Azure Core Services - Azure Virtual Machines

Deploying a Windows Virtual Machine

Workstation

Server

CD

Install Windows Server

Process can take an hour

Image

Subscription

Resource Group

OS Disk

Virtual Network

Virtual Machine

Data Disk

Subnet

Public IP Address

Disk

C:\   D:\

laptop

192.168.0.10

Wifi Router

Internet

Installing IIS on the VM

Resource
Group

Virtual
Network

OS Disk

Virtual
Machine

Public IP
Address

Internet

Subscription

Virtual
Network
Interface

Network
Security
Group

Web Server

Internet Information Services

https://cloudportalhub.com

State of the Virtual Machine

Resource
Group

Virtual
Network

OS Disk

Virtual
Machine

Public IP
Address

Internet

Subscription

Virtual
Network
Interface

Network
Security
Group

Web Server

Internet Information Services

https://cloudportalhub.com

If you do a shutdown/restart of your machine from the virtual machine itself, the
data will stay intact

Temporary storage - D: drive

If you Stop you machine from the Azure Portal, it will delete all the information
from the temporary storage

Availability Sets

app

VM   VM

Power / Network

Physical server in an Azure Data Center

Power / Network   **Power / Network**   **Power / Network**

Update Domains   VM   VM   VM

Update Domains   VM
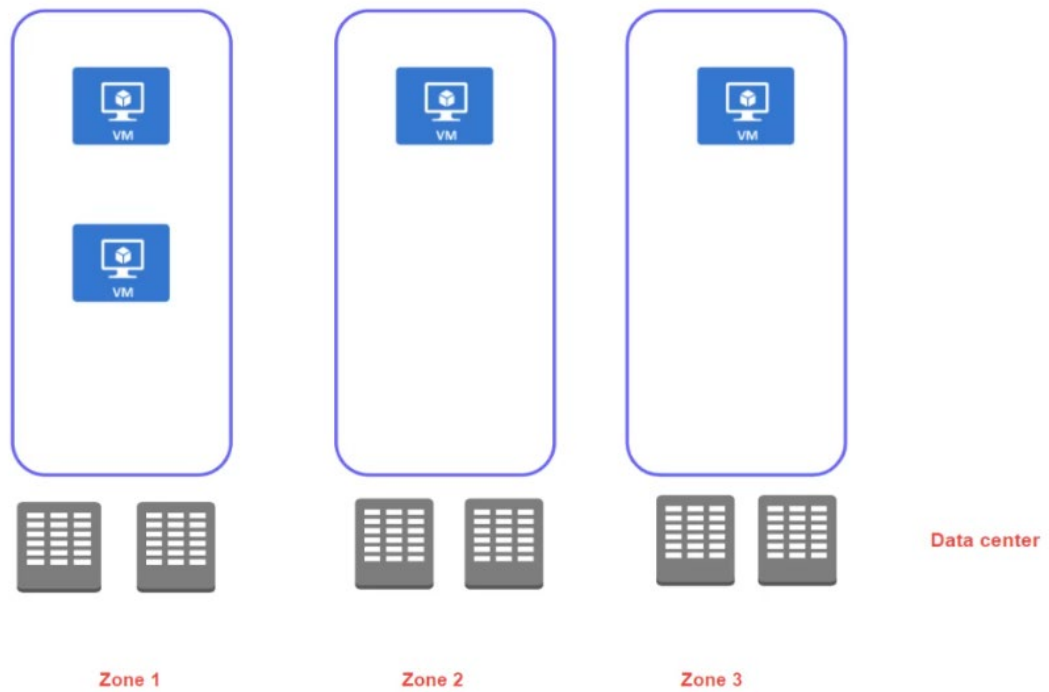
Fault Domain   **Fault Domain**   **Fault Domain**

If you have two or more instances deployed in the same Availability Set , you will get an SLA of 99.95% for Virtual Machine Connectivity to at least one instance

Availability Zones

Availability Zones are unique physical locations that are equipped with independent power, cooling and networking.

There are normally three Availability Zones in a region

If you have two or more instances deployed in the same Availability Zone , you will get an SLA of 99.99% for Virtual Machine Connectivity to at least one instance

Azure Dedicated Host

Azure Dedicated host

1. Hardware isolation - No other VM's will be placed on the host

2. You can control the maintenance events

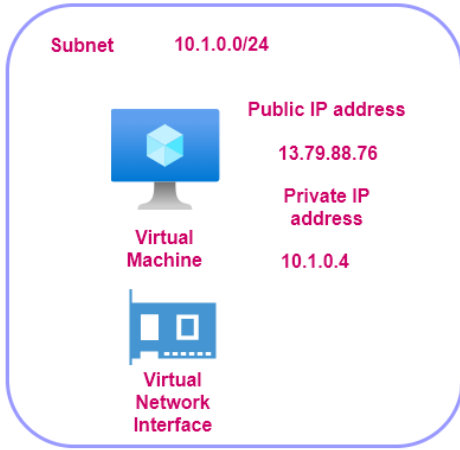**Physical host**

Azure Core Services – Networking

Network Security Groups

10.1.0.0/16

**Virtual
Network**

Subnet   **10.1.0.0/24**

Public IP address

13.79.88.76

**Private IP
address**

10.1.0.4

**Virtual
Machine**

**Virtual
Network
Interface**

Internet

My machine

50.99.88.67

**Network
Security
Group**

Inbound rules	**Outbound rules**
1. Priority	3. Protocol
2. Port No	4. Source and Destination

Application Security Groups

Virtual Network

Subnet

VM

VM

Server

database

**Application Security
Groups**

NSG

NSG

NSG
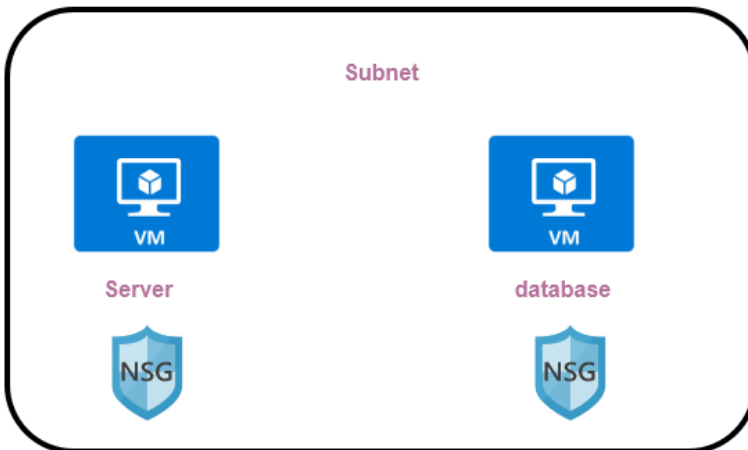
Communication across virtual machines in a virtual network

10.1.0.0/16

Virtual Network

Subnet   10.1.0.0/24

Public IP address

13.79.88.76

Public IP address

13.79.40.100

Internet

Virtual Machine

10.1.0.4

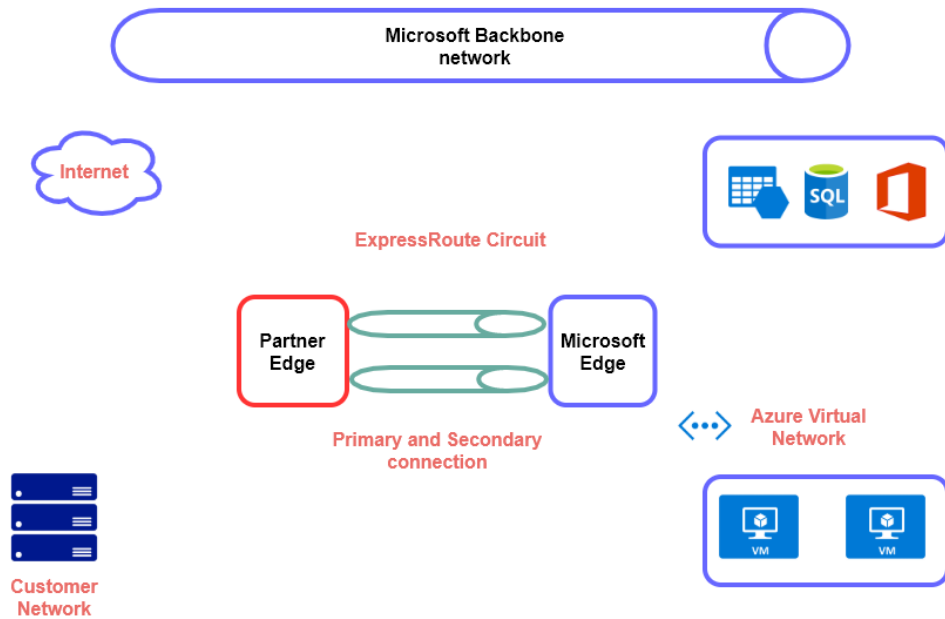**Private IP address**

Virtual Machine

10.1.0.5

Private IP address
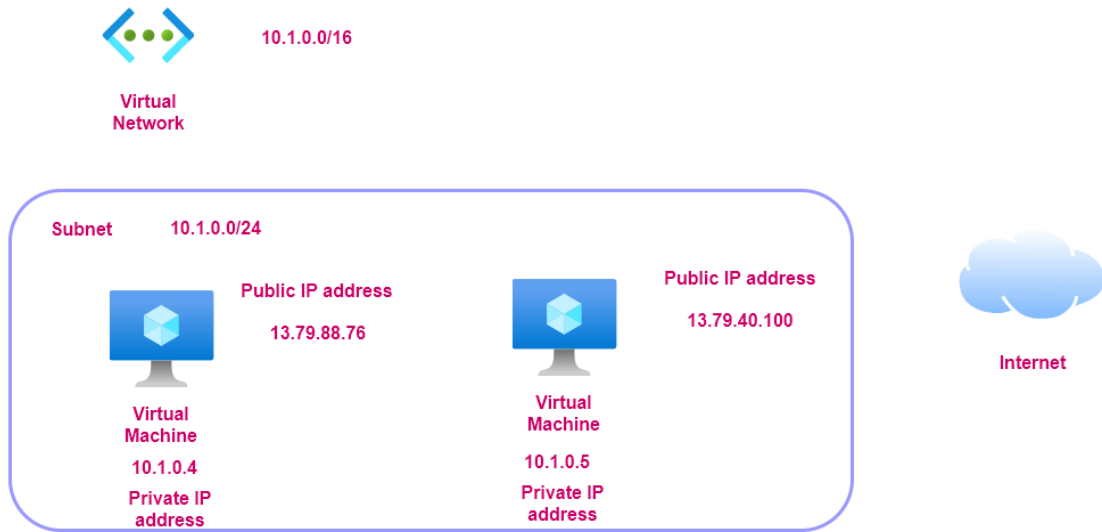
The IP address or Internet Protocol Address is a numerical label that helps to locate a machine

Network connectivity options

Virtual Network Peering

Test network

10.0.0.0/16

Staging network

20.0.0.0/16

Private IP addresses

Point-to-Site VPN Connection

Staging network

20.0.0.0/16

Client workstations

VPN Gateway

Private IP addresses
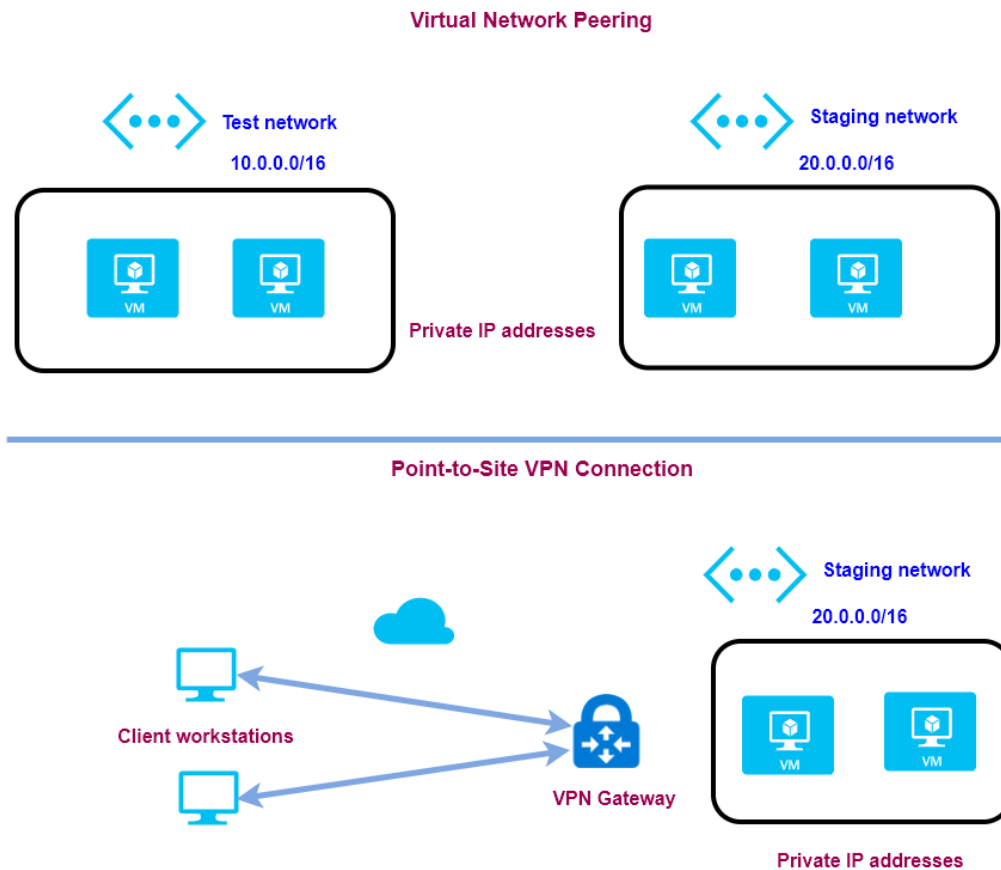
Azure ExpressRoute

ExpressRoute Direct
Here Customers can connect directly to Microsoft global network at different peering locations across the world. This connection provides 100Gbps connectivity

Choose a connectivity Provider
Here you can choose different bandwidth options - 50 Mbps , 100 Mbps etc

Azure Core Services - Azure Storage

Azure Storage Accounts

Azure Storage Accounts

This provides storage on the cloud

Blob	Table	Queue	File

Storing objects Images, Videos

Storing table data

Storing queues Used for sending and receiving messages

Used for creating file shares

10.1.0.0/16

Virtual Network

Subnet   10.1.0.0/24

Public IP address

13.79.88.76

Virtual Machine

10.1.0.4

Private IP address

Internet

Azure Storage Accounts

Udemy

Video	Video	Blob

Storing objects Images, Videos

Azure Storage account - Redundancy
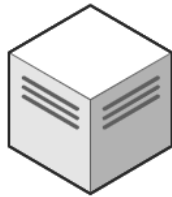
Multiple copies of your data are stored

This helps to protect against planned and unplanned events - transient hardware failures, network or power outages.

Storage Device

Locally-redundant storage

Data Center

Central US

Here three copies of your data are made

It helps to protect against server rack of drive failures
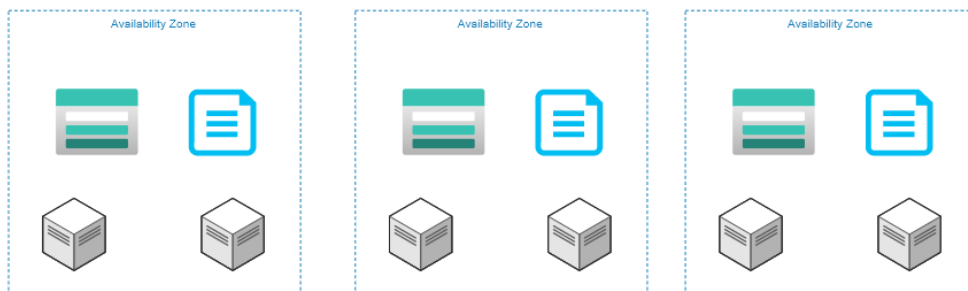
Storage Device　**Storage Device**　**Storage Device**

Zone-redundant storage　　**This helps to protect against data center level failures**

Here data is replicated synchronously across three Azure availability zones

Availability Zone　　　Availability Zone　　　Availability Zone
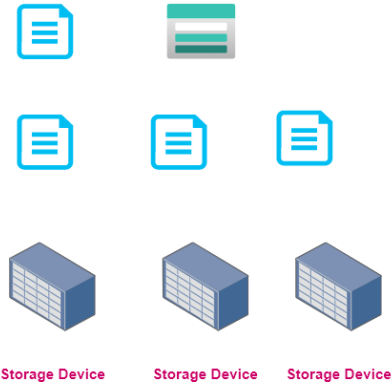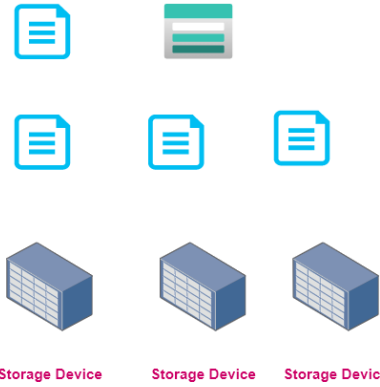
Central US

Each availability zone is a seperate physical location with independent power, cooling and networking

Geo-redundant storage

Here data is replicated to another region

Central US

East US 2

Storage Device   Storage Device   Storage Device

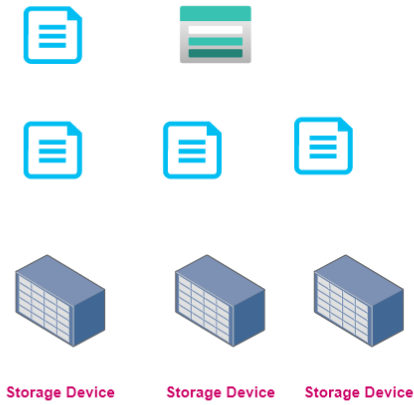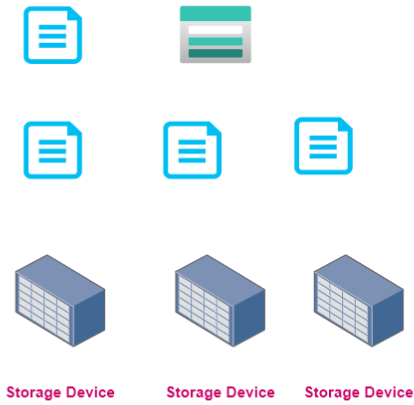Storage Device   Storage Device   Storage Device

Data is copied three times in the primary region using LRS

Data is copied three times in the secondary region using LRS

Read-access geo-redundant storage

Central US
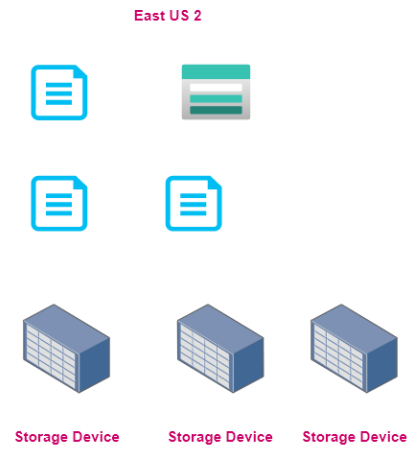
East US 2

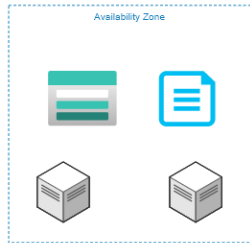Storage Device   Storage Device   Storage Device

Storage Device   Storage Device   Storage Device

Data is copied three times in the primary region using LRS

Data is copied three times in the secondary region using LRS

Central US

Availability Zone

East US 2

Availability Zone

Availability Zone

Storage Device   **Storage Device**   **Storage Device**
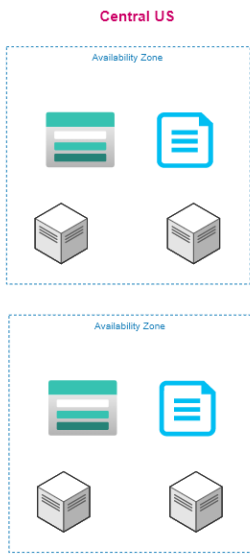
Azure File Shares

File Server

Azure Queue Storage

Azure Queue Storage

Queue   **Message Size - 64KB**

Web App

app

Blob

Container   Container

https://demostore2090.blob.core.windows.net/unprocessed/video1.mp4
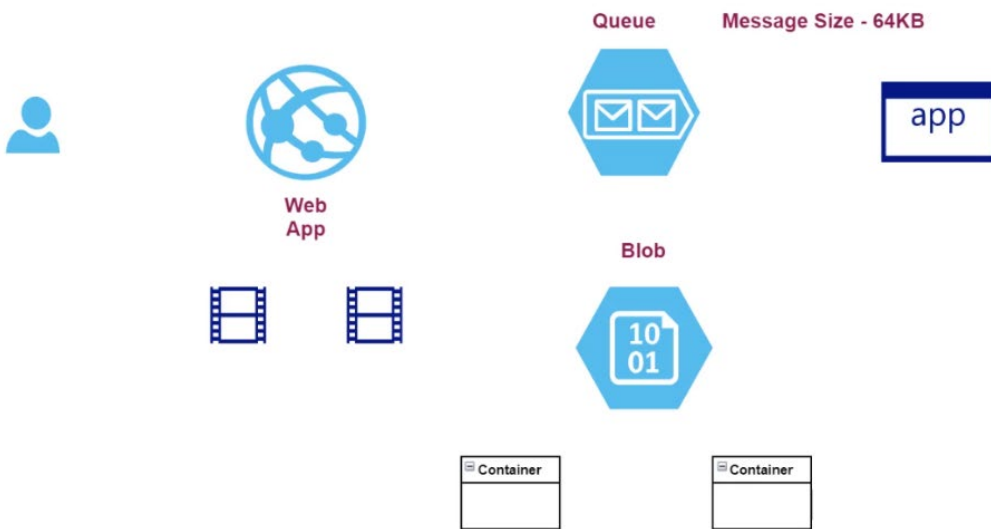
Azure SQL Databases

Virtual Machine

IaaS

Install Microsoft SQL Server

Configure the server

Configure high availability

Configure backups

Azure SQL database

PaaS

Here the infrastructure is managed for you

Backups are managed for you

You get built-in high availability

Enterprise Data Warehouse Architecture

Enterprise Data Warehouse Architecture

	Ingest	Store	Prep and train
Different types of files - unstructured data	Azure Synapse - Pipelines	Azure Data Lake Gen2 storage accounts	Azure Synapse - Apache Spark
Social Media feeds	Azure Data Factory		Azure Databricks
			Azure Synapse - Dedicated SQL Pool
			Model and serve
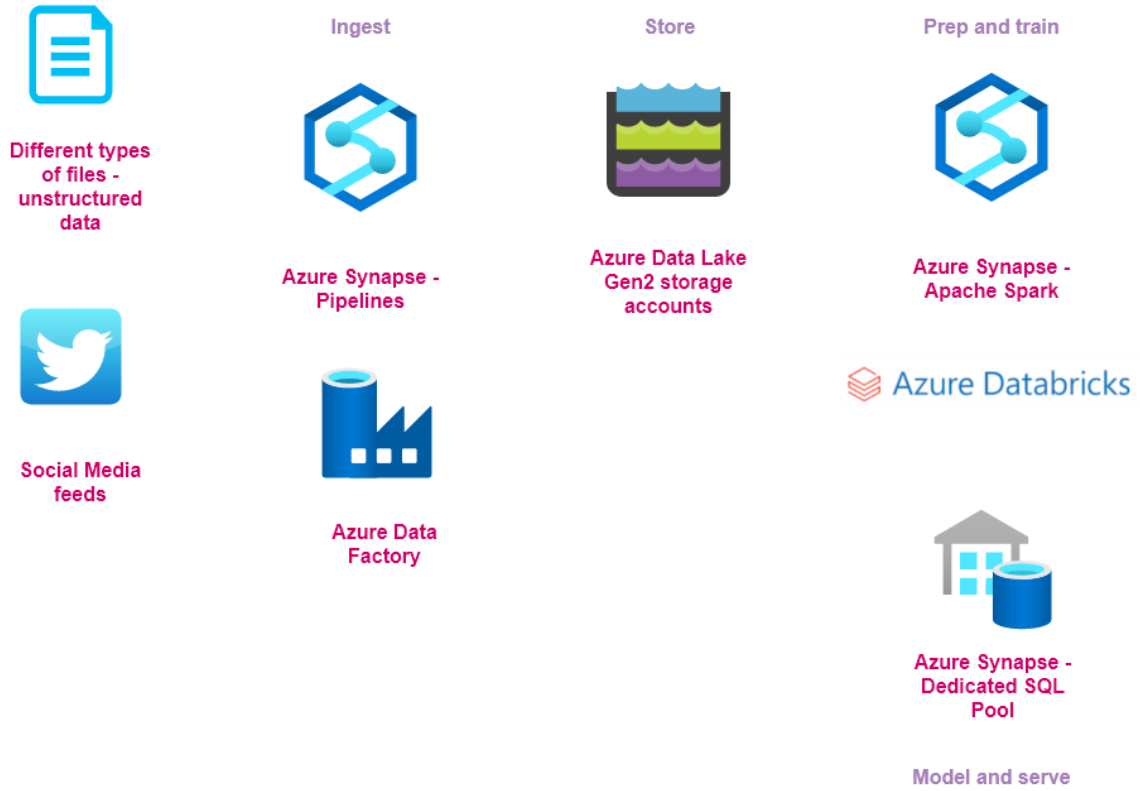
Azure Cosmos DB Introduction

Customer
* +CustomerID
* +CustomerName
* +Address

PK | uniqueId

Courses
* +CourseID
* +CourseName
* +Price

PK | uniqueId

PK | uniqueId

FK |

FK |

Orders
* +OrderID
* +CustomerID
* +CourseID

One customer can place
many orders

Several orders might be for
the same Course
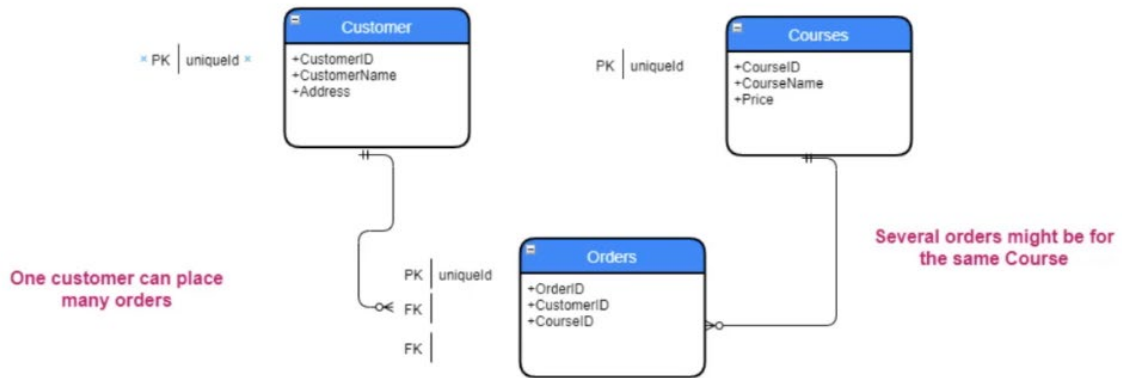
One of the main reasons for normalization was to reduce
duplication of data

And this was to save on disk space

Demand for flexibility of data , simpler database system

System where the data schema can vary for each row

System where we are not worried about joins

PK | uniqueId

Customer
* +CustomerID
* +CustomerName
* +Address

Courses
* +CourseID
* +CourseName
* +Price

Azure SQL Database vs Cosmos DB

Azure SQL Database

When you need to have relationships between tables

When you want to have constraints like foreign key constraints

Azure Cosmos DB

NoSQL data store

Flexible schemas

No need of joins between data structures

A sample architecture - use case 1

Web Application

Database server

Web Application

Azure SQL Database

Azure Web App

Database server

Azure Web App

Azure SQL Database

A sample architecture - use case 2

Azure Storage accounts

Blob container
Unprocessed videos

Blob container
processed videos

Queue

Video

Azure Web App

Azure Functions

Table

Store information about
the videos
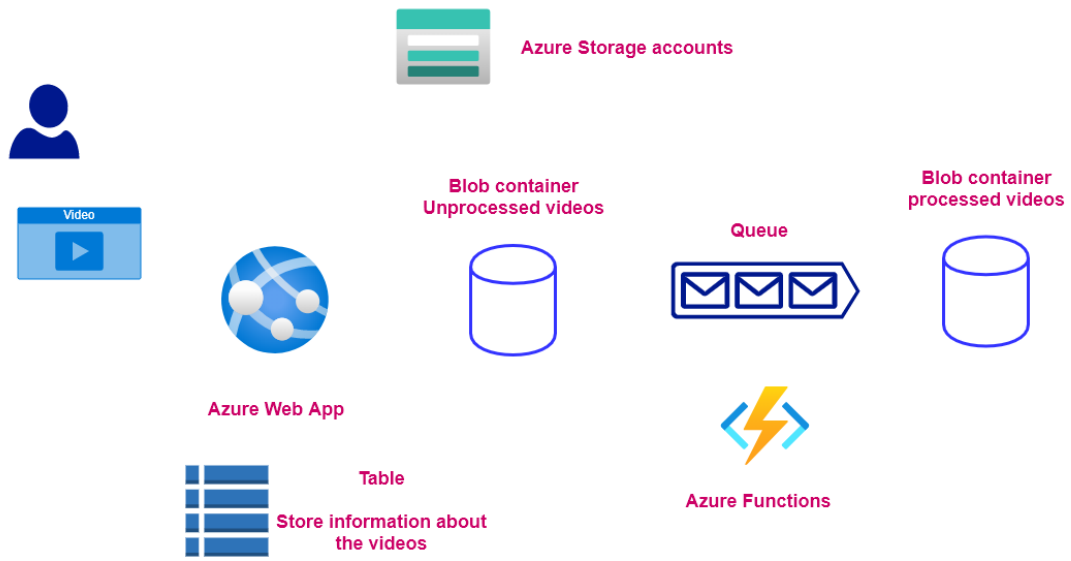
Understand cloud concepts

Benefits of the cloud - High Availability

High Availability

OS Disk

Data Disk

**Virtual
Machine**
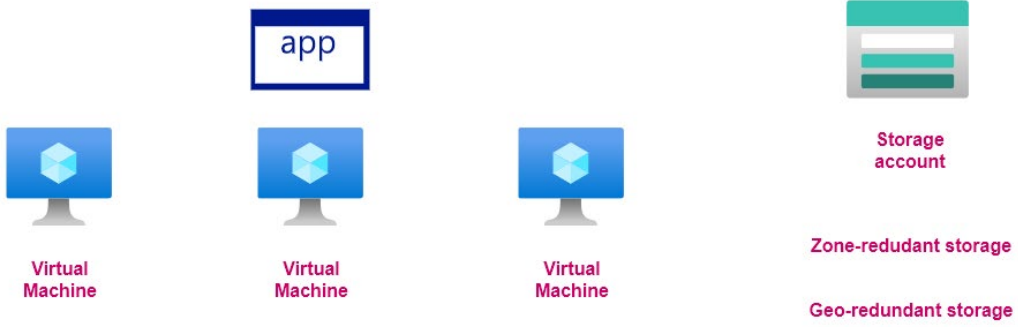
Benefits of the cloud — Scalability

Scalability

Virtual Machine

OS Disk

Data Disk

app

Virtual Machine

Virtual Machine

Virtual Machine

Storage account

You don't need to worry about the underlying storage

It will grow automatically

Availability set

Availability Zone

Virtual Machine Scale Set
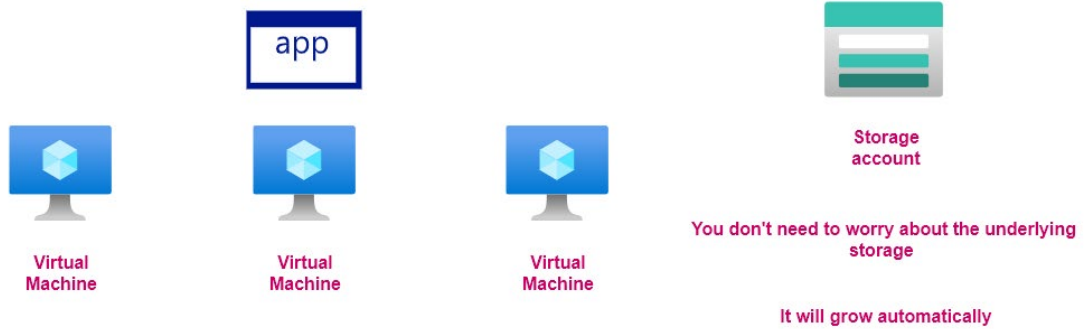
Benefits of the cloud – Disaster Recovery

Disaster Recovery

OS Disk

Data Disk

Virtual Machine

Storage account

Geo-redundant storage

Virtual Machine

OS Disk

Data Disk

North Europe region

What happens if the entire region goes down

West Europe region

Availability set

Availability Zone
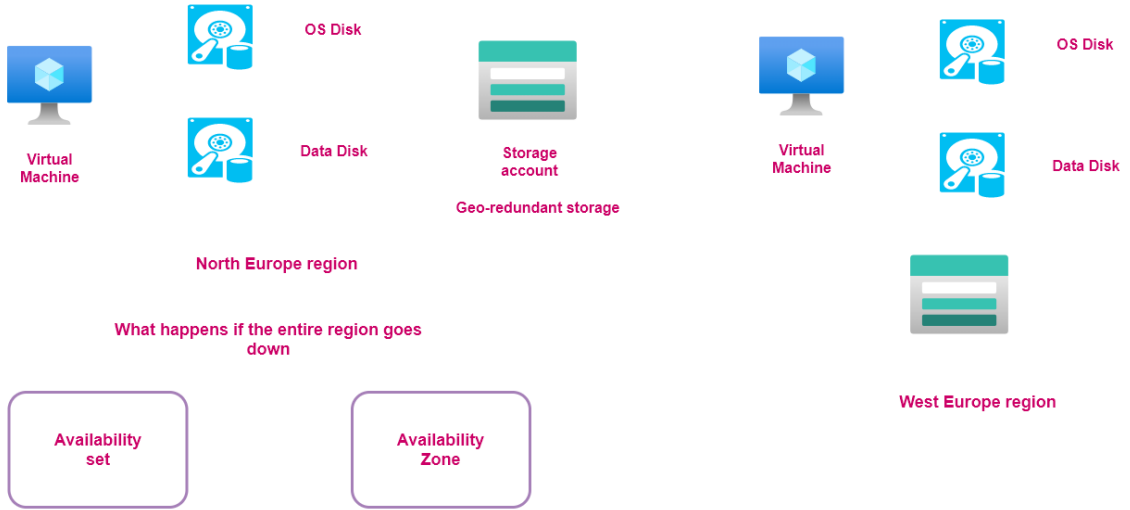
Benefits of the cloud – Fault tolerance

Fault tolerance

app

Storage account

Virtual Machine

Virtual Machine

Virtual Machine

Zone-redudant storage

Geo-redundant storage

Availability set

Availability Zone

Cloud service model

Infrastructure as a service   **(IaaS)**

Application

Data

Runtime

Operating System

Virtualization

Servers

Storage

Networking

Azure Virtual Machine

Platform as a service   **(PaaS)**

Application

Data

Runtime

Operating System

Virtualization

Servers

Storage

Networking

Azure SQL Database

Software as a service   **(SaaS)**

Application

Data

Runtime

Operating System

Virtualization

Servers

Storage

Networking

Email

Cloud model types

Cloud Model types

Public Cloud   **Private Cloud**   **Hybrid Cloud**

Public Cloud

Private Cloud

Private Cloud

Hybrid Cloud

More on Azure Core Services - Part 1

Azure Web Apps

app

.Net, .Net Core, Java,
Ruby, Node.js, Python

Azure App Service (
Azure Web Apps)

1. You don't have to
maintain the
underlying compute
Infrastructure

**Infrastructure as a
service**

Platform as a service

2. It has features such
as Autoscaling and
security.

app

3. It has DevOps
capabilities which
includes continuous
deployment

**Custom or Vendor
based application**

Virtual Machine

Azure Load Balancer

Azure Load balancer

**Virtual
Machine**

You define rules

The rule is based on a condition

**Scale out - If the CPU percentage >
70% then add one machine**

**Scale in - If the CPU percentage <
70% then add one machine**

Virtual Machine Scale set

Azure Traffic Manager

DNS Routing based service

Routing Methods

1. Priority

2. Weightage

Azure Traffic Manager Profile

Azure Web App East US

Azure Web App Central US

Web App East US 2

VM

Azure Load Balancer Network Routing Tool

Lab - Azure Traffic Manager

Routing Methods

Priority

Azure Traffic Manager Profile

Azure Virtual Machine North Europe

Azure Virtual Machine Central US

Azure Functions - Introduction

Azure Function App

f(n)

f(n)

f(n)
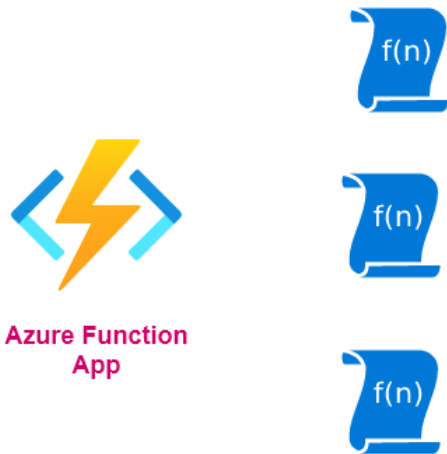
The functions could be in .Net

You are charged based on how much you consume

app

Virtual Machine Scale Sets

Virtual Machine

Virtual Machine

Virtual Machine

You define rules

The rule is based on a condition

Scale out - If the CPU percentage > 70% then add one machine

Scale in - If the CPU percentage < 70% then add one machine

Virtual Machine Scale set

Azure Resource Manager Templates

Template format

In its simplest structure, a template has the following elements:

```json
JSON                                                          Copy

{
  "$schema": "https://schema.management.azure.com/schemas/2019-04-01/deploy
  "contentVersion": "",
  "apiProfile": "",
  "parameters": {  },
  "variables": {  },
  "functions": [  ],
  "resources": [  ],
  "outputs": {  }
}
```

Version of the template language being used

Version of the template

Collection of API version for resource types

Values that can be provided during deployment

Values that can reused in the template

Resource that need to be deployed

Values that can be retrived after resource deployment

More on Azure Core Services - Part 2

Primer on Docker Containers

Containers
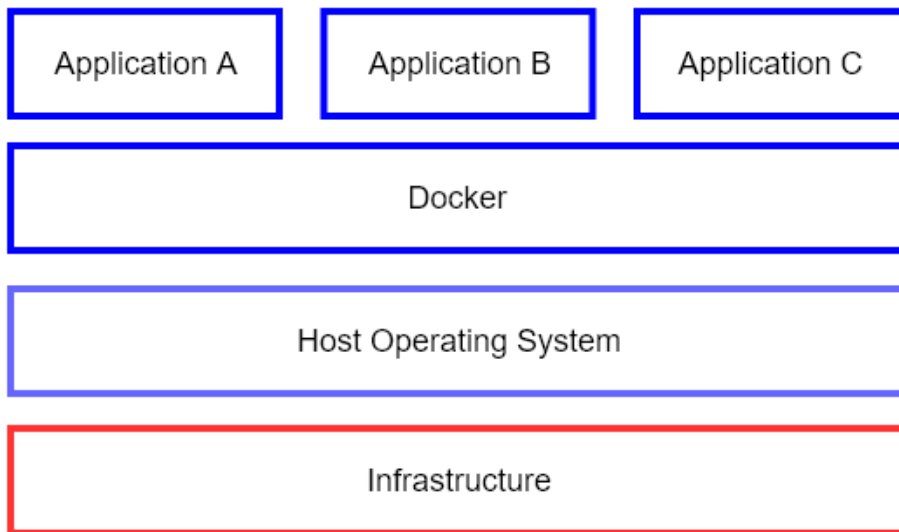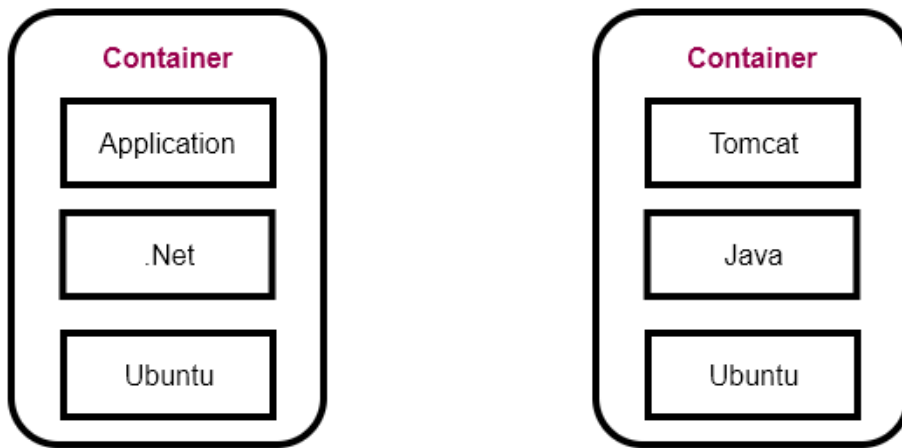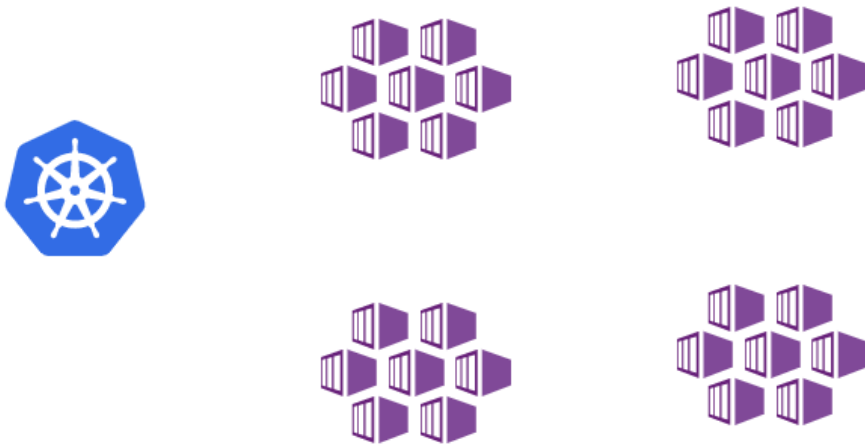
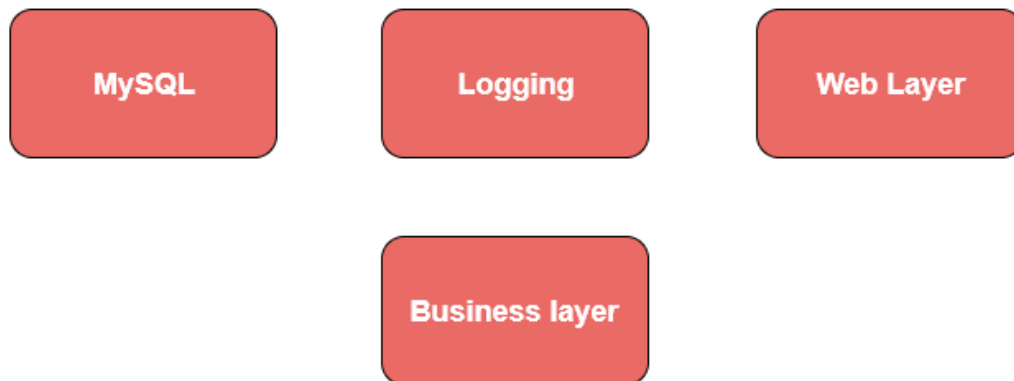## Why do we need containers

Azure Kubernetes Service

Kubernetes

Managing containers at scale

Azure Kubernetes - Managed service for Kubernetes on Azure

Kubernetes is used to orchestrate your containers for hosting your applications

MySQL	Logging	Web Layer

Business layer

Kubernetes cluster

Nodes - These are used for hosting your containers

master node

The master node is used to control the nodes in the cluster

Azure Content Delivery Network
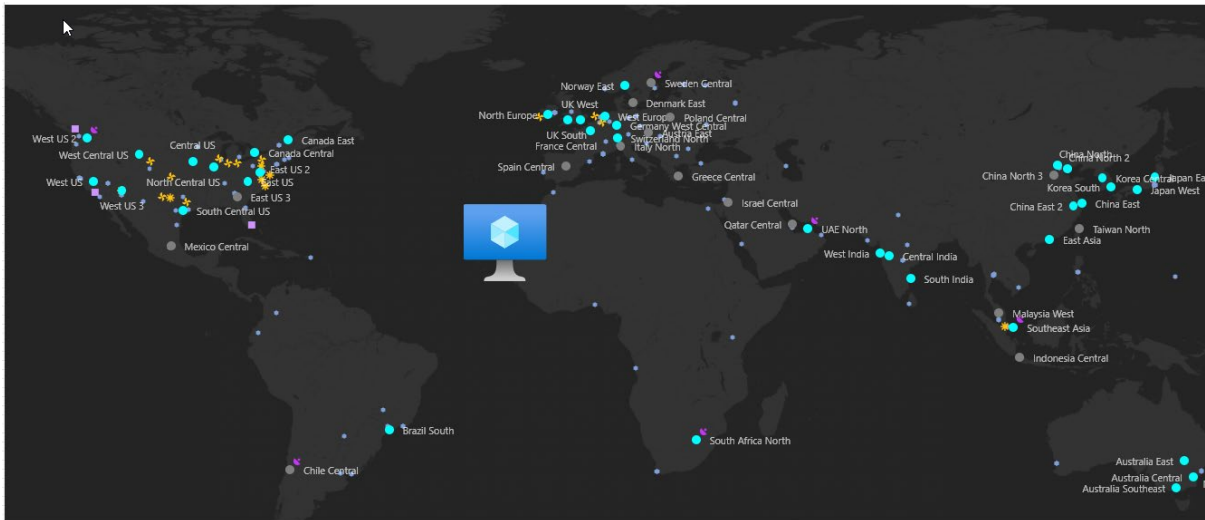
Content Delivery Network

This is a distributed network of servers that can deliver web content to users

These servers are located in point-of-presence locations that are closer to the end users

These locations can also cache requests to help minimize latency

Understand security, privacy, compliance, and trust

Azure Active Directory

Subscription

Azure Active Directory

Role-based access control

Role Based Access Control

Subscription

Azure AD

Resource Group

Authentication
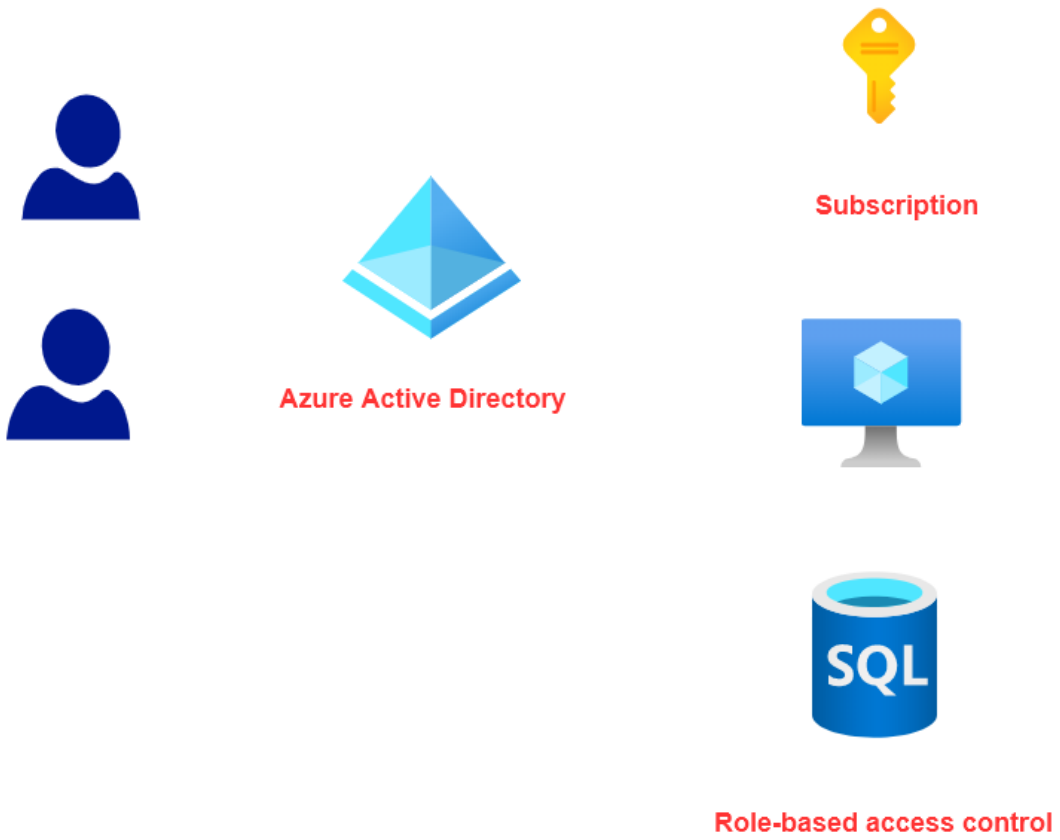
Storage Account

Role-based access control

Authorization

Management Groups

Management Groups

Tenant Root Group

Human Resources

Logistics

Staging   Production   Staging   Production

Resource Groups   **Resource Groups**

Resources   **Resources**
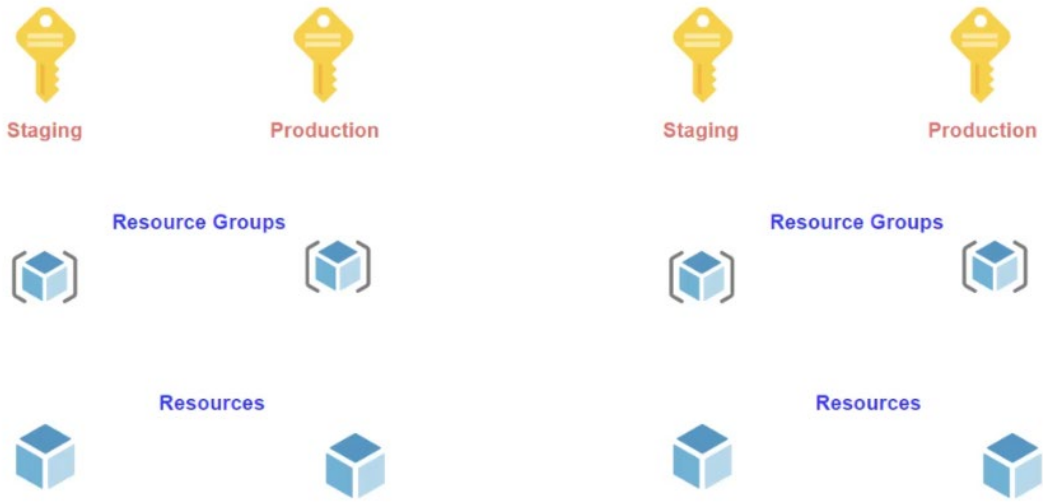
Azure Blueprints

Azure Blueprints

Orchestrate the deployment of artifacts to Azure

ARM Templates   JSON

Azure Policies

Resource Groups

Role-based acces control
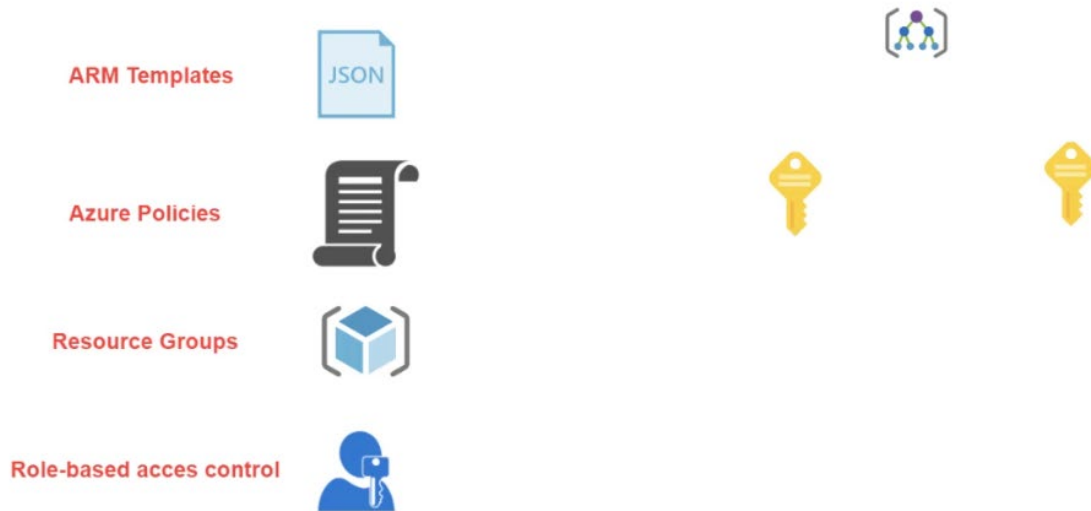
Azure DDoS protection

Azure DDoS Basic Protection

Every resource is protected by Azure DDoS Basic Protection

This helps to protect against common network-layer attacks

There is constant traffic monitoring and real-time mitigation

Azure DDoS Standard Protection - 2944 USD per month

Feature	DDoS Protection Basic	DDoS Protection Standard
Active traffic monitoring & always on detection	●	●
Automatic attack mitigations	●	●
Availability guarantee	○	●
Cost Protection	○	●
Mitigation policies tuned to customers application	○	●
Metrics & alerts	○	●
Mitigation reports	○	●
Mitigation flow logs	○	●
DDoS rapid response support		●

https://docs.microsoft.com/en-us/azure/ddos-protection/ddos-protection-overview

What is the Azure Key Vault service

Azure Key Vault

app

DB

Password

Key vault

https://cloudportalhub.com

app

Certificate

SSL padlock

Encryption Key

Secrets

Azure Firewall

Azure Firewall

This a cloud-based network security service that protects Azure Virtual Network resources

Azure virtual machines

SubnetA

Azure Firewall

Internet
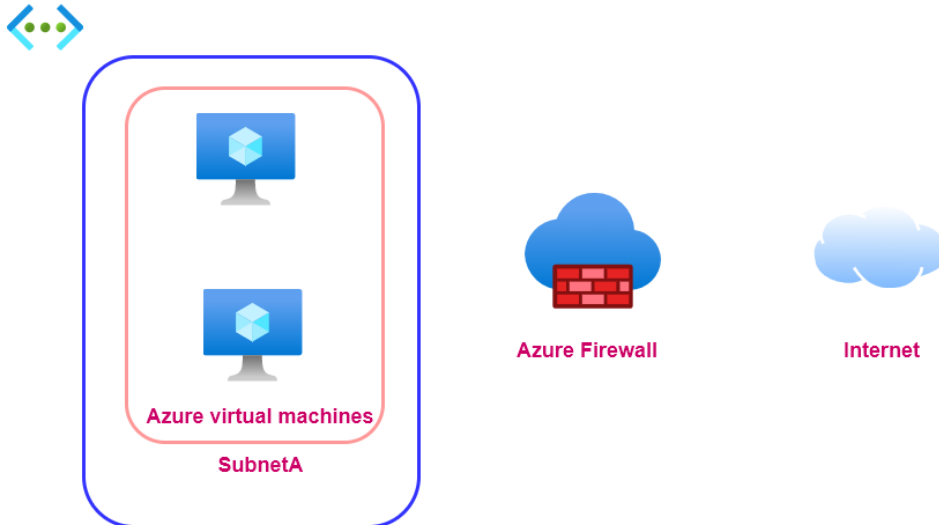
You can create network traffic filtering rules - source and destination IP address, port and protocol.

Application FQDN filtering rules - Here this can limit outbound traffic to specific fully qualified domain names

In-built Threat Intelligence that can alert or deny traffic from/to known malicious IP addresses and domains

Putting everything together

Understanding your requirements

app

app

Documents

Application/Web servers

Active Directory
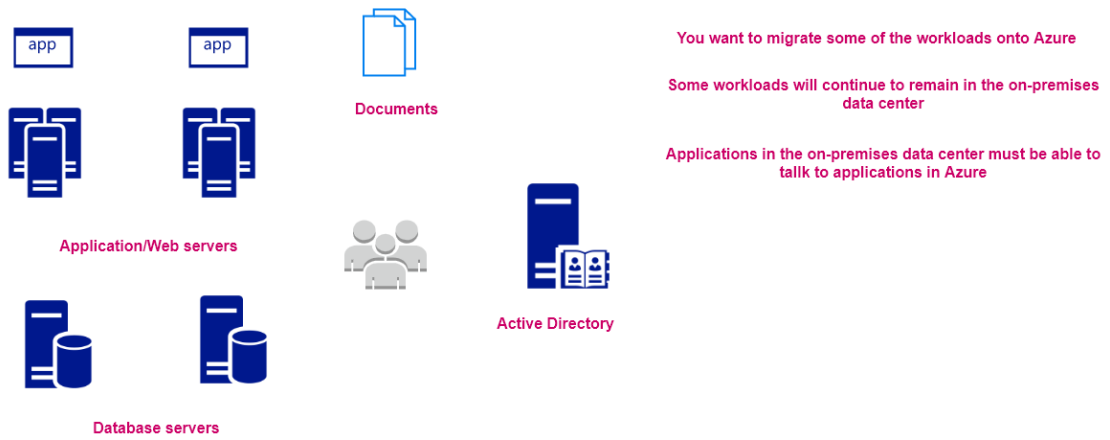
Database servers

You want to migrate some of the workloads onto Azure

Some workloads will continue to remain in the on-premises data center

Applications in the on-premises data center must be able to talk to applications in Azure

Choosing the right cloud model

The right cloud model

app

app

Documents

app

IaaS

PaaS

Application/Web servers

Azure virtual machine

Azure Web Apps

Benefits - No capital expenditure

Pay-As-You-Model - Metered pricing

Database servers

Active Directory

Azure virtual machine

Azure SQL database

Storing user documents

app

app

Documents

app

IaaS

PaaS

Azure virtual machine

Azure Web Apps

Application/Web servers

Benefits - No capital expenditure

Pay-As-You-Model - Metered pricing

10 01

Azure Storage accounts

Database servers

VM

SQL

Azure virtual machine

Azure SQL database

Active Directory

High Availability

app

SLA - 99.95% (not for Free/Shared plans)

IaaS

PaaS

app

app

Documents

Azure virtual machine

Azure Web Apps

Application/Web servers

VM

VM

Azure virtual machine

Azure virtual machine

Availability Sets

Database servers

Availability Zones - Protects against data center level failure

Does not protect against region level failures

Active Directory

Elasticity

app

app

app

Documents

Azure virtual machine

Application/Web servers

You can increase the virtual machine size

Virtual Machine Scale set

Database servers

VM

VM

Azure Load Balancer

Active Directory

Connecting data center to Azure

Connecting your networks together

app

app

Application/Web servers

Site-to-Site VPN Connection

⟨•••⟩ **Azure virtual network**

VM   VM

Azure virtual machine

app

ExpressRoute Connection

Database servers

Active Directory
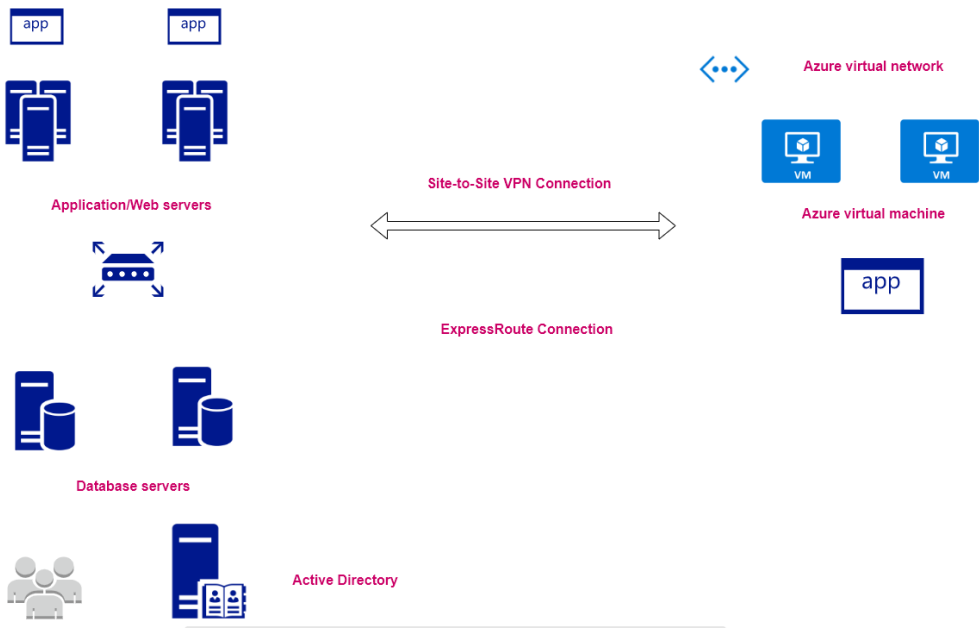
The user identities

Azure Active Directory

Azure AD Connect
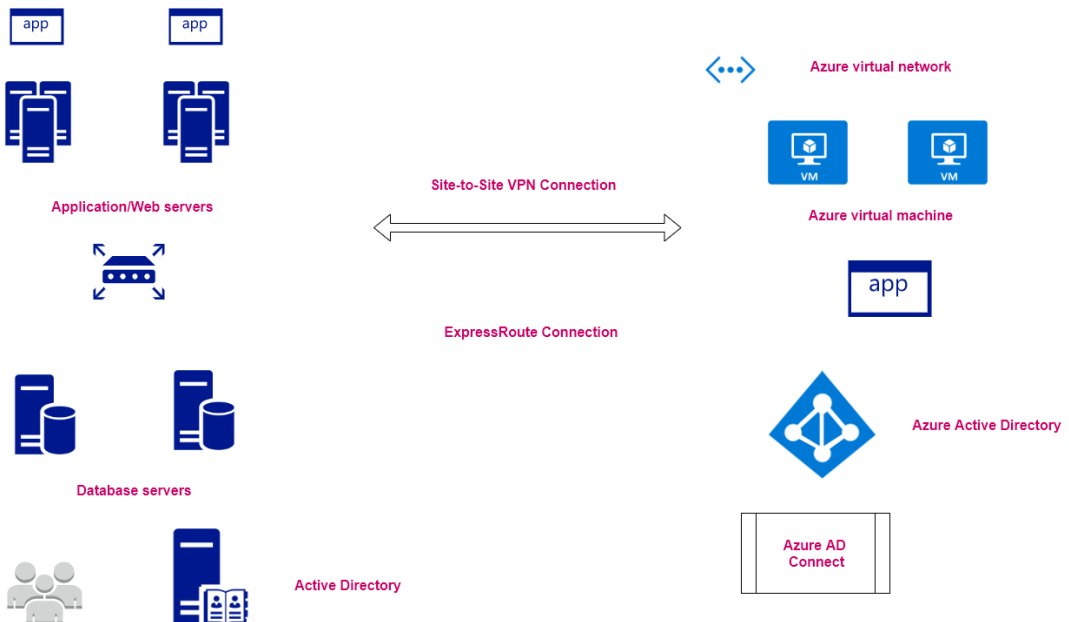
Monitoring your infrastructure

Monitoring your infrastructure

app

IaaS
Azure virtual machine

PaaS
Azure Web Apps

app

Application/Web servers

Documents

Benefits - No capital expenditure

Pay-As-You-Model - Metered pricing

Database servers

Azure virtual machine

Azure SQL database

Active Directory

Azure Monitor

Azure Log Analytics workspace