In28 Minutes

AZ-900
Azure Fundamentals

Getting Started

In28 Minutes


Advisor


Machine Learning


Cosmos DB

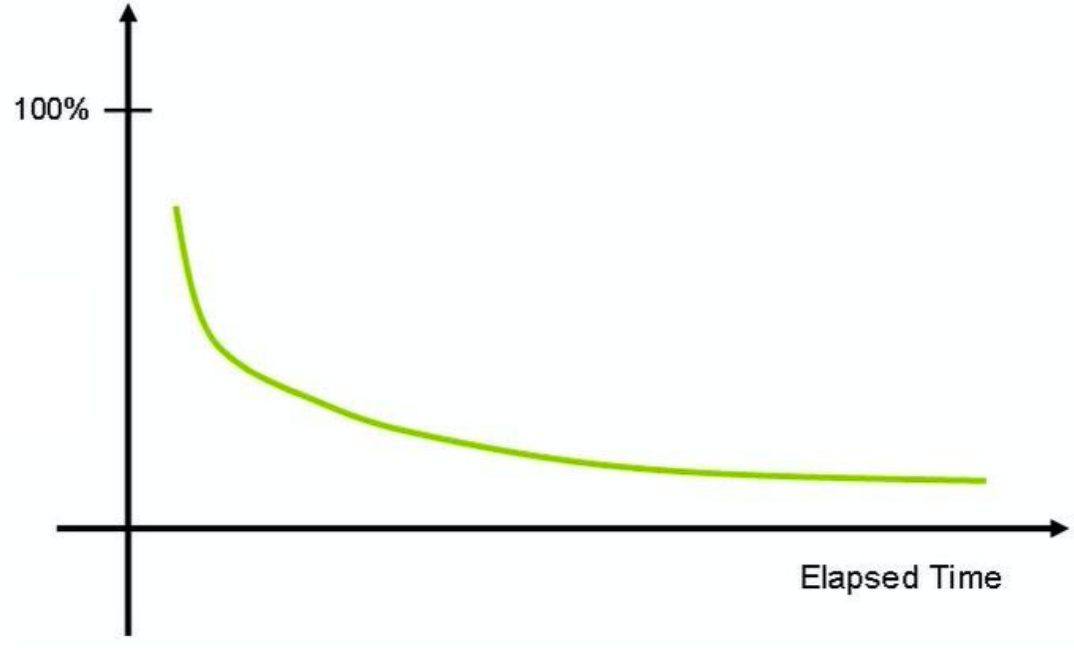

Azure DevOps

- 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?

In28 Minutes

- **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

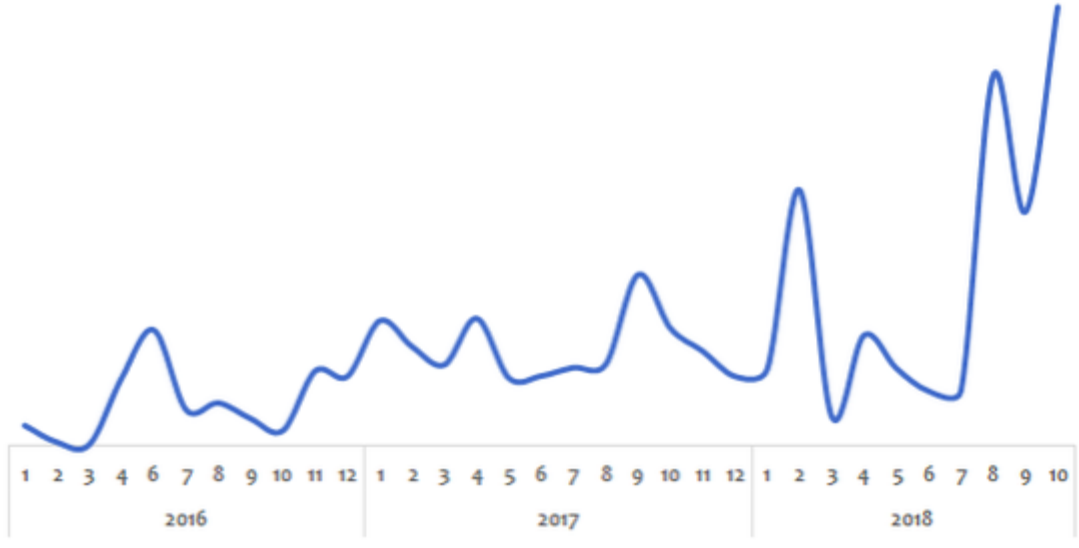
In28 Minutes

- 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!

Getting Started - Azure

Before the Cloud - Example 1 - Online Shopping App

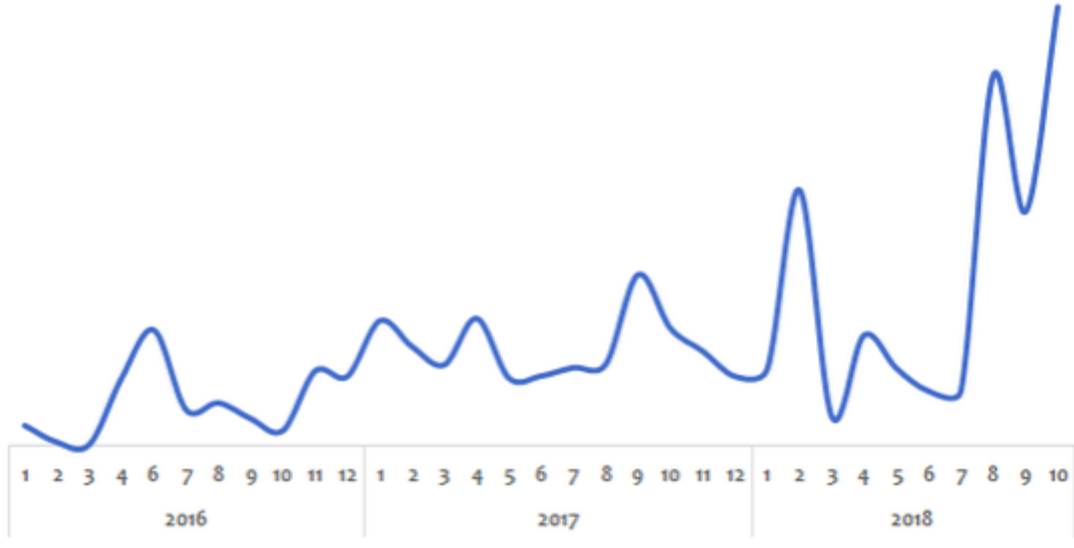
In 28 Minutes



- 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

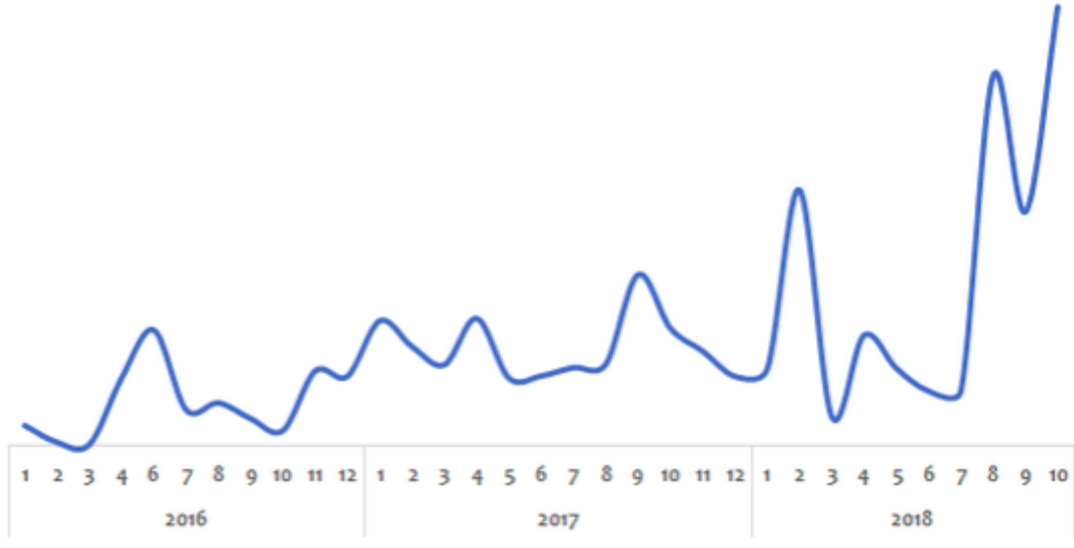
In28 Minutes



- 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

In28 Minutes



- 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

In28 Minutes

- 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

In28 Minutes

- 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!

In28 Minutes

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!

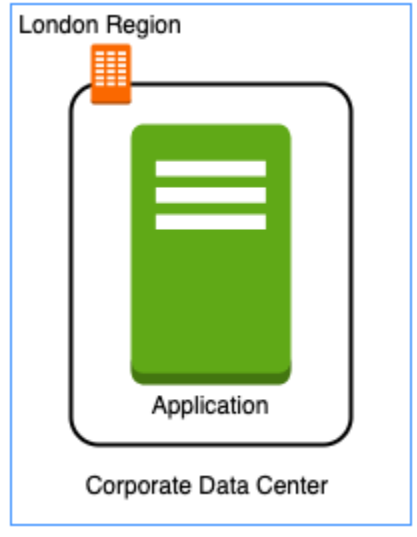
Setting up Azure Account

In28 Minutes

- Create Azure Account

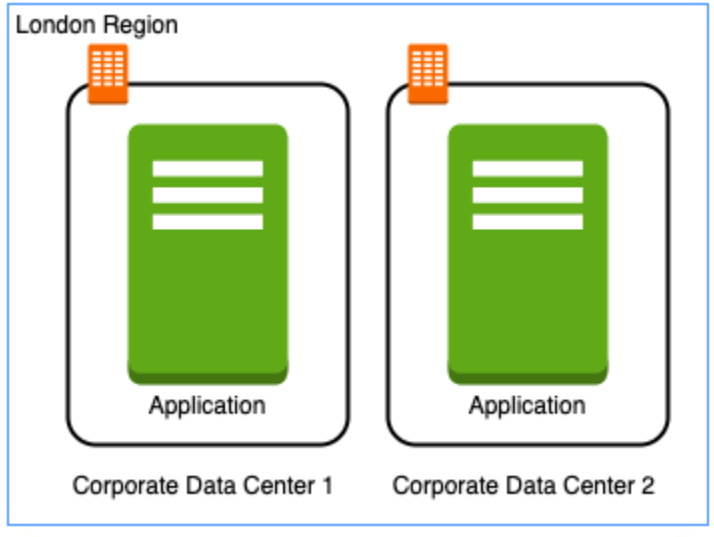
Regions and Zones

Regions and Zones



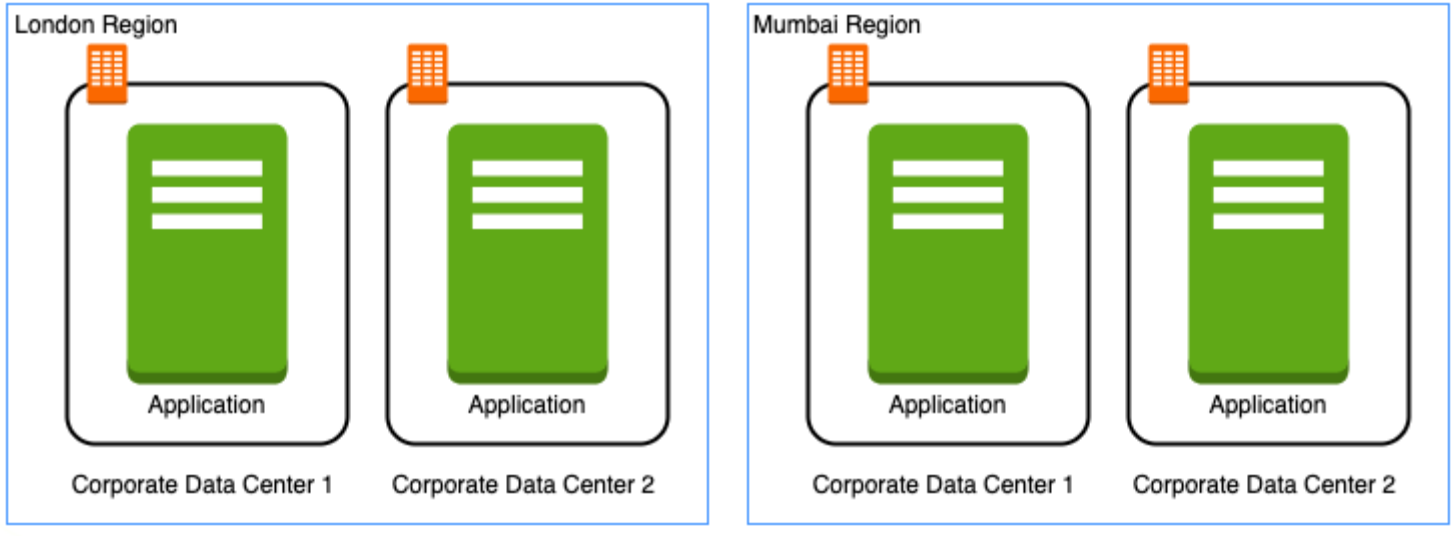
- Imagine that your application is deployed in a data center in London
- What would be the challenges?
  - Challenge 1 : Slow access for users from other parts of the world (**high latency**)
  - Challenge 2 : What if the data center crashes?
    - Your application goes down (**low availability**)

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

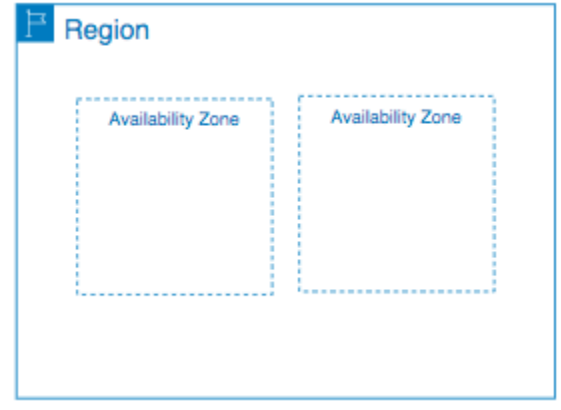
In28 Minutes

- 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

In28 Minutes

- 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

In28 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

Azure Virtual Machines

In 28 Minutes

- 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

In28 Minutes

- 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

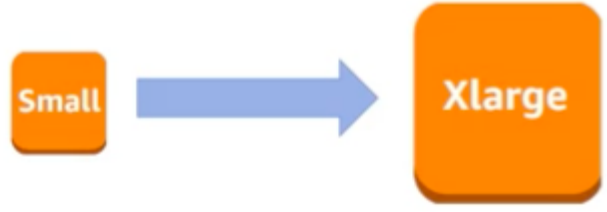
Feature	Explanation
Static IP Address	Assign a fixed IP address to your VM Public IP addresses are charged per IP per hour
Azure Monitoring	Monitoring for your Azure VMs
Dedicated Hosts	Physical servers dedicated to one customer
Create cheaper, temporary instances for non critical workloads	Azure Spot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

Designing Good Solutions with VMs

In28 Minutes

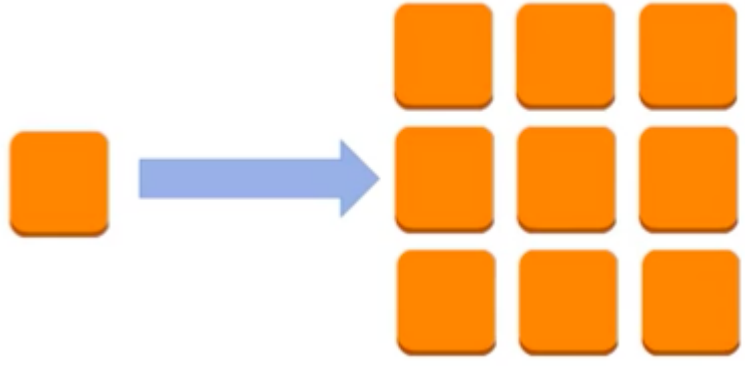
Terminology	Description	Azure VMs
Availability	Are the applications available **when your users need them**?	Availability Sets and Scale Sets
Scalability	Can we handle a **growth in users, traffic, or data size** without any drop in performance?	VM Size, Scale Sets and Load Balancers
Resilience	Ability 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 perform 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.
How can you know who performed a specific action on a VM?	Activity Logs (kept for 90 days)

Managed Services

Managed Services

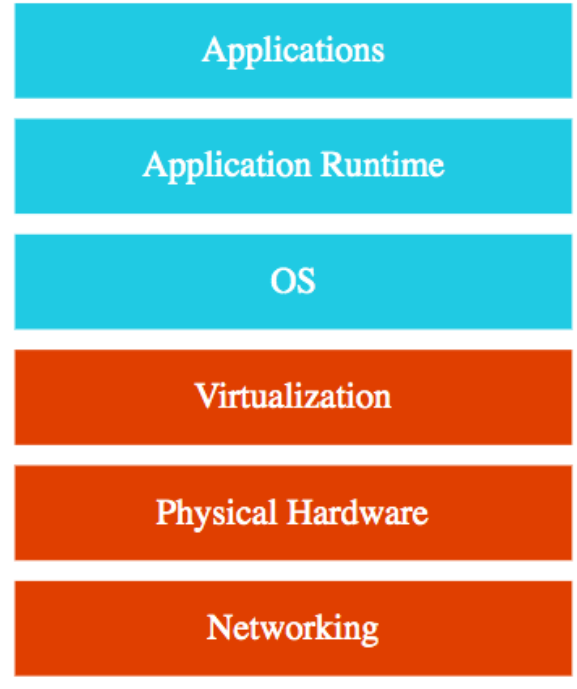
In28 Minutes

- 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

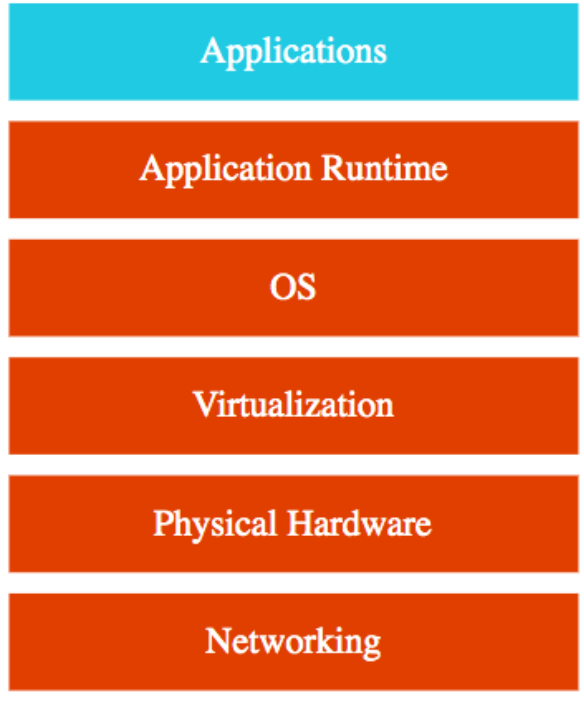
- Use **only infrastructure** from cloud provider
- **Example**: Using VM to deploy your applications or databases
- You are responsible for:
  - Application Code and Runtime
  - Configuring load balancing
  - Auto scaling
  - OS upgrades and patches
  - Availability
  - etc.. (and a lot of things!)



PAAS (Platform as a Service)

In28 Minutes

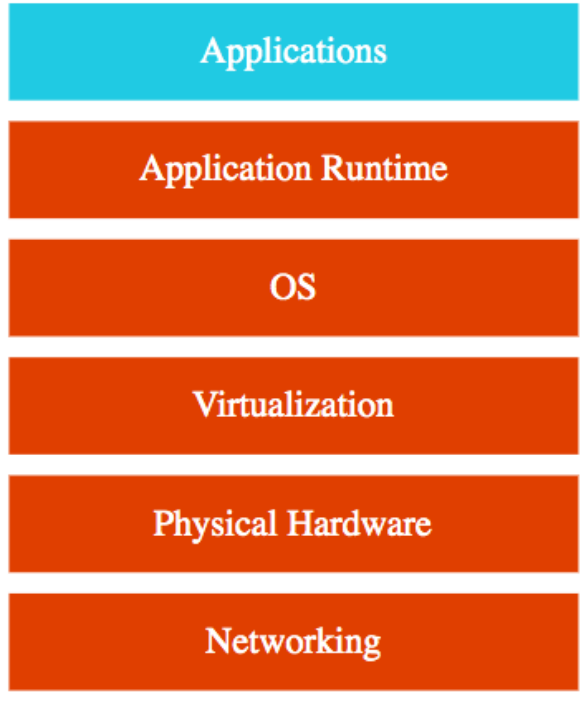
- Use a platform provided by cloud
- **Cloud provider** is responsible for:
  - OS (incl. upgrades and patches)
  - Application Runtime
  - Auto scaling, Availability & Load balancing etc..
- **You** are responsible for:
  - Configuration (of Application and Services)
  - Application code (if needed)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



Azure App Service

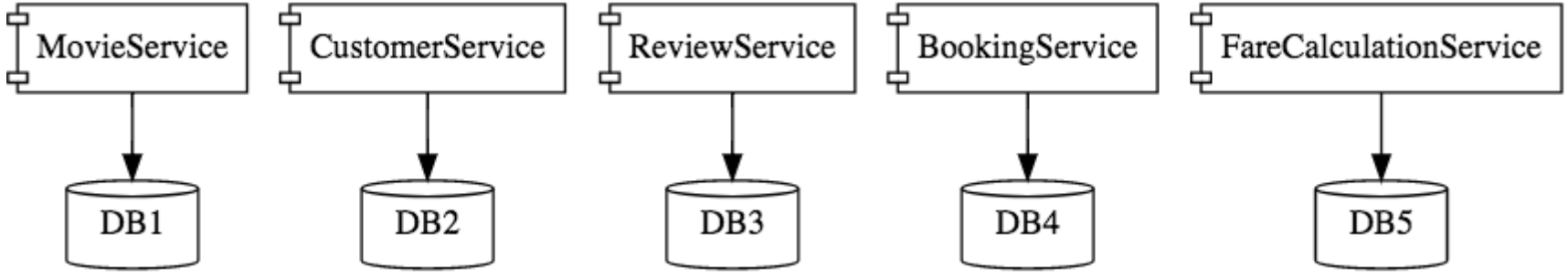
In28 Minutes

- 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

In28 Minutes

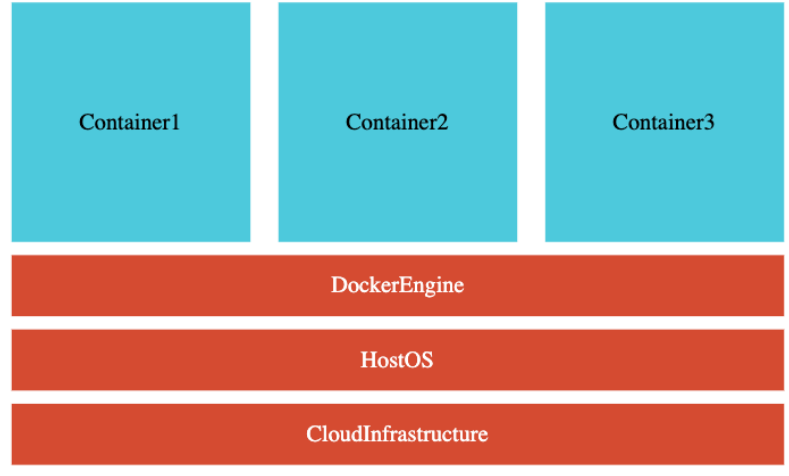


- Enterprises are heading towards microservices architectures
  - Build small focused microservices
  - **Flexibility to innovate** and build applications in different programming languages (Go, Java, Python, JavaScript, etc)
- BUT **deployments become complex**!
- How can we have **one way of deploying**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

In28 Minutes

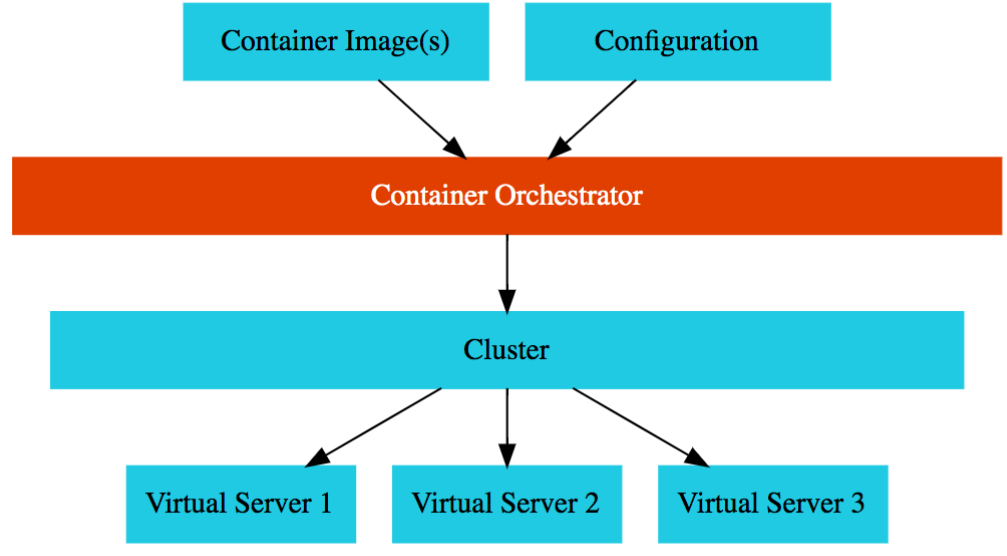
- Manage and run simple container based applications
- **You DO NOT** need to provision and manage VMs
- Start containers in seconds
- Azure App Service also supports deploying simple containers

Container Service

Container Orchestration

In28 Minutes

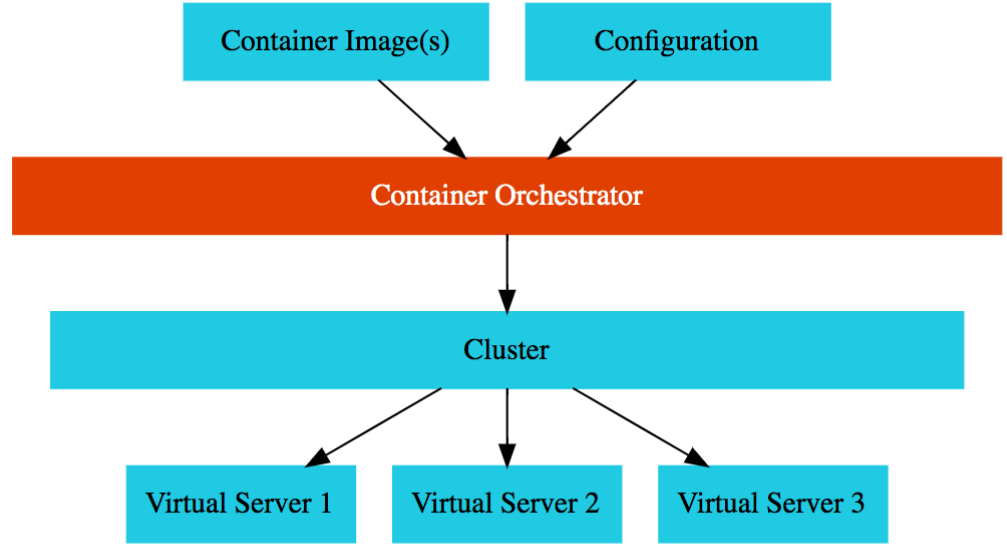
- **Requirement** : I want 10 instances of Microservice A container, 15 instances of Microservice B container and ....
- Typical Features:
  - **Auto Scaling** - Scale containers based on demand
  - **Service Discovery** - Help microservices find one another
  - **Load Balancer** - Distribute load among 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

In28 Minutes

- 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

- 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

In28 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) Use VMs when you need control over OS OR you want to run custom software You handle Availability, Scalability, Load Balancing, Software/OS Updates ...
Azure App Service	PaaS. Deploy web apps, mobile back ends and RESTful APIs quickly. Built-in Auto Scaling, Load Balancing
Azure Container Instances	PaaS (CaaS). Run isolated containers, without orchestration. 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. Package, deploy, and manage scalable and reliable microservices Run anywhere - on premises and in the cloud
Azure Functions	Serverless (FaaS) compute for event-driven apps

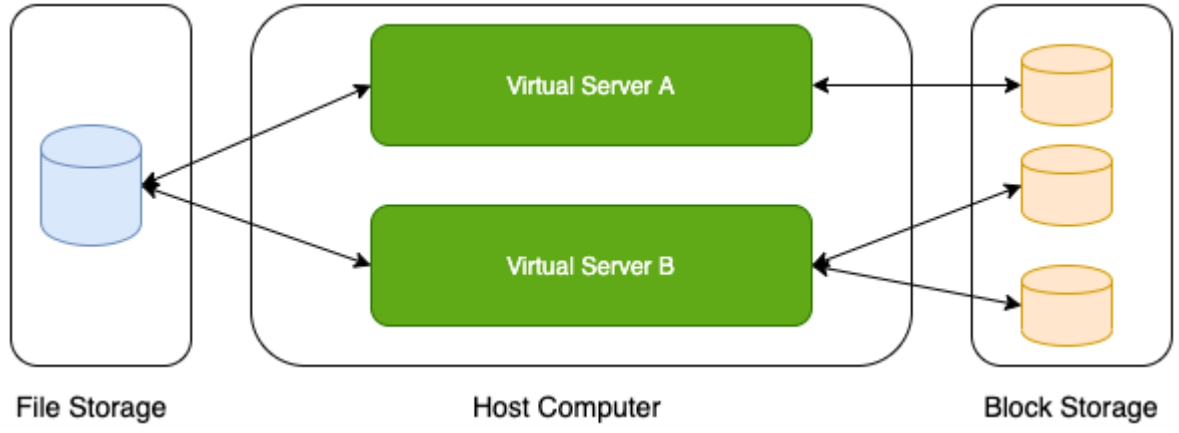
Azure Compute Services - Scenarios

In28 Minutes

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

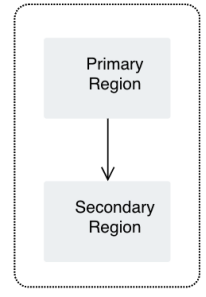
In28 Minutes

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

Region pairs

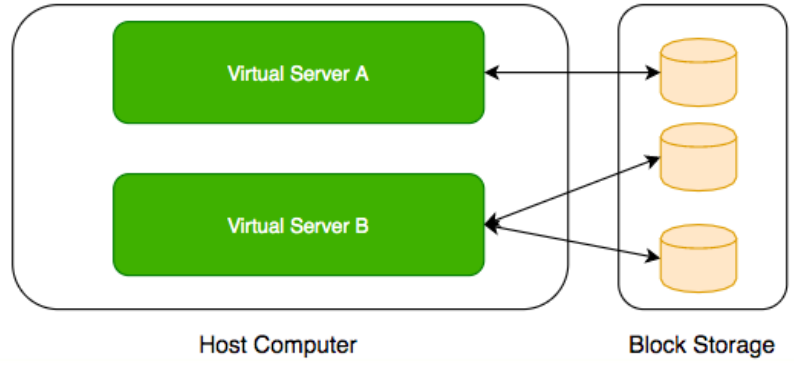
In28 Minutes

- 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



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

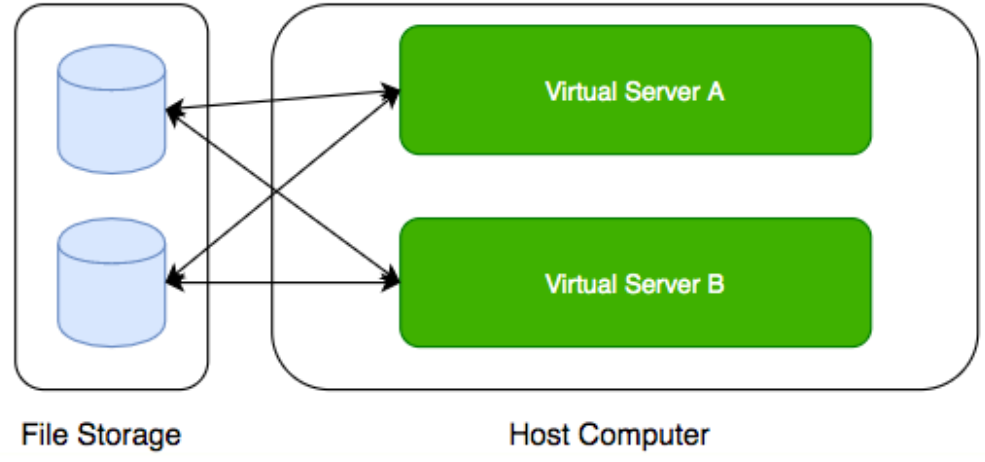
- **Disk storage**: Disks for Azure VMs
  - **Types**:
    - **Standard HDD**: Recommended for Backup, non-critical, infrequent access
    - **Standard SSD**: Recommended for Web servers, lightly used enterprise applications and dev/test environments
    - **Premium SSD disks**: Recommended for production 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

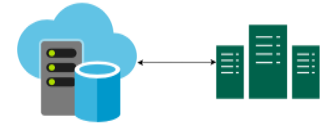
In28 Minutes

- 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

In28 Minutes



- **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**
- Can I pay a cheaper price for objects I access less frequently?
  - **Access tiers**
    - **Hot**: Store frequently accessed data
    - **Cool**: Infrequently accessed data stored for min. 30 days
    - **Archive**: Rarely accessed data stored for min. 180 days
      - Lowest storage cost BUT Highest access cost
      - Access latency: In hours
      - To access: **Rehydrate** (Change access tier to hot or cool) OR
        - Copy to another blob with access tier hot or cool
    - You can **change access tiers** of an object **at any point in time**

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

In28 Minutes

- **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

In28 Minutes

Database Fundamentals

Databases Primer

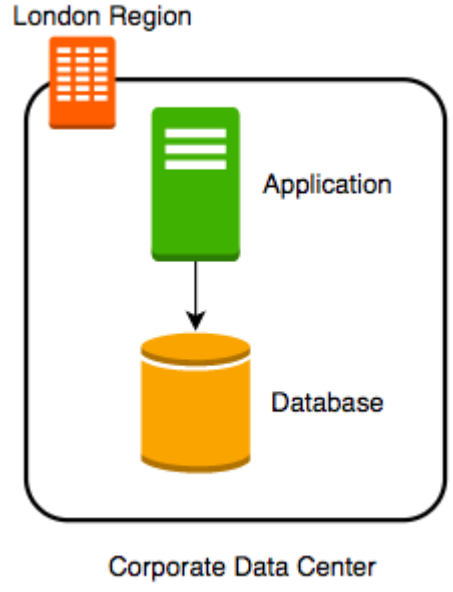
In28 Minutes

- 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

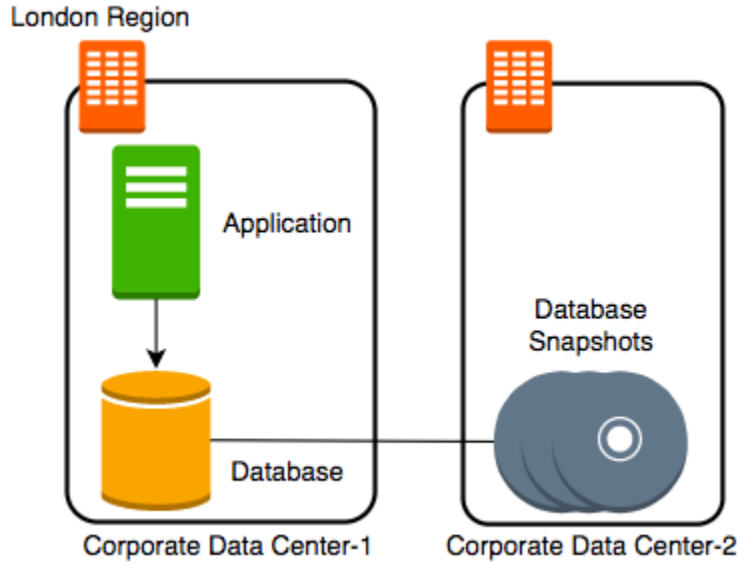
- Imagine a database deployed **in a data center in London**
- Let's consider some challenges:
  - **Challenge 1**: Your database will go down if the data center crashes or the server storage fails
  - **Challenge 2**: You will lose data if the database crashes



Database - Snapshots

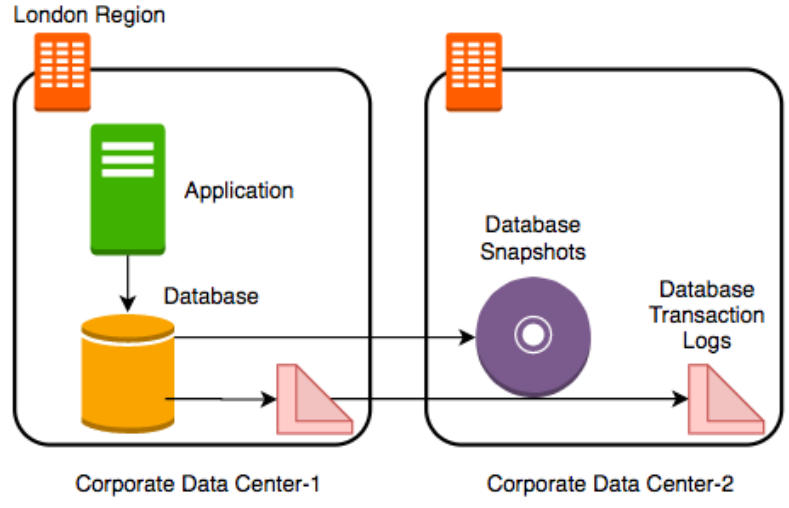
In28 Minutes

- 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

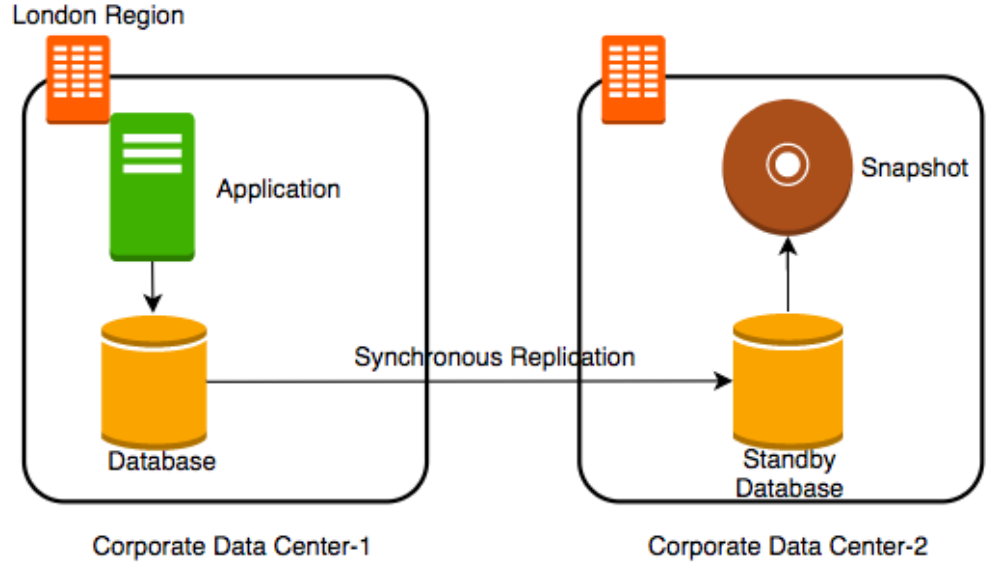
- Let's add **transaction logs** to database and create a **process to copy it over** to the second data center
- Let's consider some challenges:
  - **Challenge 1**: Your database will go down if the data center crashes
  - **Challenge 2** (SOLVED): You will lose data if the database crashes
    - You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



Database - Add a Standby

In28 Minutes

- 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

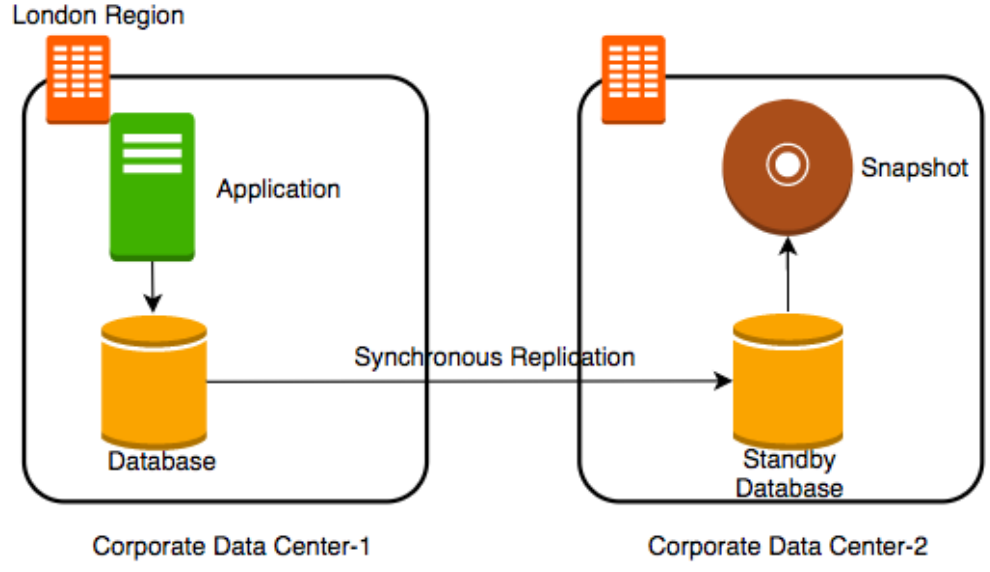
Availability

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

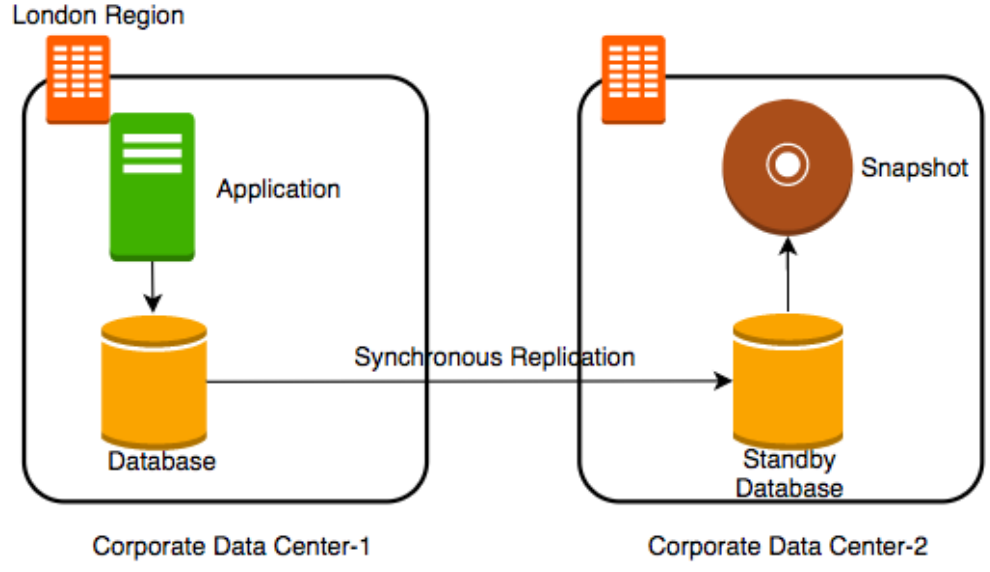
- What does a **durability of 11 9's** mean?
  - If you **store one million files for ten million years**, you would expect to **lose one file**
- Why should durability be high?
  - Because **we hate losing data**
  - Once we lose data, it is gone



Increasing Availability and Durability of Databases

In28 Minutes

- **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

In28 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

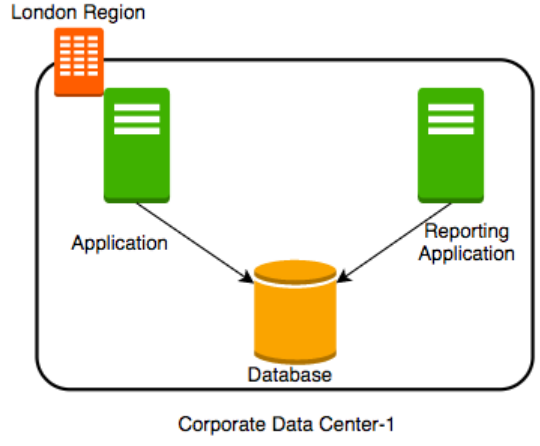
In28 Minutes

Scenario	Solution
Very small data loss (RPO - 1 minute) **Very small downtime (RTO - 5 minutes)**	**Hot standby** - Automatically synchronize data Have a standby ready to pick up load Use automatic failover from master to standby
Very small data loss (RPO - 1 minute) **BUT I can tolerate some downtimes (RTO - 15 minutes)**	**Warm standby** - Automatically synchronize data Have a standby with minimum infrastructure 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** 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

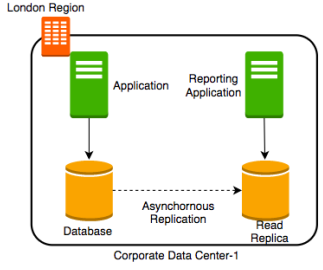
In28 Minutes

- 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

In28 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

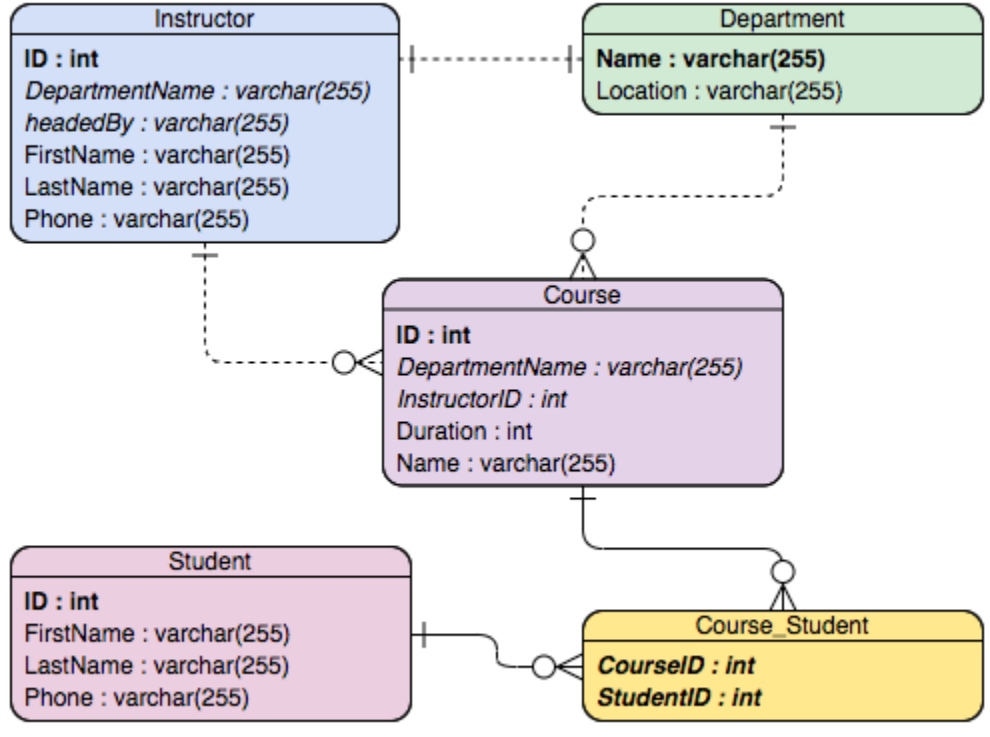
Azure Database PostgreSQL

Synapse Analytics

Relational Databases

In28 Minutes

- 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)

- 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

In28 Minutes

- **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

In28 Minutes

- 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

In28 Minutes

- 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)

In 28 Minutes

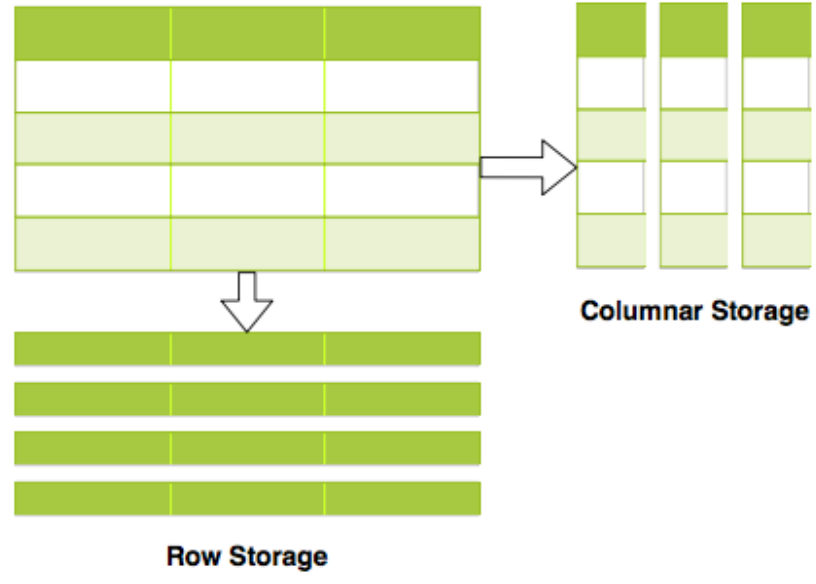
- Applications allowing users to **analyze petabytes of data**
  - **Examples** : Reporting applications, Data ware houses, Business intelligence applications, Analytics systems
  - **Sample application** : Decide insurance premiums analyzing data from last hundred years
  - Data is consolidated from 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

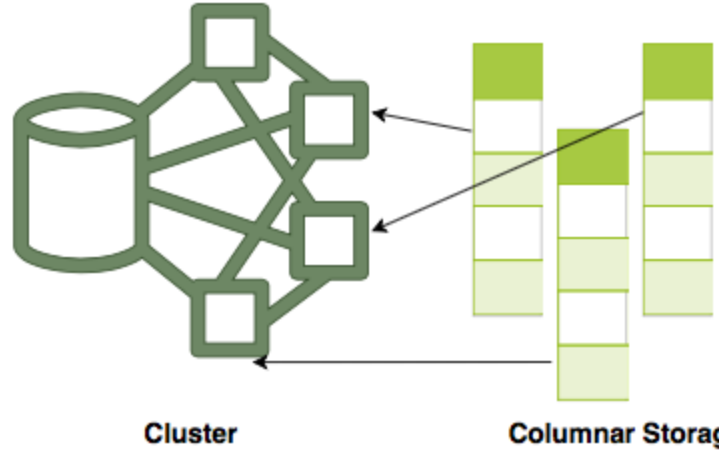
Synapse Analytics

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

Azure Cosmos DB

In28 Minutes

- **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**) MongoDB (document), Cassandra (key/value) and Gremlin (graph)
In memory databases/caches	Azure Cache for Redis	Applications needing **microsecond** responses

Databases - Scenarios

In28 Minutes

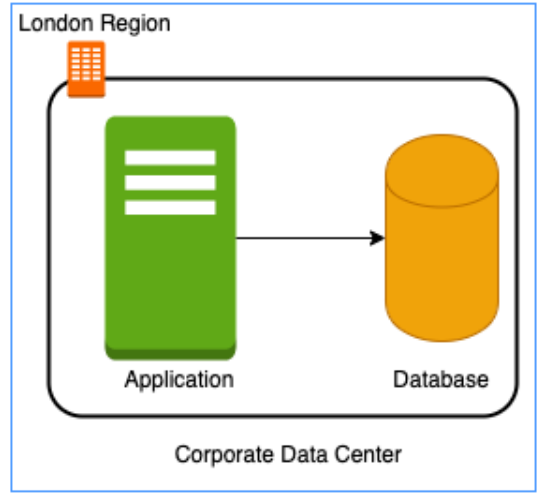
Scenario	Solution
A start up with quickly evolving schema (table structure)	Cosmos DB
Single-digit millisecond response times for global application with millions of users	Cosmos DB
Transactional local database processing thousands of transactions per second	Azure SQL Database OR Azure Database for MySQL 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

In28 Minutes

- 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

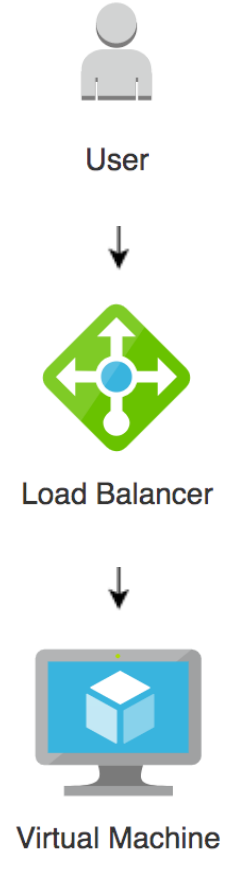
In28 Minutes

- 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



Database

Things to Remember - Virtual Network

In28 Minutes

- 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

Virtual Network

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

- **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

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
- **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

NSG

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

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 (Responsibility of Microsoft)
  - **Perimeter**: Azure DDoS Protection + Azure Firewall
  - **Network**: Restrict internet access (inbound and outbound)
    - Restrict communication between resources
  - **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!

DDoS Plans

NSG

Firewalls

Zero Trust

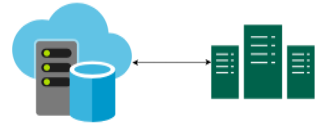
In28 Minutes

- 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

Cloud Computing: Public vs Private vs Hybrid clouds

In28 Minutes

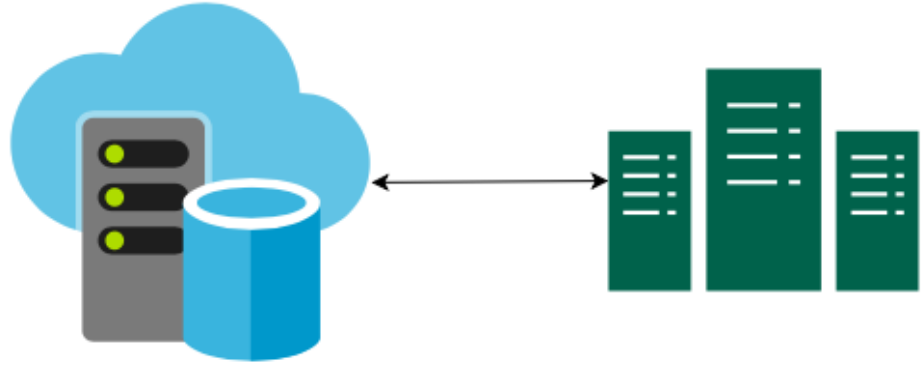
- Cloud Computing
  - Public Cloud
    - You host everything in the cloud (You DO NOT need a data center anymore)
      - No Capital Expenditure required
    - Hardware resources are owned by Azure (Microsoft)
      - Hardware failures and security of the data center are managed by Azure (Microsoft)
    - 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

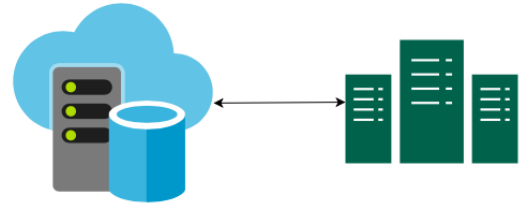
In28 Minutes

- Options: VPN and Azure ExpressRoute
  - **VPN**: Encrypted connection from on-premises to Azure over internet
    - Needs VPN device or gateway on-premises
    - Need Azure VPN gateway in the Azure Virtual Network
    - Encrypted communication over Internet (public)
  - **Azure ExpressRoute**: Private connectivity to Azure Virtual Network
    - Provides very high bandwidth
    - Very high security (private connection)
    - Traffic does NOT go over internet
    - Traffic is NOT encrypted by the connection



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

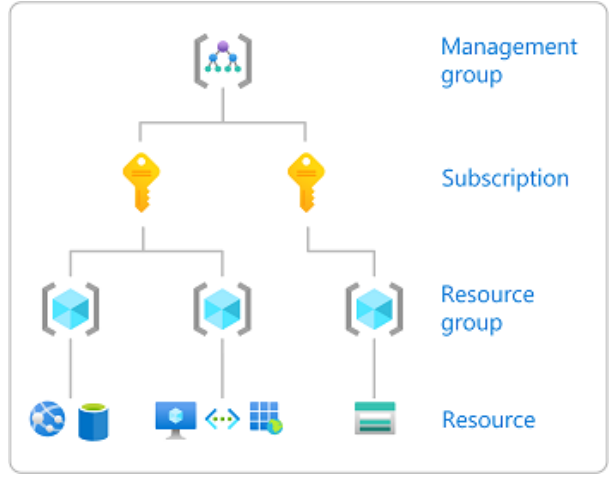


Organizing and Managing Azure Resources

Azure Resource Hierarchy

In28 Minutes

- **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



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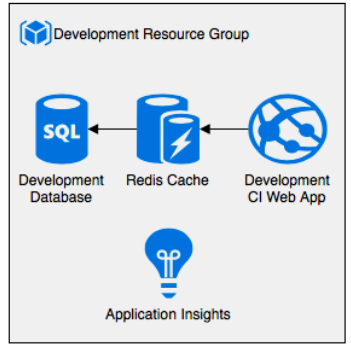
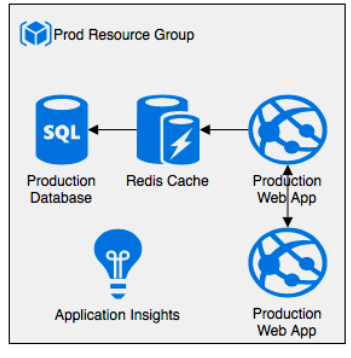
Resource Groups

In28 Minutes

- **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

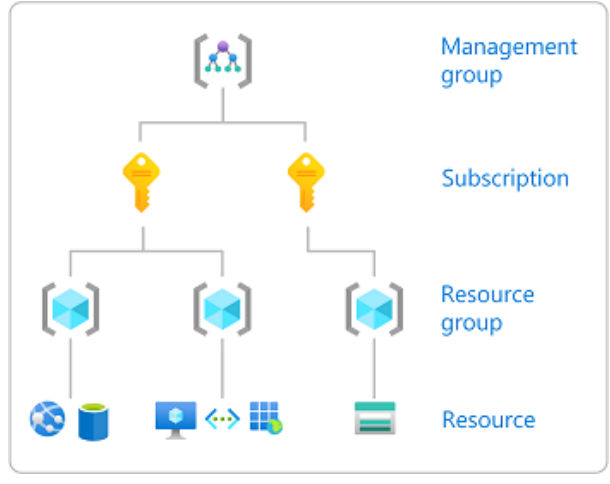
Subscriptions

- 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 associate 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

Management Groups

In28 Minutes

- 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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Azure Security Features

Microsoft Defender for Cloud

In28 Minutes

- **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

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

Key Vault

Core Azure identity services

Typical identity management in the cloud

In28 Minutes

- You have **resources** in the cloud (examples - a virtual server, a database etc)
- You have **identities (human and non-human)** that need to access those resources and perform actions
  - For example: launch (stop, start or terminate) a virtual server
- How do you **identify users** in the cloud?
- How do you configure resources they can access?
- How can you configure what actions to allow?
- In Azure, *Azure Active Directory* provides this service

Users

Authentication vs authorization

In28 Minutes

- **Authentication** (is it the right user?) and
- **Authorization** (do they have the right access?)
- Each app and service need to authenticate and authorize users:
  - Would it be a good solution for each app and service to store their own user details (including credentials)?
  - What if we can store the user details (including credentials) in a centralized way and use it across multiple apps and services?
  - Enter "Centralized identity provider"
  - Enter "SSO"

Users

Active Directory

In28 Minutes

- **Active Directory**: Very popular Microsoft's proprietary directory service
- Define users, credentials and their access rights
  - Provides authentication and authorization
  - Supports groups
- **Active Directory Federation Services (AD FS)**: Single sign-on service
  - Enables you to login to multiple apps and services with the same credentials!
- Used in on-premises environments

Active Directory

Azure Active Directory

In28 Minutes

- **Azure Active Directory (Azure AD)**: Active Directory Service in Azure
  - Control enterprise users and their access to applications and Azure resources
    - Supports Azure and Microsoft 365
    - 99.9% availability SLA (Premium edition)
  - Build applications and enable them to **use SSO**
  - **Azure AD Connect**: Synchronize on-premises Active Directory with Azure AD
    - Synchronize all user details including passwords
  - **Azure AD MFA**: Authenticate users in multiple ways
    - 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
      - Recommended for Administrative accounts
    - **Needs Azure Active Directory Identity Protection**
  - **Azure AD self-service password reset**: Global Administrators can enable the feature to allow users to reset passwords by themselves

Azure Active Directory Domain Services (Azure AD DS)

In 28 Minutes

- **Active Directory (AD)**: Microsoft's very popular proprietary directory service
- **Azure Active Directory (Azure AD)**: Managed Active Directory Service in Azure
- Azure AD is a **toned down version** of AD (works very differently)
  - Azure AD (flat structure) vs AD (hierarchical with organizational units - OUs and group policy objects - GPOs)
  - Azure AD (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) with AD in Azure?
  - Use Azure Active Directory Domain Services (Azure AD DS)

Conditional Access

In28 Minutes

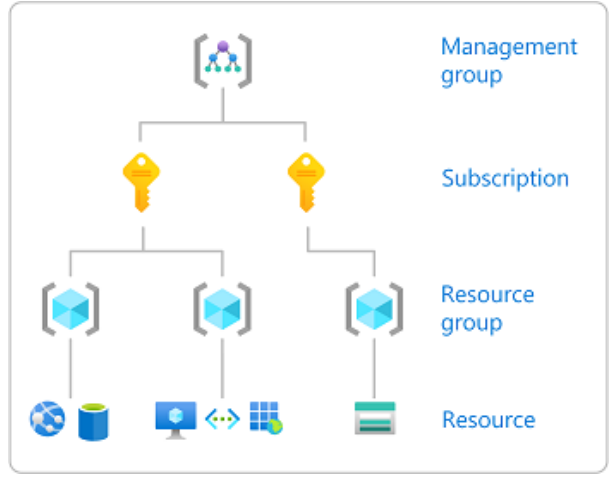
Conditional Access

- 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
- Only available with Azure AD Premium P1 or P2 licenses

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**: Apply same permissions across multiple VMs
  - Create VMs in the same resource group
  - Assign role to resource group



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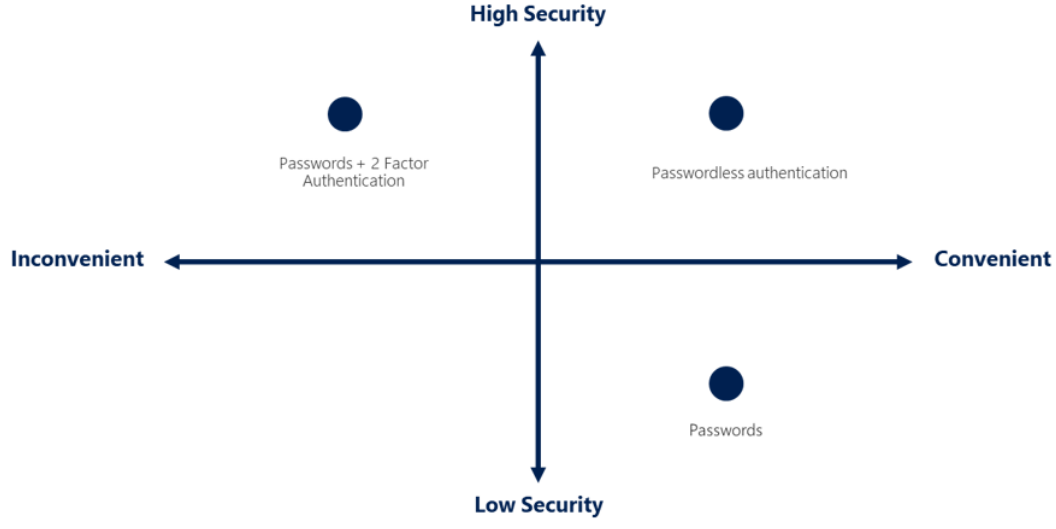
Passwordless authentication for Azure AD

In28 Minutes

- **Complex security frustrates users**
  - **Example**: MFA - User needs to remember passwords & have a security device
- How about simplifying security by going passwordless?
  - **Azure AD - three passwordless options**:
    - **Windows Hello for Business**: Credentials tied to users PC
      - For enterprise users who always perform tasks from their own designated Windows 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)
        - AD supports FIDO2 security keys (USB or bluetooth connection)



Azure Active Directory & Azure Subscriptions - Remember

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

Active Directory

Subscriptions

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

In28 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:8 hours, Sev B:4 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

Automation

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

In28 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

- **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

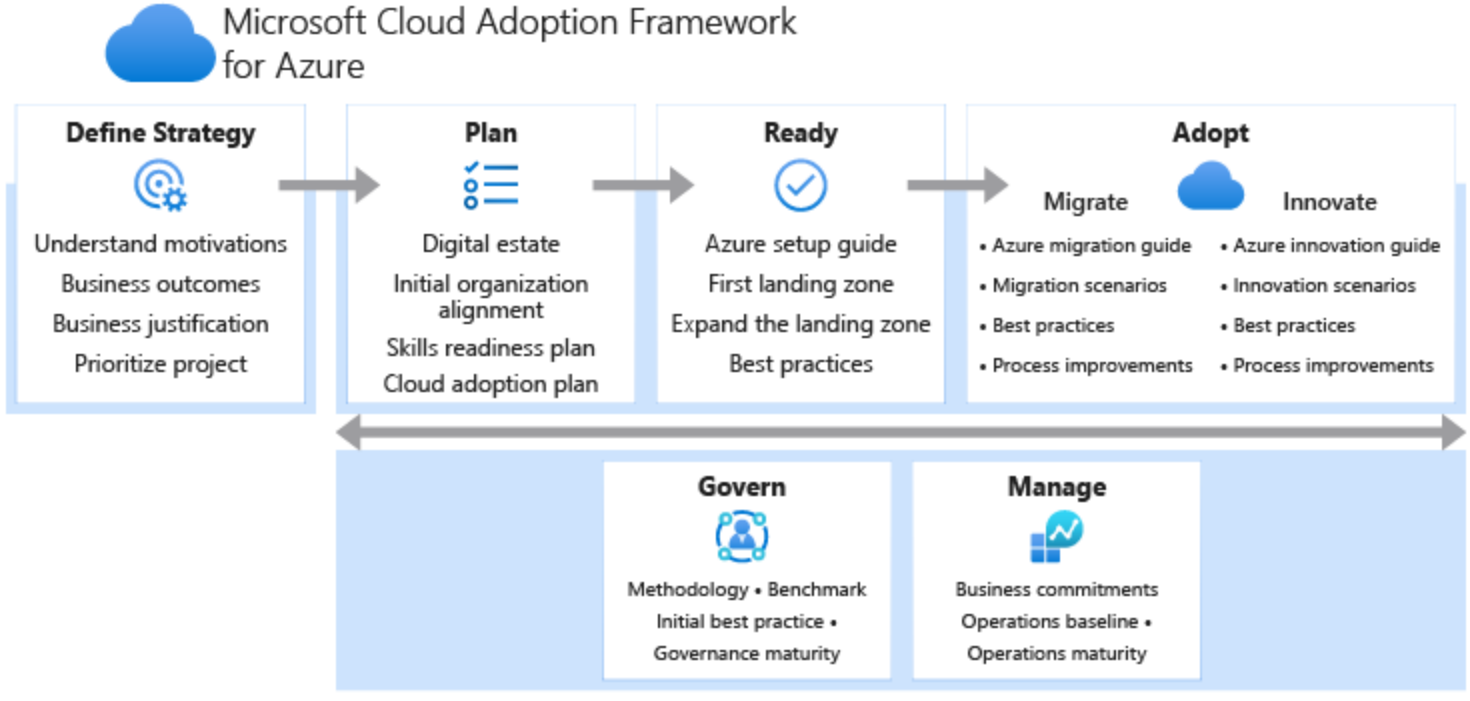
In28 Minutes

- **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

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 Search for DPA at ***https://www.microsoftvolumelicensing.com/DocumentSearch.aspx***. Covers Data transfer, Data retention, Data deletion and Data Security
Azure Information Protection	Classify and protect your documents and emails Add labels indicating what kind of protection/encryption you want Uses Azure Rights Management (Azure RMS) - Integrates with Office 365, Azure Active Directory etc 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 ***https://servicetrust.microsoft.com***
Azure Compliance Hub	Compliance offerings in Azure ***https://docs.microsoft.com/en-us/azure/compliance/*** Offers blueprints to simplify your compliance implementations
Azure Compliance Manager	Manage your organization’s compliance requirements Part of Service Trust Portal

Azure Sovereign Regions

In28 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 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) Uses physically isolated data centers and networks located in US Only US government entities and contractors are eligible to use Azure Government services
Azure China	Physically separated instance of cloud services located in China Operated by **21Vianet** (Azure China) 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

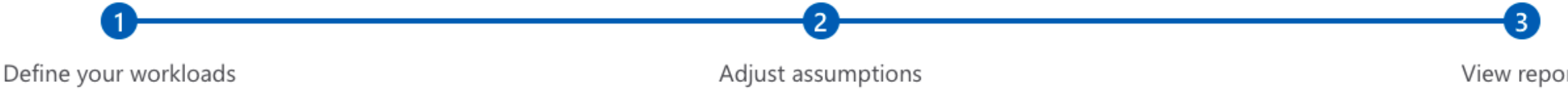
Expenditure Models: CapEx vs OpEx

In28 Minutes

- **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

In28 Minutes



- **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? 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 Inbound data from on-premises to Azure is free Outbound data from Azure to On-Premises is NOT free 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

Cost Management

- 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)

More Azure

Tags

In28 Minutes

- **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

Windows Virtual Desktop

In28 Minutes

- Your enterprise has remote developers. **How do you provide Desktops to them?**
  - One option to consider is "Windows Virtual Desktop"
- Connect with any device (Windows, Mac, iOS, Android, and Linux) over the internet
- Centralized security with Azure Active Directory (Azure AD)
- Option to **Bring your own licenses (BYOL)**
  - Bring in an eligible Microsoft 365 license

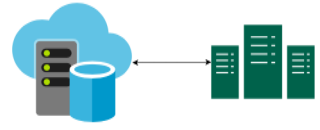
Azure Marketplace

In28 Minutes

- 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

In28 Minutes



- **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

DevOps

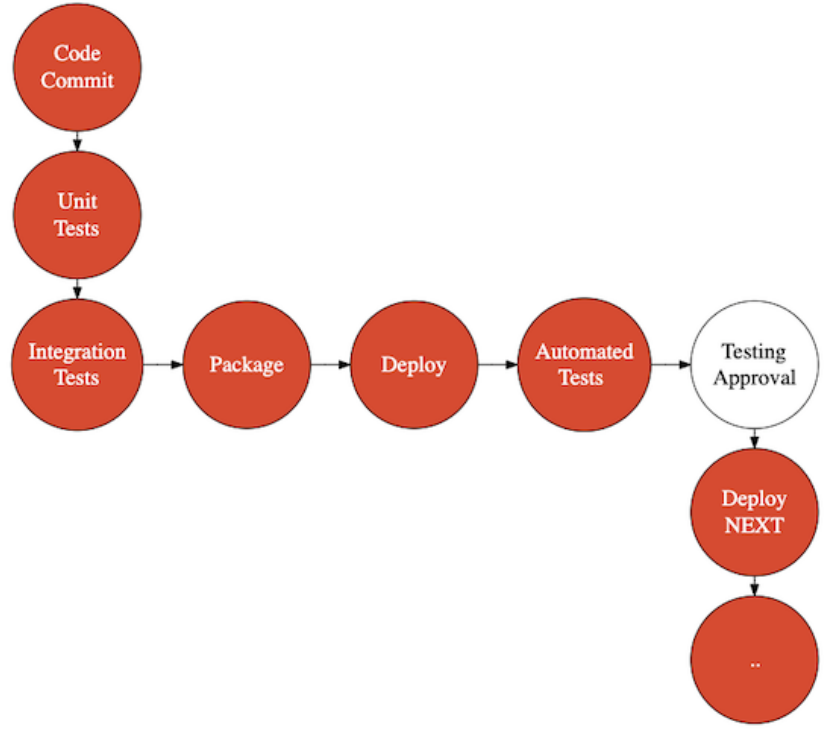
DevOps

In28 Minutes

- 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

In28 Minutes

- **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

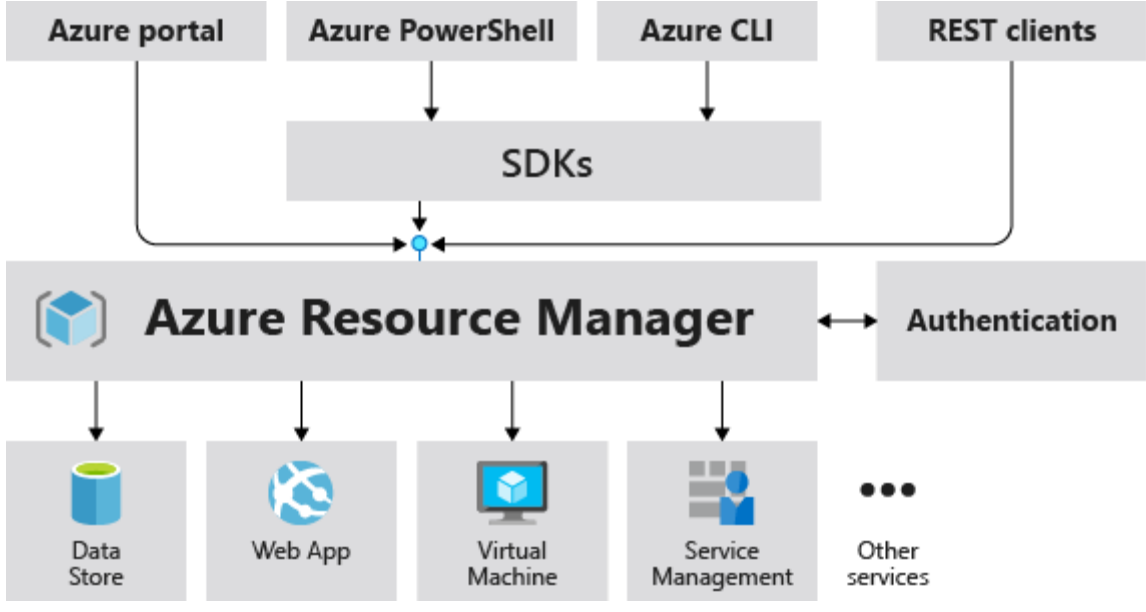
- **Lets consider an example:**
  - I would want to create a new VNet with two subnets
  - I want to provision a Load Balancer, Scale Set with 5 VM instances and an Azure Cosmos DB database in the subnet
  - I would want to setup the right network security groups
- AND I would want to create 4 environments
  - 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

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. 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) Recommended for teams familiar with Windows administration Cross-platform (Windows, Linux, and macOS)
Azure CLI	Similar to Azure PowerShell BUT uses a different syntax (Bash Scripts) Recommended for teams familiar with Linux administration (and Bash Scripts) Cross-platform (Windows, Linux, and macOS)
Azure Cloud Shell	Free Browser based interactive shell (Access from Azure Portal) Common Azure tools pre-installed and configured to use with your account Supports both PowerShell and CLI (bash) 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

In28 Minutes

Azure Service Name	Description
Azure VMs	Windows or Linux VMs (IaaS) 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. 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. 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. Package, deploy, and manage scalable and reliable microservices
Azure Functions	Serverless compute for event-driven apps

Networking

In28 Minutes

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 Traffic goes over Internet (public).
Azure DNS	Manage your DNS records Map Domain Name to IP Address
Azure Content Delivery Network	Cache content on edge servers (POPs) located around the world Minimize latency to global users

Storage

In28 Minutes

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

In28 Minutes

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

Get Ready

Certification Exam

In28 Minutes

- Certification Home Page
  - *https://docs.microsoft.com/en-gb/learn/certifications/exams/az-900*
- Different Types of Multiple Choice Questions
  - Type 1 : Single Answer - 2/3/4 options and 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
- Result immediately shown after exam completion
- Email with detailed scores (a couple of days later)

Certification Exam - My Recommendations

In28 Minutes

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

You are all set!

Let's clap for you!

In28 Minutes

- 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!

In28 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?

In28 Minutes

https://github.com/in28minutes/learn

- Learn Other Cloud Platforms:
  - Gartner predicts a multi cloud world soon
  - Get certified on AWS, Azure and Google Cloud
- Learn DevOps (Containers and Container Orchestration)
- Learn Full Stack Development