

⇒ Benefits of Cloud Computing

Agility

Availability

Security

Global reach

Range of ready on-demand services

Range of tools

a) Cost Saving :- Cheapest Servers/Service available at cheapest rate

Availability ⇒ % of time a system is able to respond.

Scalability ⇒ Ability of a system to handle growth of user or work.

Elasticity ⇒ Ability of a system to automatically grow and shrink based on application demand.

Agility ⇒ Ability to change rapidly based on changes in market or environment.
i.e. Creating, deleting, increasing, decreasing etc. as per your convenience.

Disaster Recovery \Rightarrow Ability of a system to recover from failure within a period of time, and how much data is lost.

CapEx (Capital Expenditure) \Rightarrow Money invested in assets that return investment over time.

OpEx (Operational Based Expenditure) \Rightarrow Money spent every day on operating expenses.

\Rightarrow Pay / minute Or Pay / hour Or Pay / execution

\Rightarrow Cloud Models

i) IaaS :- VM, Networking, Load Balancer, Firewall
 \downarrow
Mostly consist of Hardware Services.

ii) PaaS :- Upload Code packages and have them run, without access to the hardware.

i.e. Compile Your Code \rightarrow put in zip file \rightarrow upload

No choices over hardware.

iii) SaaS :- Using the Software to get your job done.
eg:- Office 365, Active directory

④ Physical security is with azure for all three models.

⇒ The Serverless Model

There are still servers in serverless model.

- * Within PaaS, scaling is your responsibility.

Serverless model is extended version of PaaS model, where you don't have to worry about right plan and scaling of platform.

- * In app service or PaaS, you are paying for usage but in Serverless model you will pay for uses / execution, which reduce your cost radically.

Azure Serverless Options:

- i) Compute Service ⇒ Azure functions
Serverless Kubernetes
- ii) Database ⇒ Azure SQL database Serverless
Cosmos DB Serverless

⇒ Cloud types

- i) Public Cloud: Azure own the hardware on their network and infrastructure Available to all over the internet.

ii) Private Cloud: Act like a cloud but customer has exclusive access to hardware. Available to a specific group of client.

i.e.: Bringing On-premis Infrastructure with Cloud Facility.

Azure stack is a software you can install on your own hardware, and you can use a portal and can do cloud stuff.

3) Hybrid Cloud \Rightarrow Combination of public and private cloud.

i.e. Scale private infrastructure to the cloud.

i.e. Some part from public Cloud

+
Some part from on-premise

Public

Private

Hybrid

Hardware
Owner

Cloud Provider

Organization
or
Cloud provider
on Contract

Organization
+
Cloud provider
Basic

Core Azure Services

In India → Earlier 3 now 4.

Regions (60+):- Not all regions are accessible by everyone.

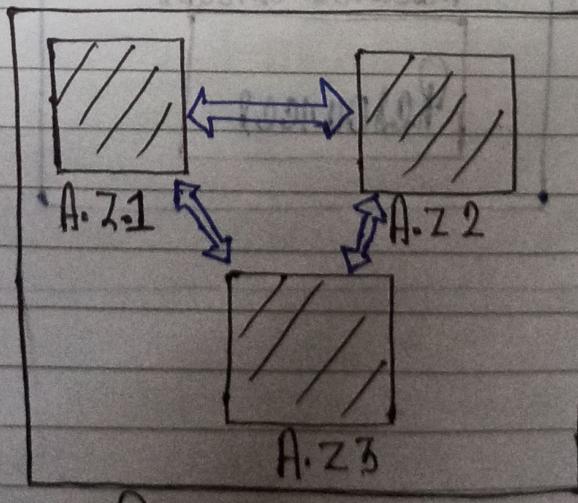
↳ Geographical locations where servers exist physically.

Region pairs :-

- Each region has one region which is treated as its pair.
- Almost always in same geography - i.e. same data storage loc.
- Software Rollout are deployed to one region of a pair and the other is not touched.
- Both regions in any pair will have highest speed, lowest latency.

Availability Zones :- Not available for all regions.

Using A.Z will ↑ availability of your system.



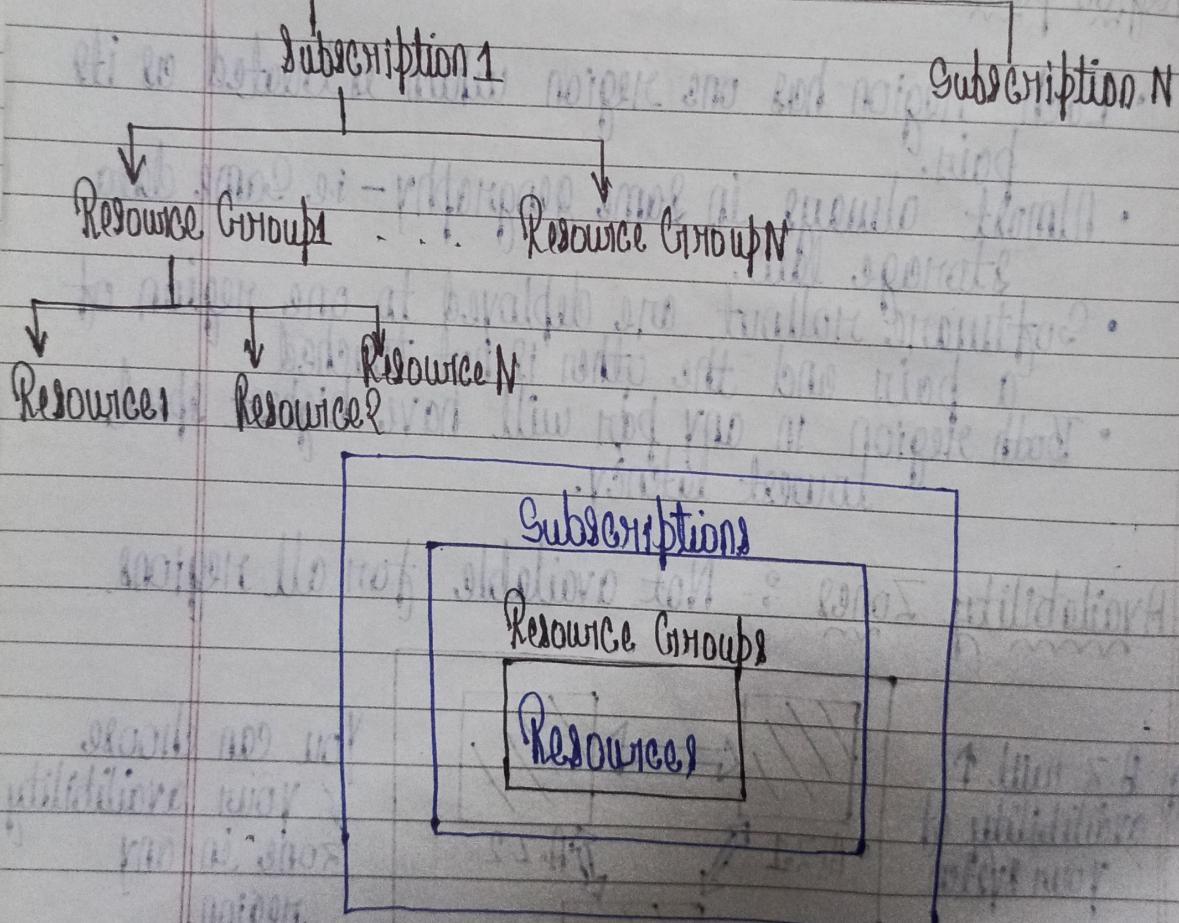
Region

You can choose your availability zone in any region.

All A-Z in a region have their own infrastructure connected internally to each other.

Resource Group : Logical Grouping of related resources.

Management Groups

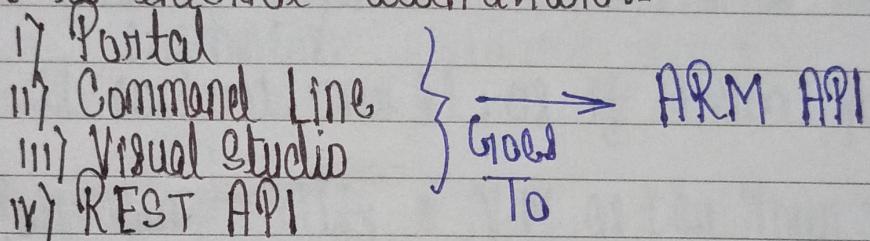


Subscription :- Subscription is a billing unit.

- You can create multiple subscription under 1 Group.
- You may have different level of access to different subscriptions.

Azure Resource Manager (ARM)

Ways to interact with Azure:-



(*) Azure Resource is instance of service that we create.

(*) Explore your subscription and try to break down.

⇒ Services provided by Azure

- Compute Services
- Networking Services
- Storage Services
- Database Services
- Azure Marketplace.

→ Execute Code in the Cloud.

Azure Compute Resources

- VM
- App Services
- Azure Container Instance
- Azure Kubernetes
- Windows Virtual Desktop.

1 ⇒ V.M ⇒ Logs

A slice of physical machine shared with other customis.

Full control over it, as if it was your machine.

You can modify a V.M as per your requirement.
i.e Customization of V.M.

2 ⇒ App Service ⇒ Logs

- Windows or Linux OS.
- Give your code and configuration to Azure, and they will run it.
- Promise of performance but no access to hardware.
- Can be integrate with visual studio.
- .Net, .Net Core, Java, Ruby, Node.js, PHP & Python.

3 ⇒ Containers

- Containers contain everything the app need to run in a "Container image".
- Fastest & Easy to deploy.

Azure Container Instance (ACI) :- Single Instance.

Azure Kubernetes Service (AKS) :- Runs on a cluster of service.

4) Windows Virtual Desktop

Desktop version of Windows that runs in the cloud.

Your installed software, your files - available from anywhere, * even on iOS and Android or from any web browser.

Azure Networking Resources

- Virtual Network
- VPN Gateways
- VNet Peering
- Express Route.

Types of Networking Services

- Connectivity Service
- Protection Service
- Delivery Service
- Monitoring Service

a) Connectivity Service

Virtual Network :- Just like a physical Network of your own environment.

⇒ MS Global network already exist, so a VN is just Software Configuration.

VPN :- Two network in Azure On 1 Azure Network with office Network
Connecting two network as if they were on the same network, uses a Network Gateway.

Express Route :- High Speed private connection to azure.
↳ Private Network.

b) Protection Services

- DDoS Protection \Rightarrow Distributed Denial of Service attack protection.

\hookrightarrow Thousand of Computer directing traffic to your application to make it down.

~~MS~~ include basic level of DDoS but you can purchase advance DDoS protection.

- Firewall \Rightarrow Protect a Network

Firewall rules to allow some traffic and block some traffic.

- Network Security Groups (Access Control List)

Basic type of firewall.

If you are in New ACL, you can access.

- Private Link

c) Delivery Services

- Load Balancer :- Distribute traffic evenly between multiple backend servers.
- Application Gateways :- Higher level of load balancers with an optional firewall.
- Content Delivery Network (CDN) :- Stores common files on the edge, closer to user for improved performance.
- Azure front door service :- A load balance, CDN and firewall all in one.

d) Monitoring Services

- Network Watcher
- ExpressRoute Monitor
- Azure Monitor.

Creating a Virtual Network

Virtual Network → Add → Subscription, Resource Group, Name

Create ← Select option ← Provide IP Addresses
for Bastion/DDoS/Firewall

VN will have a list of IP address and devices connected to that VN will pull any IP from that list.

~~Every VN have min of 1 Subnetwork.~~

* * It's a better practise to create Virtual Machine using already built Virtual Network.

i.e First Create a VN; Then Create a V.M

* Explore SSH, RDP options of VM in Azure.

- Stopping a VM will still charge you for storage, i.e disk will be charged even if you are not using it.

So, while deleting any resource, delete all related components of it as well to safeguard you from any hidden charge..

Storage Services (File storage)

- Container Storage (BLOBs)
- Disk storage
- File storage
- Storage Tiers

• Container (Blob) and File Storage

→ Commonly known as Azure storage account.

- a) → General Purpose V2 (GPV2) is most common type
Can store Blob, Tables, Queues, Files.

b) Azure Data Lake Storage Gen2

- For big chunk of data (Big Data)
- Cheapest type of storage.
- Pay per GiB (1.8 Cent/GiB)

Redundancy / Replication :- By default, MS provide 3 replication.

• Disk Storage :- Azure virtual Machine disk

- Need to Reserve capacity in advance. (More of private cloud disk)
- Optimised to virtual hard disks.

Creating a Storage Account

Storage Account → Select Subscription, RG, Name

Select Replication → Select Account kind, Performance

→ Connectivity method → Create (Explore)

* LRS (Locally-redundant storage) will cost min but will have no replication.

* Storage can be used with VM or standalone just to store file.

Explore Storage Account

There are two different thing when we talk about storage:-

1) Storage with VM (Disk Storage): Pay for what you reserved.

e.g.: If you create a 512 GB disk, you need to pay for 512 GB, even if not using single bit.

2) Storage Account: Pay for what you use.

Azure Marketplace \Rightarrow Image/Service provided by third party.

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Database Services

- Cosmos DB.
- Azure SQL Database.
- Azure DB for MySQL. \rightarrow For bigger DB that require cluster
- Azure DB for PostgreSQL.
- SQL Managed Instance.

1) Cosmos DB :- NoSQL Storage, Extremely Fast

- Designed for modern application such as mobile video game, social network, and things requiring thousand of global replication.
- For small piece of data that need to be executed fast.

2) Azure SQL Database Relational DB

- Runs on SQL Server engine underneath.
- Database as a Service
- Easy to replicate, easy to scale.

⇒ Internet of Things (IoT)

⇒ IoT Hub

⇒ IoT Central

⇒ Azure Sphere

⇒ IoT Hub and IoT Central allow IoT devices to communicate through Cloud.

Azure Sphere includes a secure, silicon chip along with Sphere OS which helps to keep your device safe from hackers/unauthorized users.

⇒ Big Data and Analytics

⇒ Azure Synapse Analytics (Type of Data Warehouse)

⇒ HD Insight

⇒ Azure Databricks

→ MS offers managed Hadoop services such as Hadoop, Apache Spark, Apache Hive, Kafka etc, i.e. MS will operate service and you can use them as PaaS or SaaS, these all falls under HD Insight.

Azure Databricks is a data analytics platform, running and managed by Azure, a modern platform for many areas of your organization, working together.

⇒ AI Solutions

- ⇒ Azure Machine Learning
- ⇒ Cognitive Services
- ⇒ Azure Bot Service

✳ Cognitive Service ⇒ Visual Service, eg: Identification of photo, counting numbers of people in photo etc.

✳ Azure Bot Service ⇒ A natural language chatbot service

Serverless Computing

There are still servers in serverless computing but they are hidden from you.

⇒ Azure function

⇒ Logic App

⇒ Event Grid → Messaging Communication

Azure function is small piece of code hosted in azure that runs after a trigger.

- Logic Apps:- Work flow service; You can define your flow of work.
i.e. Step 1 → Step 2 → Step 3
then you can use logic app.

DevOps Solution

- ⇒ Azure DevOps
- ⇒ GitHub
- ⇒ GitHub Actions
- ⇒ Azure Dev Test Labs

Azure Cost Management and Service Level Agreement

⇒ Factors affecting Costs

Different services are billed based on different factors.

a) Free Services

Resource Group

Virtual Network (Up to 50)

Load Balancer (Basic)

Azure Active Directory (Basic)

Network Security Group

Free-tier web app (up to 10)

DDoS Protection (Basic)

b) Pay per use service (Consumption model)

- Azure function :- 1 million execution free per month
afterward \$0.20 per million execution

- Logic Apps

- Storage (Pay per GB)

- Outbound bandwidth (5 GB free)

- Cognitive Service API

C) Pay for time (per second)

for VM; pay / sec

VM billing include \Rightarrow VM instance, Storage, Bandwidth.

* Data transfer into azure will free of cost, while data transfer out from azure will cost you

Best Practices for minimizing Azure costs

★ Azure Advisor cost

- ⊗ Auto shutdown on dev/qa resources. (You can also use auto turn on).
- ⊗ Utilize cool/archive storage where possible.

↳ For backup files.

- ~~⊗~~ Use Reserved Instance for long term services.
- ~~⊗~~ Configure billing alert for unexpected use.
- ~~⊗~~ Auto Scaling resources.

- ⊗ Downsize when resources over-provisioned.
i.e. Analysing your resource such as Memory usage, CPU usage and downsize if you feel it will work, on smaller version as well.
- ⊗ Spot Pricing :- Ability to use VM when nobody is using it, for a discounted price.

⇒ Hashing function to store password.

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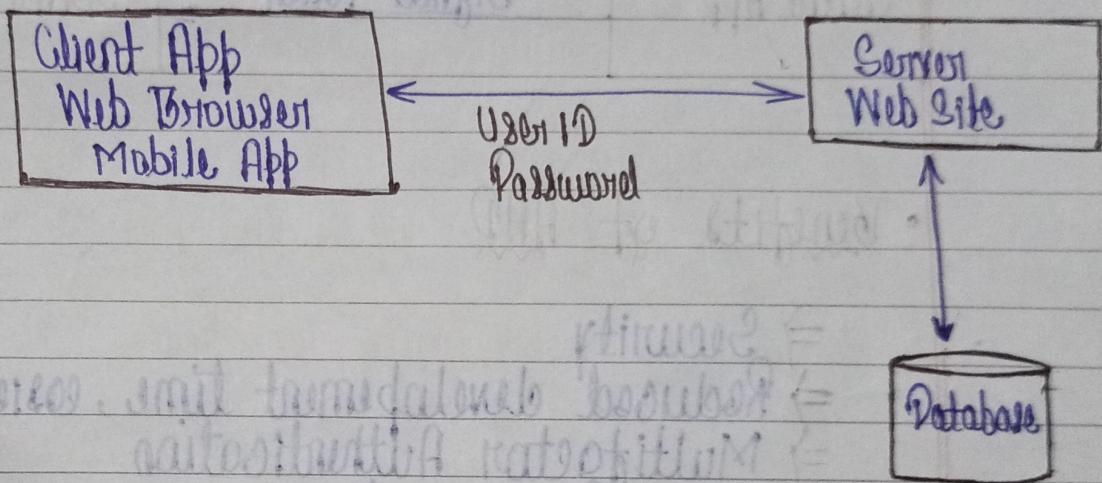
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Identity, Governance, Privacy and Compliance

Identity ⇒ Representation of a person, application or device.

- Client Server model



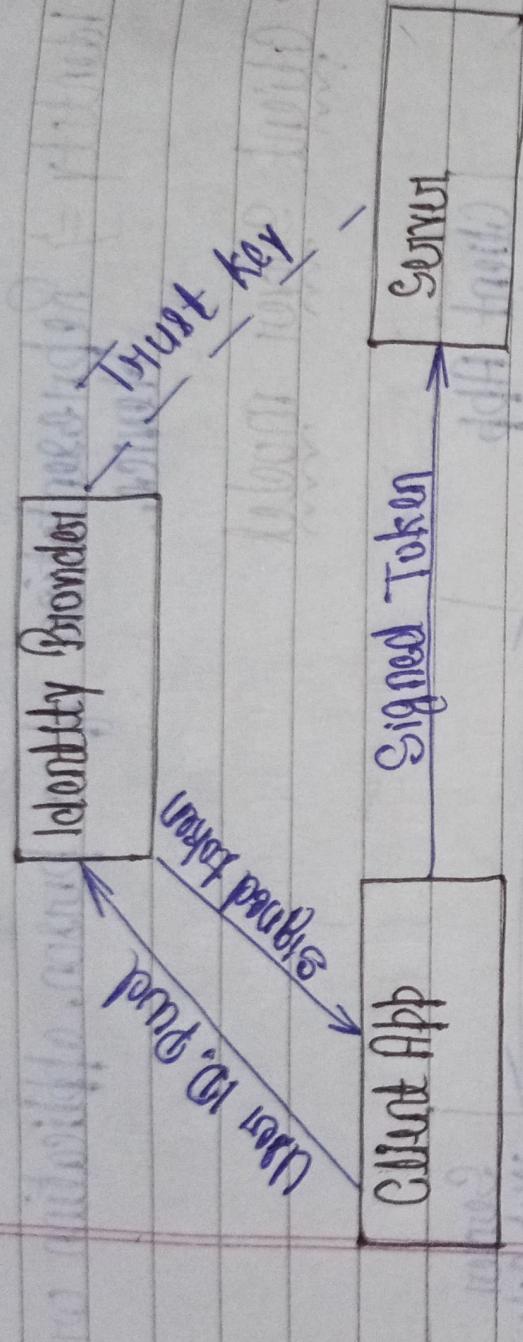
Azure provides an identity management system based on their popular 'Active Directory'. → Azure Active Directory

⇒ Azure Active Directory

AAD is not the same as Window provided Active directory

AAD provides Identity as a service.

The AAD Model



Benefits of AAD

- Security
 - ⇒ Reduced development time, easier support.
 - ⇒ Multi-factor Authentication
 - ⇒ User Access etc
- Centralized Administration
 - ⇒ Integration with Windows Active Directory
 - ⇒ Single sign-on (One User ID & Password)
- ⇒ Integration with other Azure services.

Difference between authentication and authorization.

Authentication is a user proving who they are - user id and password. i.e. Who is user.

Authorization is knowing that a user is permitted to perform an action. i.e. What he can do.
Or providing privileges.

- * AAD is Microsoft's preferred solution for identity management, and access control
- AAD provides Identity management to other MS services:-

Azure
Skype
Outlook
OneDrive
Xbox
Office 365 - Teams, Sharepoint, PowerBI etc

AAD is complete solution for managing users, groups & usage

- Single Sign On:- Synchronization your corporate Active directory with Azure, so that you can login to all azure application using your organization credentials.

Conditional Access

You can enable it in Azure.

Conditional access is a security feature measure to login or authentication if detected unusual or suspicious activity.

e.g:- User A :- Attempt to login to app from within company office, as he does every day.

Suspicious User B :- Attempt to log in for first time in 4 month.

Suspicious User C :- Attempt to log in using their phone.

Azure Role-Based Access Control (RBAC)

RBAC is Microsoft preferred solution for Access Control

- Request \Rightarrow Can access but can't change.
- Contributor \Rightarrow Will have almost all except creating permission, adding using etc.
- Owner \Rightarrow Will have Complete control of resources

• Resource Locks

on anyone

- Locking a resource means, you can't make any changes. You need to unlock the resource to make changes.
eg:- Preventing a resource from deletion.

Using RBAC, You can restrict who has access to locks.

Governance and Policy in Azure

You can create your own policies as well in Azure using JSON definition.

Both option \Rightarrow Built-in policy & Customised policy are available.

- To enforce a policy \Rightarrow You have to assign it.
You can assign a policy at Management level, Subscription level, or Resource group level or from Individual resource.

★ Use tag policy for Azure Resources. (Unbuilt)

\Rightarrow Blueprint

\hookrightarrow Azure Subscription template with Roles and policies already defined.

Set of defined policy that can be used in creating a subscription.

\Rightarrow Cloud Adoption Framework

\hookrightarrow Set of documentation, Guidance, and tools includes best practices for succeeding in the cloud. Used while on organization decide to migrate to cloud.