data - video files, database archives etc. |
| **Azure File storage** | Create file shares or file servers in the cloud |
| **Azure Queue storage** | Decouple applications using a queue (asynchronous communication) |
| **Azure Table storage** | Store structure data using NoSQL approach (NON-relational). Schemaless. Key/attribute store. |

# Databases

| Service | Description |
| --- | --- |
| **Azure Cosmos DB** | NoSQL database. Globally distributed. |
| **Azure SQL Database** | Relational database |
| **Azure Database for MySQL** | Fully managed MySQL database |
| **Azure Database for PostgreSQL** | Fully managed PostgreSQL database |
| **Azure Database Migration Service** | Migrate databases to the cloud |
| **Azure Cache for Redis** | Managed service for Redis |

# Key Benefits Enabled by Cloud Computing

In 28 Minutes

| Benefit | Description |
|---|---|
| **Elasticity** | Ability to automatically scale resources up or down based on demand |
| **Agility** | Adapt to changing business needs. Quickly delivery software. Adapt new services rapidly. |
| **Availability** | Are apps available **when your users need them**? |
| **Scalability** | Can we handle a **growth in users, traffic, or data size** without any drop in performance? |
| **Geo-distribution** | Distribute applications across regions and zones. Deliver content from the nearest geo location. |
| **Predictability** | Predictable performance and costs |
| **Reliability** | Ability of a system to automatically recover from failures |
| **Disaster Recovery** | How to keep your systems running in face of disasters? |

# Get Ready

# Certification Exam

- **Azure Fundamentals**: ***Certification Home Page***
- **Different Types** of Multiple Choice Questions
  - **Type 1** : Single Answer - 2/3/4 options & 1 right answer
  - **Type 2** : Multiple Answer - 5 (or more) options and 2 (or more) right answers
- **No penalty** for wrong answers
  - Feel free to guess if you do not know the answer
- **40-60** questions and **80** minutes
- **Immediate Result**: Result immediately shown after exam completion
- **Detailed Email Later**: Email with detailed scores (a couple of days later)

# Certification Exam - My Recommendations

In28 Minutes

- **Read the question**: Read the entire question
- **Key Parts**: Identify the key parts of the question
- **Read all options**: Read all answers at least once
- **Eliminate wrong answers**: If you do NOT know the answer, eliminate wrong answers first
- **Mark questions and Review**: Mark questions for future consideration and review them before final submission

# You are all set!

# Let's clap for you!

- You have a lot of patience! Congratulations
- You have put your best foot forward to get Microsoft Certified - Azure Fundamental
- Make sure you prepare well and
- Good Luck!

# Do Not Forget!

In 28 Minutes

- Recommend the course to your friends!
  - Do not forget to review!
- Your Success = My Success
  - Share your success story with me on LinkedIn (Ranga Karanam)
  - Share your success story and lessons learnt in Q&A with other learners!

# What Next?

# FASTEST ROADMAPS

in28minutes.com

In28 Minutes

- Google Cloud Certifications
- Azure Certifications
- AWS Certifications
- DevOps
- Java Full Stack
- Java Microservices