



QUICK INTRODUCTION:

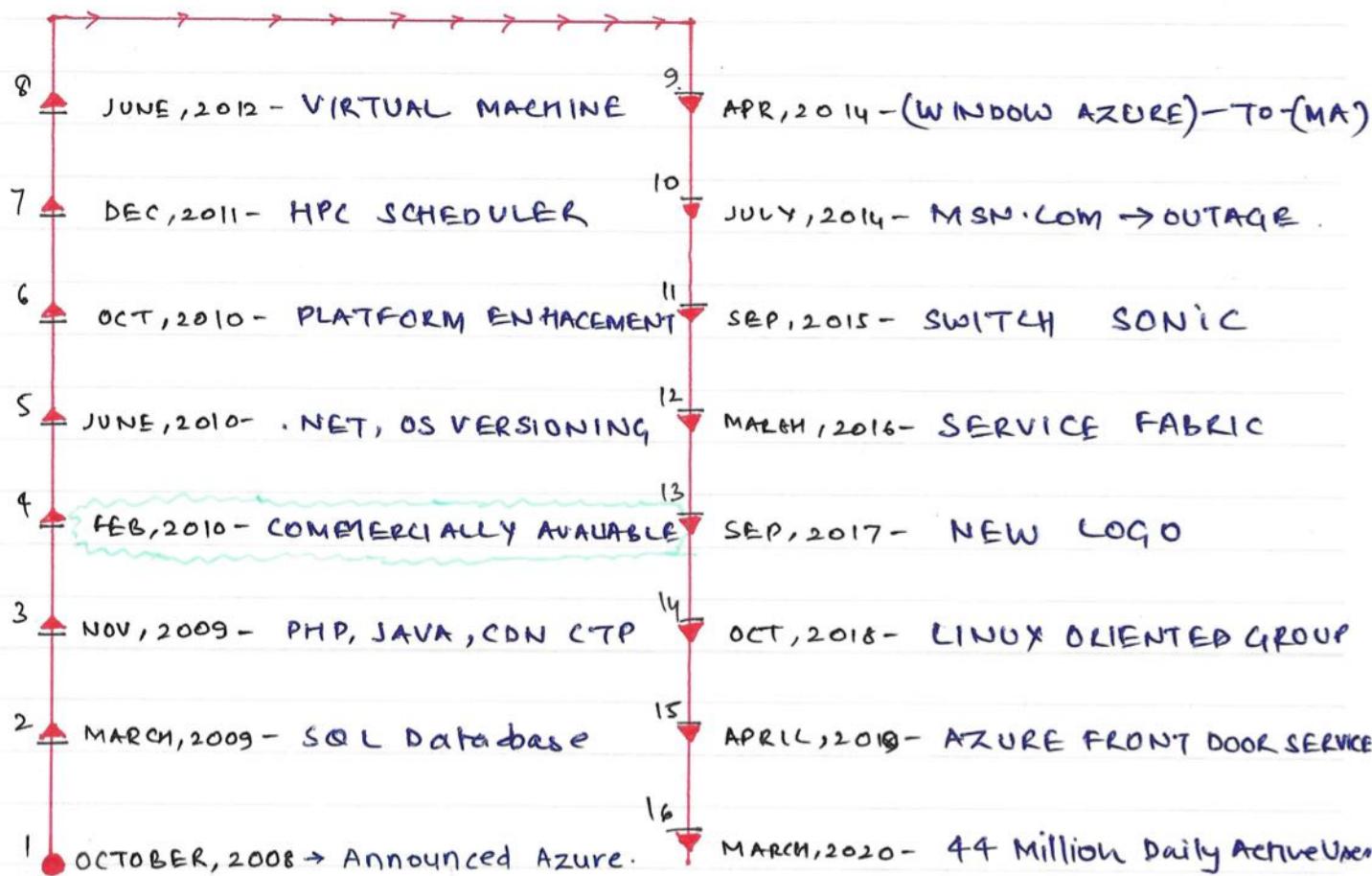
- * MICROSOFT AZURE, commonly referred as Azure. *(60+ Datacenter)*
- * DEFINITION:- AZURE IS A CLOUD COMPUTING SERVICES CREATED BY MICROSOFT FOR BUILDING, TESTING, DEPLOYING AND MANGING APPLICATION AND SERVICES THROUGH MICROSOFT-MANAGED DATA CENTER.

- * Developers - Microsoft
- * Initial Release - 27 OCTOBER, 2008
- * Operating System - LINUX, WINDOWS, iOS, ANDROID
- * License - closed source, open source, SDK's.
- * GLOBAL (DATA CENTER) - 1,65,000 miles fiber + 140 country.
- * ✓ CONTAINERS - Azure used (Resource Group) to host resources

TYPE OF MICROSOFT AZURE SERVICES-

- * SaaS - (Software as a Service) - 3rd party software over internet
- * PaaS - (Platform as a Service) - Tools over internet
- * IaaS - (Infrastructure as a Service) - cloud based services (storage)

HISTORY TIMELINE-





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1 Introduction

2 Azure Services

3 Virtual Machine

4 Virtual Network

5 Storage Services

6 Core Azure Solution

7 Azure Security

8 Identity, Privacy & Compliance

9 Service SLA and Pricing



Microsoft Azure

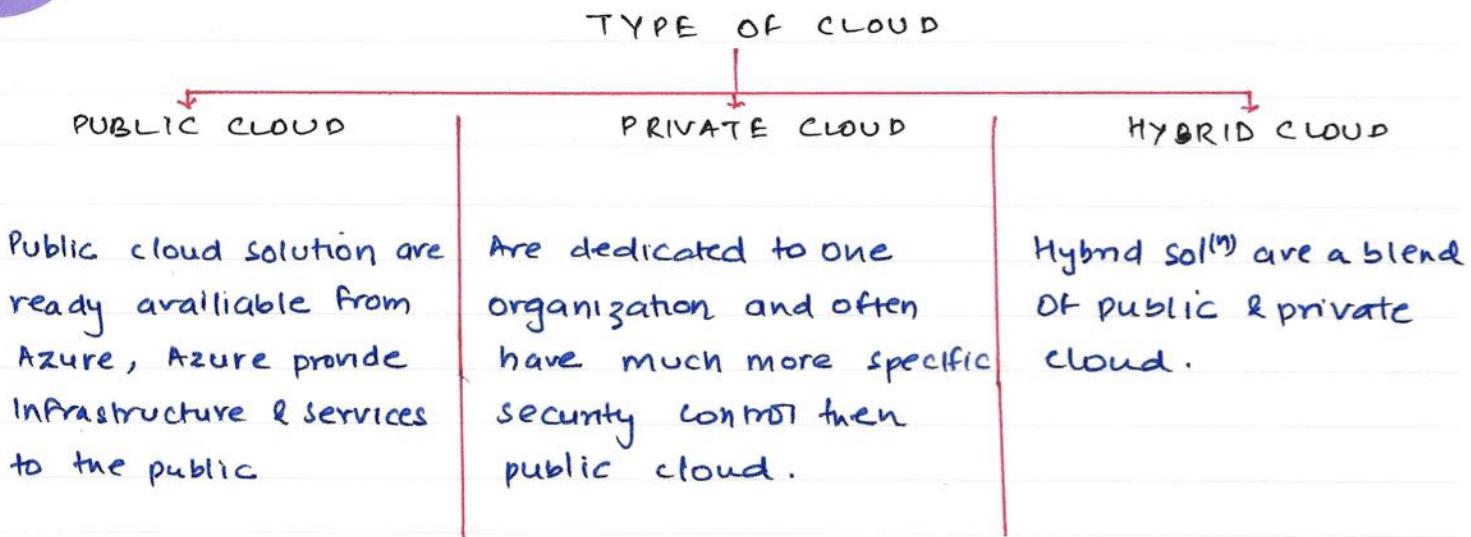
MODULE # 01

* WHAT IS CLOUD COMPUTING? Is a delivery of computing services over the Internet., enabling faster innovation , flexible resources and economies of scale.

- (i) COMPUTE - Provide the Compute Power. (memory and processor)
- (ii) NETWORKING - Connection of computer together of VM.
- (iii) STORAGE - store of data / Information
- (iv) ANALYTICS - *IMPORTANT* KIND of load, how much memory required etc.

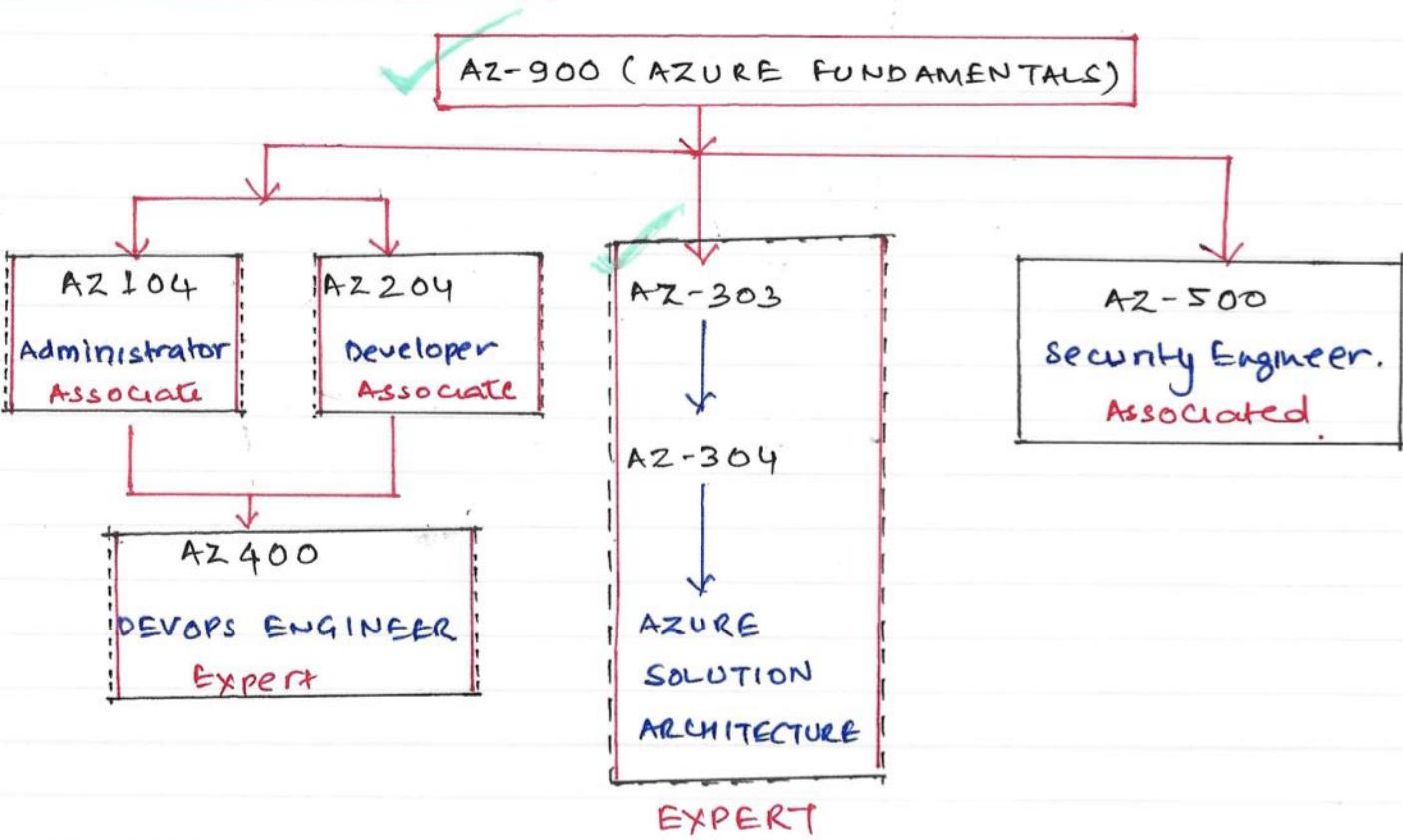
* SERVICE PROVIDER (MICROSOFT AZURE) HOSTING AS A SERVICE PROVIDER.* (ALL SERVICE PROVIDED BY INTERNET*)

PUBLIC CLOUD	PRIVATE CLOUD	HYBRID CLOUD
<ul style="list-style-type: none">* General public can host their services.* Public cloud owned by cloud services or hosted provider* Provide resources and service to multiple organization and user.* Access via - Internet <p>(*EXAMPLE → AZURE)</p>	<ul style="list-style-type: none">* organization create a cloud environment in their data center* organization is responsible for operating the service* Does not provide access to user outside of the organization	<ul style="list-style-type: none">* organization today adopting today hybrid cloud. which come combination of Public & private both.→ Connecting existing data center to Azure data center via Internet with help of VPN Tunnel.(Example → Application host on Azure. and datacenter. on and the Database in client data center.)



* AZURE USER ACCOUNT ? open free Azure account from link (www.azure.microsoft.com/en-us/free) that give you 12 month free popular services + 200 \$ credit for 30 days + 25 services

* AZURE CERTIFICATION !-



* CLOUD BENEFITS'

- * HIGH AVAILABILITY:- Application hosted into one data center and copy existing into another data center.
→ Replicate or Data into two different machine (Datacenter)
- * SCALABILITY:- Two type of scalability (Vertical & Horizontal)

VERTICAL	HORIZONTAL
* SCALE UP/DOWN	* IF ONE VM (VIRTUAL MACHINE) IS HIGHLY UTILIZE, THEN TRAFFIC SHIFTED TO ANOTHER VM AND MANAGE BY <u>LOAD BALANCER</u>)
* INCREASING/DECREASING - - COMPUTE ENTITY (RAM & PROCESSOR)	
- * ELASTICITY:- Only adding the scaling is called elasticity.
- * AGILITY:- (On-demand services). fast to deploy vm. Control panel / Portal easy to create Virtual Machine define the properties .
- * DISASTER RECOVERY:- Replicate the data into another to prevent during disaster time. Easy to recovery. It is part of Availability.
- * CONSUMPTION-BASED MODEL:- pay as per the use.
- * COST OPTIMIZATION:- CAPEX & OPEX OPTIMIZATION.
- * GLOBAL REACH- Availability of data center across globe.
- * SECURITY:- Secure to access and use the application .

* CLOUD - CAPEX & OPEX:-

CAPEX - Capital Expenditure

OPEX - Operational Expenditure

- | | |
|--|---|
| * The up-front spending of money on physical infrastructure. | * spends on products and services as needed, pay as you go. |
| * costs from CAPEX have a value that reduces overtime. | * get billed immediately. |

* CONSUMPTION - BASED - MODEL:- Azure or any cloud service provider

operate on ~~consumption~~^{Consumption-}-based model. which mean end user only pay for the resources that they use.

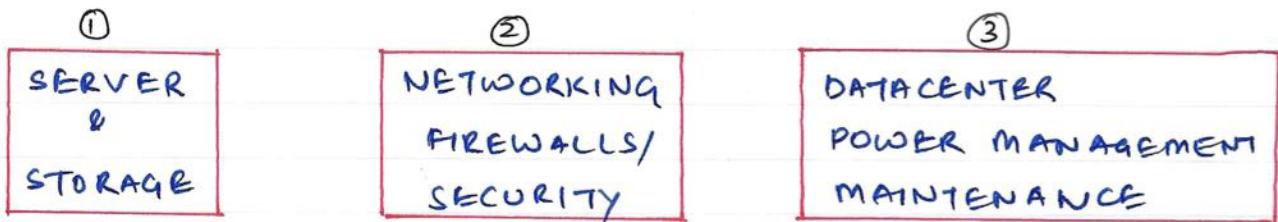
WHATEVER THEY USE IT, IS WHAT THEY PAY FOR.

- Better cost prediction.
- Price for individual resources and services are provided.
- Billing is based on actual usage.

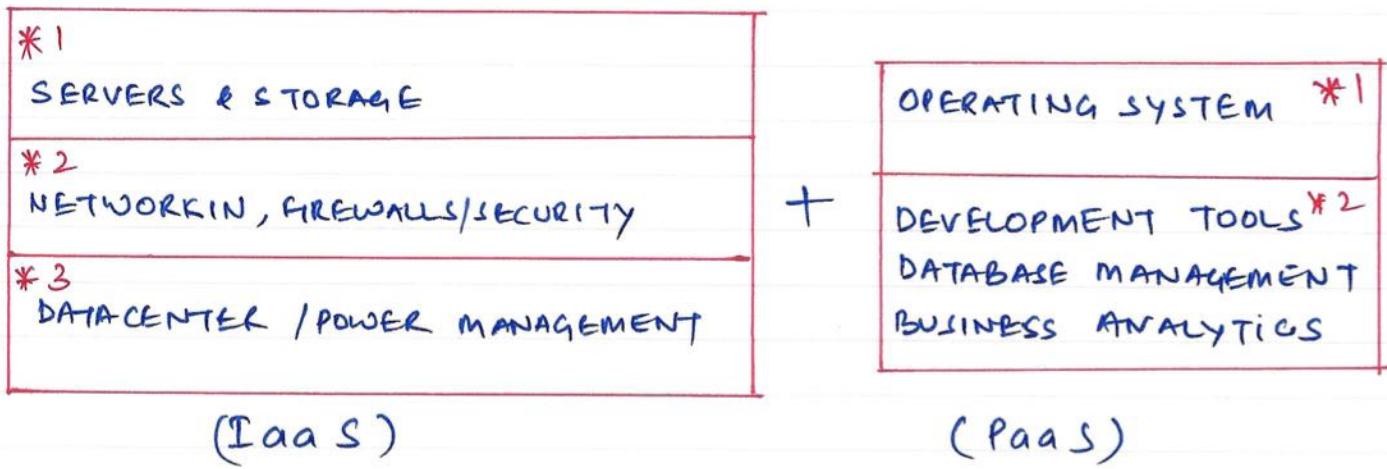
* CLOUD SERVICES:- (OBJECTIVE DOMAIN).

- (1) IaaS - (Infrastructure-as-a-service)
- (2) PaaS - (Platform-as-a-service)
- (3) SaaS - (Software-as-a-service).
- (4) Identify a services type based on use-case.
- (5) Describe the shared responsibility model.
- (6) describe Serverless computing.

(1) INFRASTRUCTURE - AS - A - SERVICE (IaaS) - In this cloud service Infrastructure (Build pay-as-you-go) by renting servers, virtual-machine, storage, network and operating system from cloud provider's.



(2) PLATFORM - AS - A - SERVICES (PaaS) - Provides environment for building, testing and deploying software application, without focusing on managing underlying infrastructure.



(3) SOFTWARE - AS - A - SERVICE (SaaS) - User connects to and uses cloud-based application (app) over the internet.

Example → office 365, emails, Teams software.



* SHARED RESPONSIBILITY MODEL:-

	PRIVATE CLOUD	IaaS	PaaS	SaaS
DATA & ACCESS	**	**	**	**
APPLICATION	**	**	**	AZURE
RUNTIME	**	**	AZURE	AZURE
OPERATING SYSTEM	**	**	AZURE	AZURE
VIRTUAL MACHINE	**	**	AZURE	AZURE
COMPUTE	**	AZURE	AZURE	AZURE
NETWORKING	**	AZURE	AZURE	AZURE
STORAGE	** **	AZURE	AZURE	AZURE

** → client are manage the responsibility.

* RESERVE-LESS COMPUTING (IMPORTANT) - In general client

shared requirement of infrastructure (ex→ capacity of RAM & processor), but in case no-load on your server but still we have to pay because we reserved the capacity to host application in Data-Center

* → Modern way to work on this approach is change. there is no reserved server for work-load, when request come it will automatically allocated the resource on-need basis and release the resource once no-usage. In Azure below two entity are important —

* AZURE FUNCTIONS:- Is a code running your services and not the underlying platforms or infrastructure. It creates infrastructure based on an events.

* AZURE LOGIC: Is a cloud service that help you automate and orchestrate tasks, business process and workflows when you needed to integrate application, data, systems and services.

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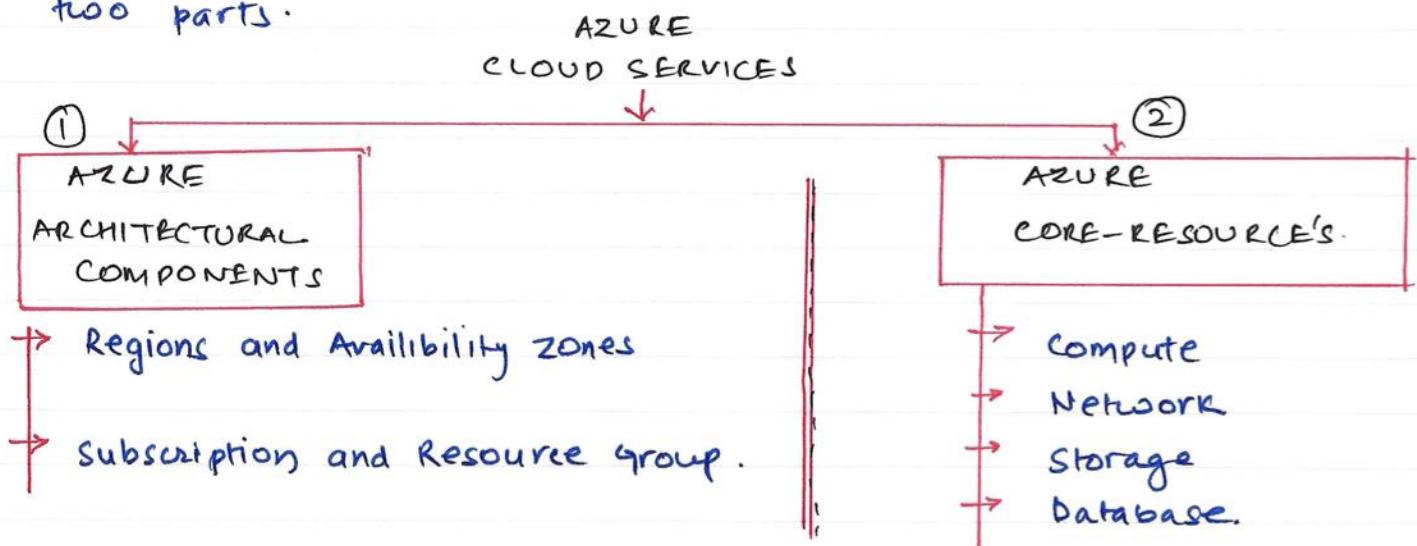
7 Azure Security

8 Identity, Privacy & Compliance

9 Service SLA and Pricing

* MODULE #: 02

CLOUD AZURE SERVICES:- Azure services are divided into two parts.



(1) AZURE - ARCHITECTURAL COMPONENTS:- Azure is an operating system, which manage a data center of microsoft. To manage below are Key architectural components —

- Region's & Region's Pairs
 - Availability zone
 - Azure Resources
 - Resource group.
 - Azure Resource Manager's.
 - Subscriptions
 - Azure Management group's.
- Azure Architectural Components

(1) REGIONS:- Azure offers more global regions than any other cloud provider with 60+ Regions representing over 140+ Countries.

- Regions are made up of one or more data centers.
- provide flexibility and scale to reduce customer latency.
- Preserve data residency with a comprehensive compliance offer.

* 1 REGION → MIGHT BE A COLLECTION OF ZONES

REGION PAIR'S:- For Availability, in ~~worst case scenario~~ worst case scenario.

a complete region might be outage. (might be due to nature problem or some disaster happen, flood, power outage. To avoid this problem Statement a region-pairs is done where microsoft create a pair-zone to prevent data during such disaster.

- | | |
|-------------|---|
| PAIR POINTS | * → (Both Region → should be in same geographic location) |
| | * → (At least 300 miles of separation between region pairs) |
| | * → (Automatic replicate for some services) |
| | * → (Prioritize region recovery in the event outage) |
| | * → (Pairs are defined by Microsoft (Microsoft)) |
| | |

PAIRING ARE FIXED, DEFINED BY → MICROSOFT ONLY

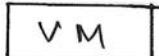
REGIONS	REGIONS - PAIR
<ul style="list-style-type: none">- North Central US- East US- West US2- US East2- India South- Canada Central- Japan East	<ul style="list-style-type: none">- South Central US- West US- West Central US- Central US- India-Central- Canada East- Japan West

AVAILABILITY OPTIONS:- Availability is a factor which decide how much time is our application up and running.

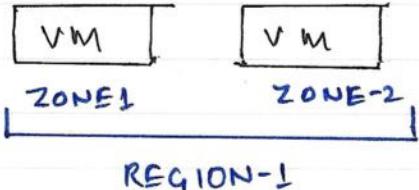
Ex → 100% mean no down-time, Always working.

Availability is defined by → SLA (Service Level Agreement)

Ex → 99.9%.



Ex → 99.99%.



DIASTER RECOVERY



- * SINGLE VM HOST ONLY.
- * Dependent on single VM

SINGLE-VM

- * Each zone have independent Power Backup, physical separated.

AVAILABILITY-ZONES

Regional protection with Data Residency Boundaries.

REGION-PAIRS

AVAILABILITY ZONE - One zone treated as a one Data center.

Multiple zones lead for regions, Each data center is equipped with independent power, cooling and networking. each zone are interconnected via fiber-optics networks

Availability zone

REGION-1

REGION-2

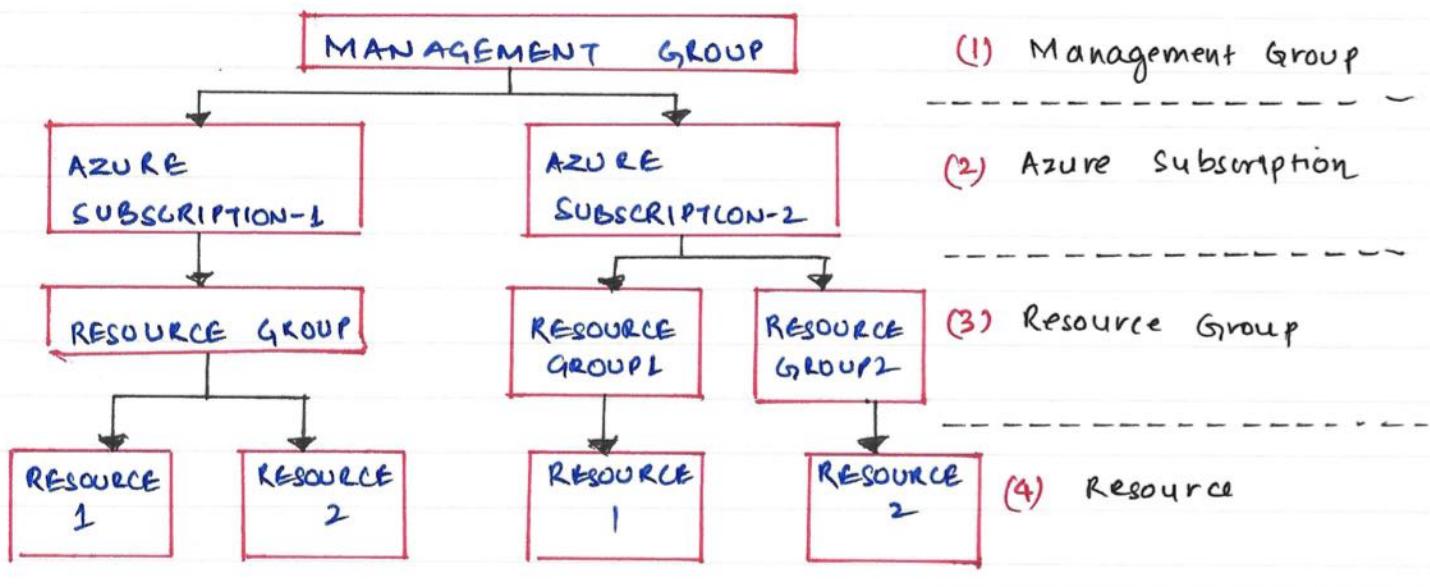
REGION-3

AZURE SERVICES:- There are various services offered in Azure service , few point are capture below.

* GENERAL	* COMPUTE	* STORAGE	* NETWORKING
- Management Groups	- Virtual Machine	- Storage account	- Virtual Network
- Resource Groups.	- Kubernetes	- Recovery	- Express Route
- Market place	- OS Image	- Data Lake	- Public-IP
- Subscription	- VM-Scale sets	- Storage Explorer	- Network Interface
- Templates	- Cloud Services	- Data Box	- CDN Profile .
- Tag	- Hosts	- Data Shares	- Route tables
- Resource Explorer	-	- HPC Caches	- Network Security

MANAGEMENT GROUP:-

- * Management groups can include multiple Azure Subscription
- * 10,000 management group can supported in a single directory.



AZURE RESOURCE:-

- * After selecting → Region and zone of Data Center.
- * Below are the important services as part of Azure—

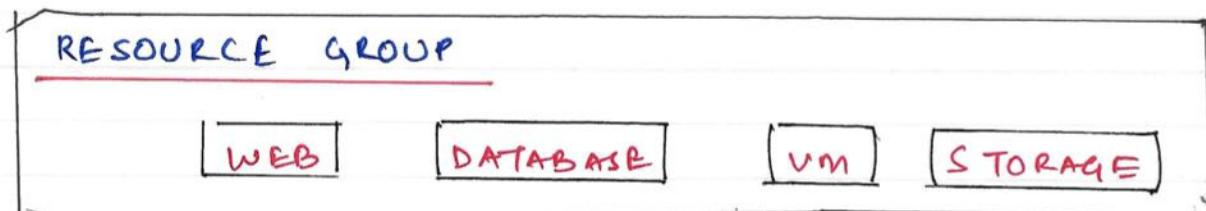
1. Virtual Machine.
2. Storage Accounts
3. Virtual Networks
4. App Services
5. SQL Databases
6. Functions



RESOURCE GROUP!— It is very important to group the resource into a single unit. So Every resource need to be part of resource group.

→ AFTER AZURE ACCOUNT > WE NEED TO CREATE A AZURE GROUP

- + * Every Resource Group have a location
 - + * Resource can exist in only one resource group.
 - + * (Resource) → can exist in the different Region
 - + * It is possible (Resource @ Region-1) & (Resource group @ R-2)
- * A Resource in Resource-Group can be moved from One resource group to another resource-group but one time only associated in 1-Resource group.



(* IF DELETE, RESOURCE GROUP IT WILL AUTOMATICALLY)
DELETE ALL RESOURCES

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MODULE # 02

~~Module 1~~ :- AZURE VIRTUAL MACHINE

Azure Virtual Machine (AVM) is one of several types of on-demand, scalable computing resources that Azure offers.

Azure Virtual Machine (AVM) give you the flexibility of virtualization without having to buy and maintain the physical hardware than run its.

THINK ABOUT BEFORE CREATING a VM (VIRTUAL MACHINE)

1	Application Resource Name	5	Operating system run on VM
2	Location where resource store	6	Configuration after VM start
3	Size of VM	7	VM need resource.
4	Maximum number of VM		

* LOCATIONS - There are multiple location in many geographical regions around the world. These are the region is called locations which specifies the location of virtual machine.

The way to get the available location are-

- ① Azure portal.
- ② Azure Powershell
- ③ REST API
- ④ AZURE CLI

* AVAILABILITY:- Azure announced an industry leading single instance virtual machine. Service level agg agreement of 99.9%. provide you deploy the VM with premium storage of all disks. (BELOW SLA)

- * 99.9% - Two or more instances deployed across two or more availability zones
- * 99.95% - 2 or More instance deployed in same Availability set.
- * 99.9% - Single Instance VM using premium SSD/Ultra Disk All OS
- * 99.5% - Single Instance VM with standard SSD Managed Disks
- * 95% - Single Instance VM with standard HDD Magnetic Disks.

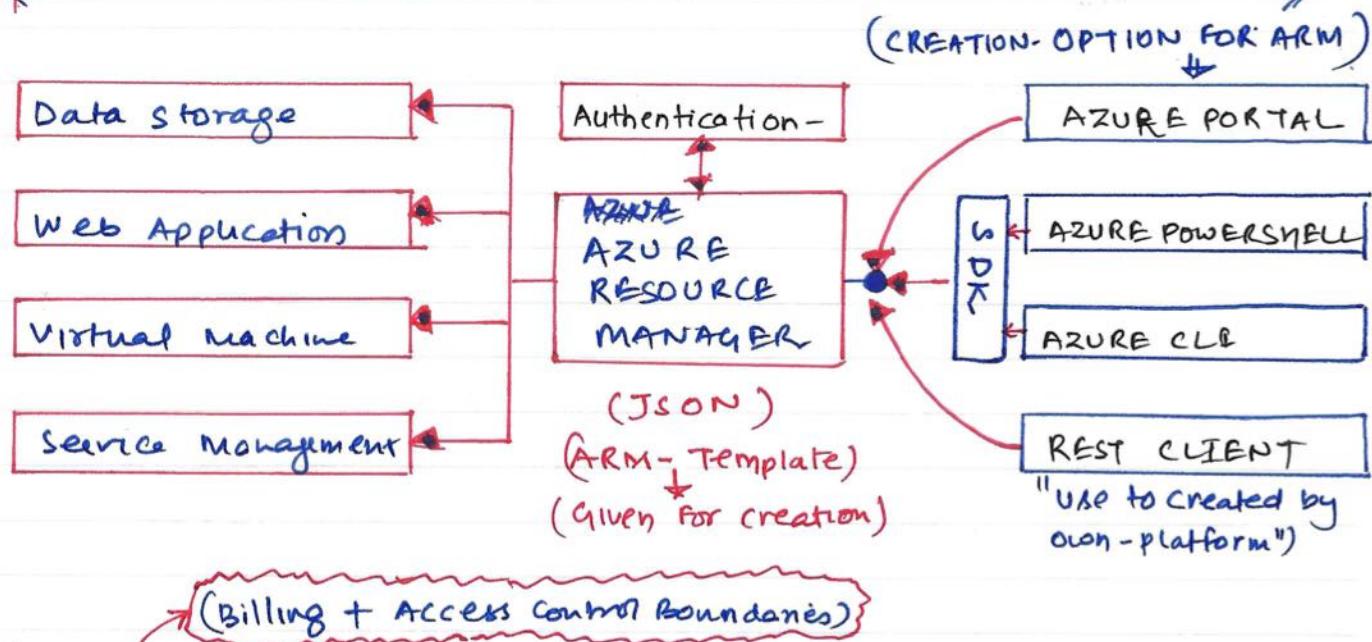
AZURE RESOURCE MANAGER: ~~MANAGEMENT~~ The Azure resources

Manager (ARM) provides a management layer that enables you to create, update and delete resources in your azure subscription.

As we know, Azure is an operating system which manage data center of Microsoft, which manage various service present in data center. (ARM → help to interact with it)

ARM is a ~~Deployment~~ deployment model which can be used for creating a → Web application / Virtual machine / or data storage. (~~* * *~~)

→ AZURE PORTAL IS USED TO COMMUNICATE → ARM



AZURE SUBSCRIPTION!:- To start working with Azure, we need a subscription of Azure. Azure subscription provides you with authentication & authorized access to Azure account.

BILLING BOUNDARY:- Generate separate billing reports and invoice for each subscription and control resources.

AZURE ACCOUNTS

Development
Subscription

Test
Subscription

Production Subscription

REVIEW OF AZUREAZURE COMPUTE SERVICES

* COMPUTE = MEMORY + PROCESSOR *

* Compute where application are run, computation process, instructions are executed.

COMPUTE SERVICE LIKE:-

- + Virtual Machine
- + Application Services
- + Container Instances
- + Azure Kubernetes services (AKS)
- + Window Virtual Desktop.

VIRTUAL MACHINE:- Virtual Machines are software emulations

of physical computer. which included the - (Virtual Processor, memory, storage, and networking.)

* VIRTUAL MACHINE = IaaS *

CREATE VIRTUAL MACHINE:- (@AZURE)

1. go → All services
2. click → Virtual Machine.
3. (+) Add - Virtual Machine
4. choose → Subscription
5. Resource group → Name.
6. Virtual machine Name → VM
7. Region - Select Region
8. Image - OS Name (Window)*
9. Size - (Processor + RAM) - cost
10. Username
11. Password.
12. INBOUND → ((RDP / HTTP(80))
13. (Open port for public IP)

OPTION DURING CREATING VIRTUAL MACHINE

1. BASICS
2. DISK
3. NETWORKING
4. MANAGEMENT
5. TASK
6. REVIEW + CREATE

(12,000 INR/HR)

Example

↑
(At last you will get prices)

(* Readymade OS > Image copy)

AFTER VIRTUAL MACHINE CREATION:- Once virtual machine

is created. (once we click create button the page will scroll to "ARM Templates (AZURE RESOURCE MANAGEMENT)"

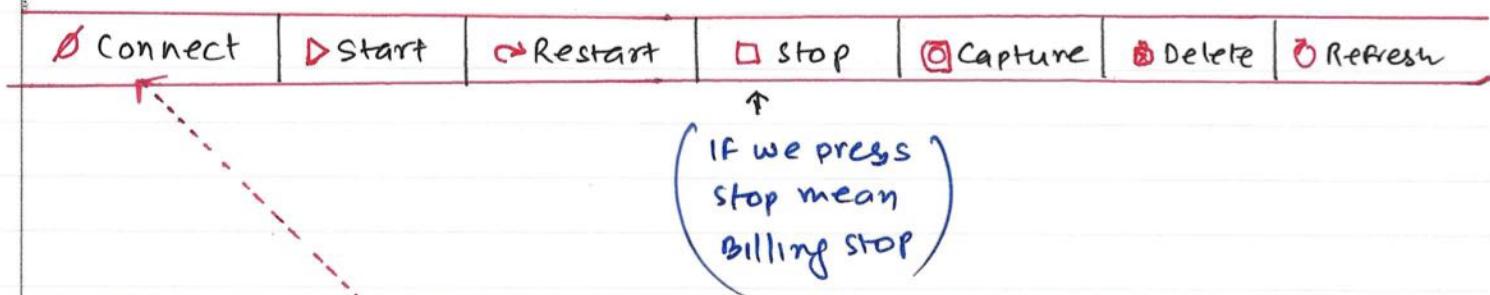
* ARM is a JSON Document (Overview > Input > Output > Templates)
(JSON → JAVA SCRIPT OBJECT NOTATION)

Once virtual machine created it will show file are -

EXAMPLE → (DEMOVM)

* NAME	* TYPE	* RESOURCE GROUP	* LOCATION	* SUBSCRIPTION
(RESOURCE) ↓ Demovm	Virtual Machine	DEMO-GRP	North Europe	Demo AS-1
Demovm-IP	Public IP address	DEMO-GRP	North Europe	Demo AS-1
Demovm-nsg	Network Security Group	DEMO-GRP	North Europe	Demo AS-1
Demovm-334	Network Interface	DEMO-GRP	North Europe	Demo AS-1
Demovm-os-disk	DISK	DEMO-GRP	North Europe	Demo AS-1
demo-grp.net	Virtual Network	DEMO-GRP	North Europe	Demo AS-1
Networkwatcher	Network Watcher	DEMO-GRP	North Europe	Demo AS-1

@ TOP



(1) PRESS → CONNECT BUTTON > open > (RDP > SSH)

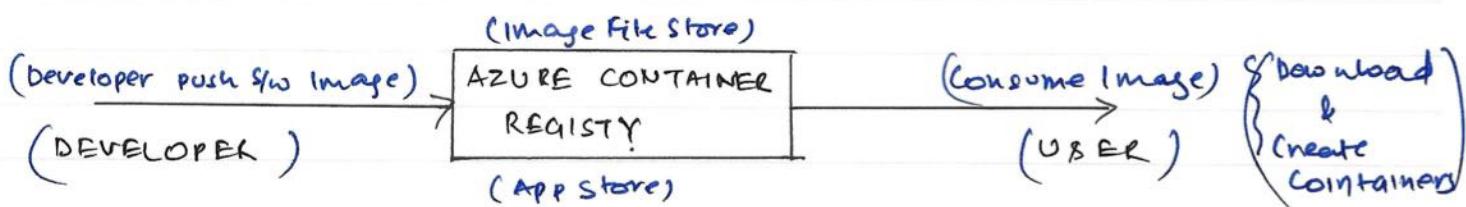
→ (* Public IP = x.x.x.x)
→ (* Port number = 80)

download RDP file

AZURE CONTAINER SERVICES

CONTAINER IS HELPING US IN CREATING ISOLATED WORKLOAD'S ON THE SAME PHYSICAL MACHINE, BUT AT SAME TIME THESE WORKLOAD DO NOT NEED OPERATING SYSTEM

(* In general if we run 2 VM's both need own OS to run the resource, to avoid such requirement need → containers)



- * Container are created to run the application at user device
- * Container is light weight, (does not have operating system) It will always run on the underline on which it is created.
- * Container does not required Operating System

AZURE CONTAINER INSTANCES a PaaS offering that runs a container in Azure, without the needs to manage a virtual machine# AZURE KUBERNETS SERVICES:- an orchestrations services for container with distributed architecture and large

* KUBERNETS → is open source software, which is also called a orchestration services. help to active and integrated multiple container with least amount of efforts.

(In Azure → It is coming as AKS.), Need to create multiple VM and top of VM need to create multiple containers.

KUBERNETS SERVICE → FREE

VIRTUAL MACHINE SERIES!:-(INR)
*(SEP-21)

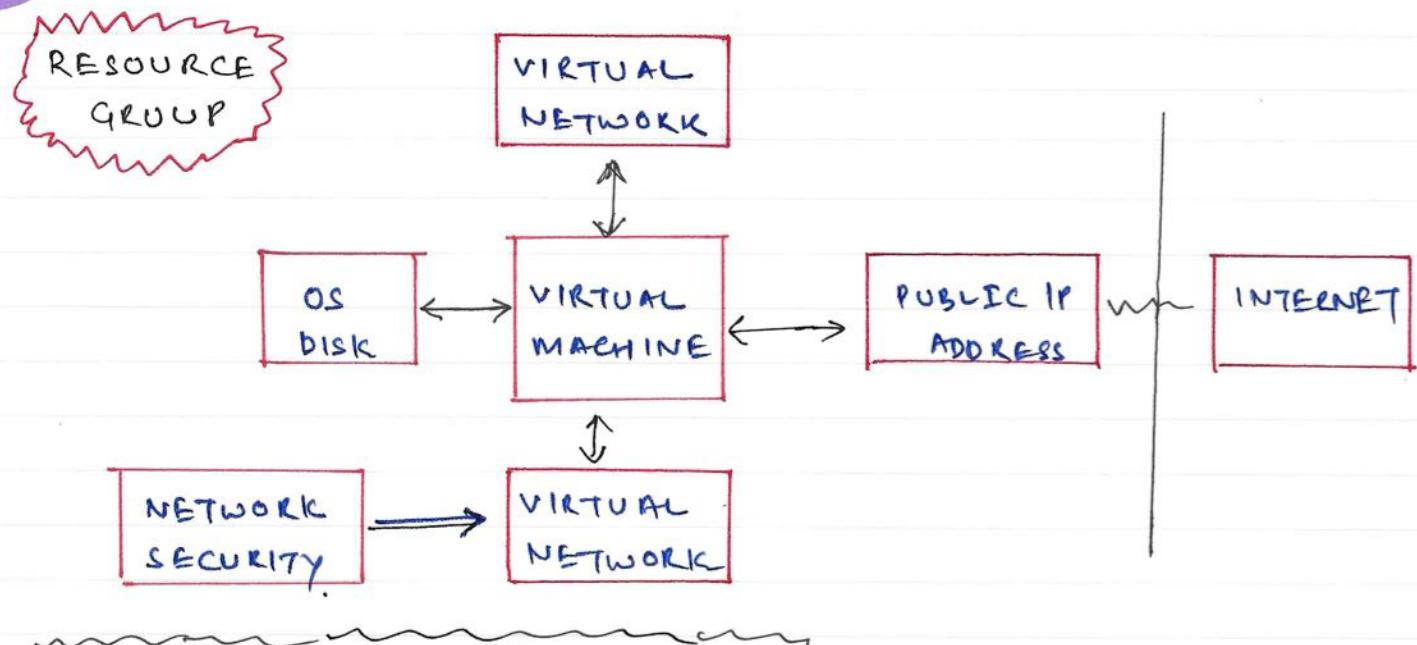
SERIES	VM SIZE FAMILY	USE CASES	PROCESSOR	PRICE*starty per month
A	Entry level VM's	Test server, server POC		1,893
D	General Purpose Compute	Application , Database		2,997
D-v2	Next Gen-General Purpose	Enterprise application		
F	Compute Optimize - VM	Batch Processing, webserver		2,577
G	Memory & storage Optimize	ERP, SAP, SQL		23,088
H	High performance-VM	High performance computing		41,864
L	Storage optimize-VM	Mongo DB, DB Warehouse		32,818
N	GPU enable - VM	Graphics, video - editing		47,333
M	Memory optimized-VM	Required massive Parallel compute .		80,809

* AVAILABILITY ZONE!:- HELP TO MAINTAIN SLA 99.95%. IN CASE OF DISASTER RECOVERY.

* PRICING CALCULATOR!:- HELP TO GET POSSIBLE COSTS FOR HOSTING THESE RESOURCE IN AZURE.

* AZURE MARKETPLACE!:- FOR DEPLOYING AZURE SUBSCRIPTION.

* AZURE VIRTUAL NETWORK!:- IT HOSTS THE VIRTUAL MACHINE IN AZURE.



SUBSCRIPTION → for Billing purpose.

- 1 - **VIRTUAL MACHINE** - COMPUTE MACHINE ON AZURE PLATFORM.
- 2 - **OS DISK** - VM having disk associated with VM, (storing information) attached other disk to host Data Disk
- 3 - **VIRTUAL NETWORK** - Is an isolated network on cloud, Virtual network help to create a networking part's. (N/w Interface card)
- 4 - **NETWORK SECURITY** - Attached to secure In & Out bound data
- 5 - **VIRTUAL NETWORK** - Attached on VM machine It is a network interface card
- 6 - **PUBLIC-IP ADDRESS** - Allow to comput through internet.
- 7 - **RESOURCE GROUP** - All are part of logical group called resource group
- 8 - **SUBSCRIPTION** - For Billing purpose.

7 STEP TO CREATE - VIRTUAL MACHINE:-1. BASICS

- 1 Subscription - for billing
- 2 Resource group - logical group
- 3 VM Name - VM Name
- 4 Region - Ex-Europe / USA
- 5 Availability -
- 6 Image - Operating System
- 7 Size - VM SIZE (refer-table)
- 8 Username - XXXX
- 9 Password - XXXX
- 10 Inbound Ports - RDP (3389) ^{Unlimited traffic}

2. DISK'S:-

- 1 OS Disk - SSD/HDD
- 2 SSE Encryption -
- 3 Data Disk

3. MANAGEMENT NETWORKS

- 1 Virtual Network -
- 2 Subnet -
- 3 Public IP -
- 4 NIC Security -
- 5 Inbound Port -

4. MANAGEMENT - Configuring monitoring & management option for VM.

5. ADVANCED Additional agent, Scripts or application via VM

6. TAGS Consolidated bills by applying same tag to multiple resource groups

(7) REVIEW + CREATE

HOURLY ESTIMATION = (0.123 USD/Hr)

After created we have below resource file in Virtual machine.

Example:- (DEMOVM)

Name	Type	Resource Group.	Location (Ex)	Subscription AS (Ex)
demo-grp.vnet	Virtual Network	demo-grp	North Europe	AS-L
demovm	Virtual Machine	demo-grp	" "	"
demovm-ip	Public IP address	demo-grp	" "	"
demovm-nsg	Network security group	demo-grp	" "	"
demovm334	Network Interface	demo-grp	" "	"
demovm-OS DISK-1-	Disk	DEMO-GRP	" "	"
Networkwatcher	Network Watcher	Network Watcher	" "	"

~~AVAILABILITY ZONE → HELP TO MAINTAIN SLA 99.95%. IN CASE DISASTER RECOVERY.~~

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MODULE # 04

VIRTUAL NETWORK: When we created a virtual machine in azure network it will allocate a → virtual network interface

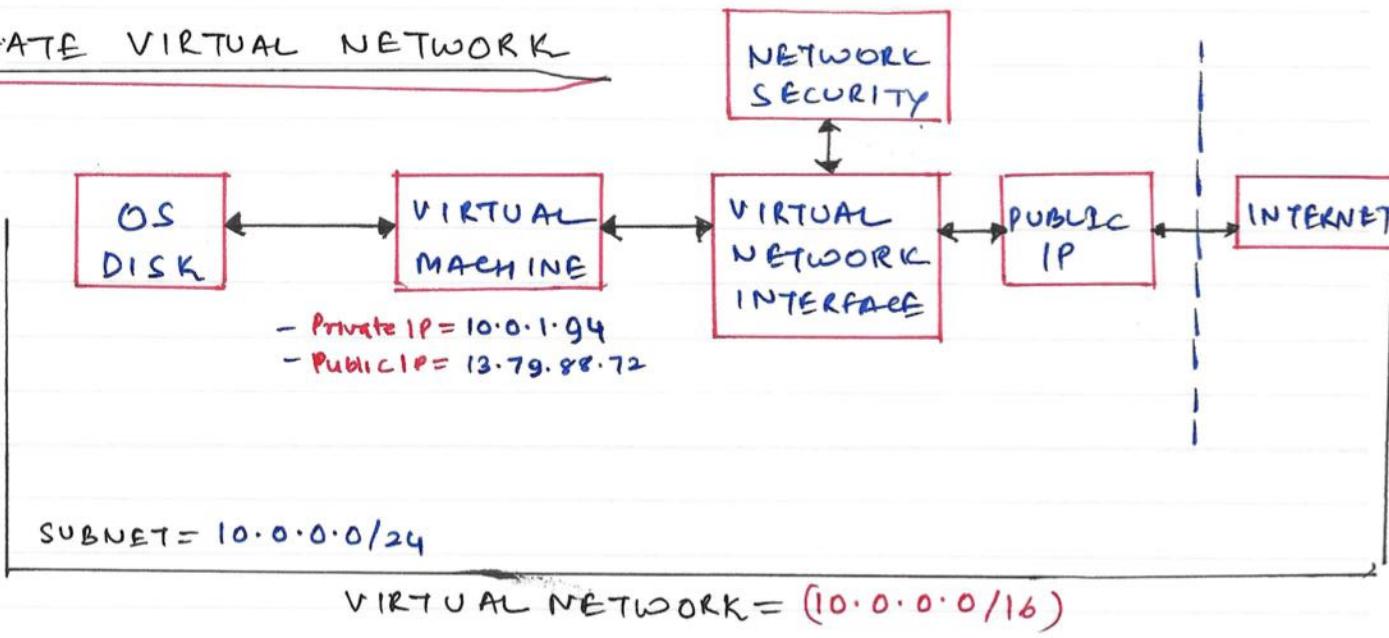
VIRTUAL NETWORK INTERFACE:- Manage all traffic moving

in-and-out of the virtual machine (via - virtual network - interface). so the data flow via virtual network interface

1. → IP ADDRESS — help to locate a machine
2. → PUBLIC IP ADDRESS — help to locate machine on internet
3. → PRIVATE IP ADDRESS — help to locate machine on local-network
4. → SUBNETS — It help to separate one or more sub-nets.

AZURE VIRTUAL NETWORK	VIRTUAL PRIVATE NW GATEWAY	AZURE EXPRESS ROUTE
<ul style="list-style-type: none"> * A collection of (VM) computer to each other • Internet → Public IP • Intranet → Private IP 	<ul style="list-style-type: none"> connection via Internet and sending traffic with support of encryption / decryption 	<ul style="list-style-type: none"> Dedicated lease route only for connection between (Azure Data Center & user)

* When we created a Virtual Machine, Automatically it will Create a Virtual network.

*** CREATE VIRTUAL NETWORK**

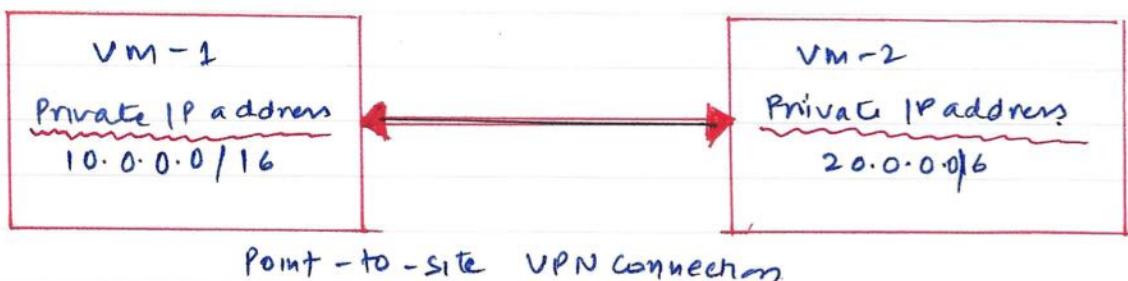
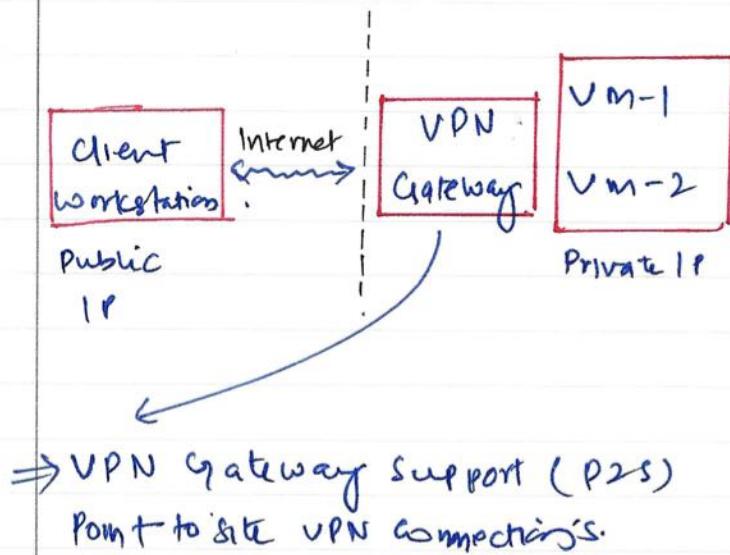
CREATED VIRTUAL NETWORK: creation of virtual network is divided into 5 steps-

① BASICS	② IP ADDRESS	③ SECURITY	④ TAGS	⑤ REVIEW + CREATE
→ Subscription → Region group. → Instance Name → Instance Region	→ IPv4 address → IPv6 address → Subnets	→ Host → DDoS Protect → Firewall	Targ are name/value pair that enables you to categorize	(review & create)

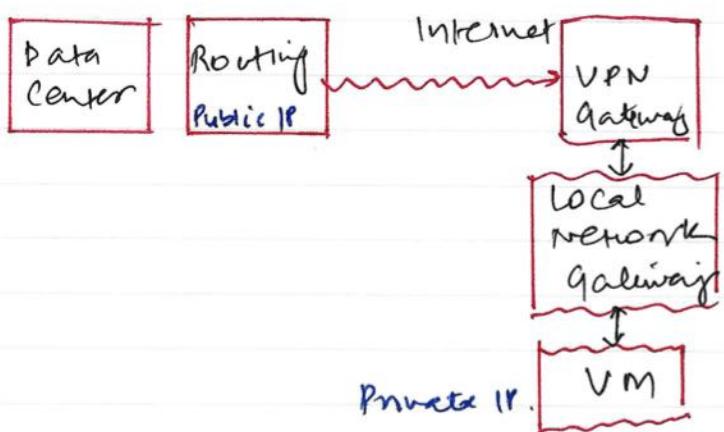
TYPE OF NETWORK CONNECTION:-

1. VIRTUAL NETWORK (PEERING) → "MORE SECURE"
2. POINT-TO-SITE
3. SITE-TO-SITE

1. VIRTUAL NETWORK (PEERING):- This basically help to Interconnected two different virtual machine based on Private IP address.

2. POINT-TO-SITE

* Since information flows from Internet so we are using VPN gateway to make it more secure.

3. SITE-TO-SITE

Routing:- H/w CISCO router or machine help to route traffic on Internet.

Local Net Gateway:- Information at public IP of local network help to route

VPN Gateway → Attached from (LNG) to route the traffic

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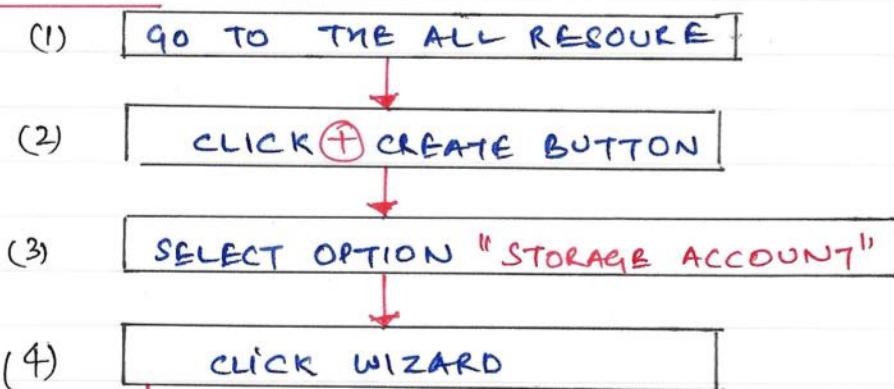
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MODULE #

AZURE STORAGE SERVICES - below are the type of storage services, this are the parts of Azure storage services

① BLOBS	② TABLES	③ QUEUE	FILE ④
- storing object - image - video	- storage Table data	- storing queue - sending message - receiving message	creat a file.

HOW TO ADD !

- (1) - BASICS - Account name / Region / Performance
- (2) - ADVANCED - For secure the account's
- (3) - NETWORKING - Public / Private IP's
- (4) - DATA PROTECTION - Deletion or modification
- (5) - TAG'S - categorization
- (6) - REVIEW + CREATE - final creation > CREATE STORAGE ACCOUNT

AZURE STORAGE SERVICES

- (1) CONTAINER STORAGE (BLOB) - Is optimized for storing amount of unstructured data, such as text or binary data.
- (2) DISK STORAGE Provides disks for virtual machines, application, and other services to access and use.
- (3) AZURE FILES - Sets up highly available networks file shared that can be accessed by using the standard server message block (SMB) protocols.

AZURE STORAGE ACCESS TIER'S

HOT	COOL	ARCHIVE
<ul style="list-style-type: none">optimized for storing data that is accessed <u>frequently</u> <p>↑ (READ & WRITE ARE VERY FREQUENTLY) (most cost \$)</p>	<ul style="list-style-type: none">optimized for storing data that is infrequently accessed <u>at least 30 days</u>	<ul style="list-style-type: none">optimized for storing data that is rarely accessed & stored. <u>at least 180 days</u>

(LESSER)
(Read & write cost more)

(Read & write is expensive)
(This cheap to store)
It will take time.

Q.53

EXPLORE AZURE MARKETPLACE:- It similar like Playstore,

Azure marketplace allow customer to find, try, purchase and process application and services from hundreds of leading service provider, which are all certified to run on Azure.

- 1> Open source container platforms
- 2> Virtual machine and Database Images
- 3> Application build and Deployment software
- 4> Developer's tools

AZURE DATABASE SERVICES

- * AZURE COSMOS DATABASE→ Is a globally-distributed database that elastically and independently scale.
- * AZURE SQL DATABASE→ Is a relational database as a services (DaaS) based on the latest version of microsoft SQL Server database engine.
- * AZURE DATABASE FOR MYSQL→ Is a fully-managed MySQL database services for application developer.
- * AZURE DATABASE FOR POSTERSQL→ Is a relational database services based on the open-source Postgres database engine.

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MODULE

* CORE SOLUTION:-

CORE AZURE SOLUTION	AZURE MANAGEMENT TOOLS.
I. IoT to Azure Sphere II. Synapse Analytics to Databricks III. Artificial Intelligence IV. Machine learning	I. Portal, Powershell, CLI II. Advisor III. Monitor IV. Service Health. V. VI.

* AZURE - INTERNET OF THINGS - IoT describe physical objects

that are embedded with sensor's , processing ability , software and other technologies and that connect and exchange data with other device and system over the Internet.

* AZURE IOT CENTRAL:- is a fully managed global IoT SaaS

Solution that makes it easy to connect , monitor and manage IoT assets at scale .

* AZURE IOT HUB:- is a managed services hosted in the cloud

that acts its central message hub bi-directional communication between IoT application and the device it manage .

* IOT CENTER * (DASHBOARD) \leftrightarrow TOP @ (IOT HUB)

* IOT CENTRAL	(Build top of hub, It has UI to manage multiple device)
* IOT HUB	(device control by IOT Hub)

BIG DATA & ANALYTICS → over a period of time, mostly all organization is capturing a huge amount of data. (Ex → Develop ecommerce website) → how many people visited etc.

Here Big-Data help to analyze the complete data. here we dump all data and using ETL Tool and process the data and create a data warehouse. Below are the Big-data tools —

- * AZURE SYNAPSE ANALYTICS — A cloud-based enterprise data warehouse solution, (Example → Hadoop)
- * AZURE HD INSIGHT:- A fully-managed, open sourced analytics services for enterprises.
- * AZURE DATA BRICKS!:- Apache spark based analytics services.
 - These three are majorly common used to analyze huge data

ARTIFICIAL INTELLIGENCE & MACHINE LEARNING:- (ML) is when understand the pattern and learn the output with help of (AI)

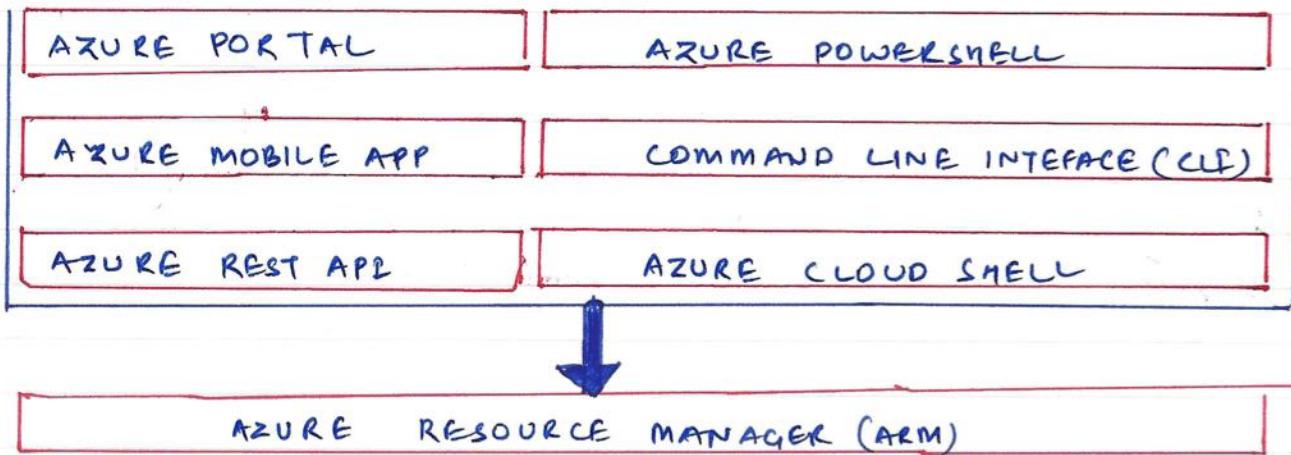
AZURE MACHINE LEARNING!:- cloud-based to develop, and deploy machine learning model

COGNITIVE SERVICE!:- quickly enable app to see, hear, speak, understand and interpret a user's needs.

AZURE BOT SERVICES! Develop intelligent, enterprise-grade bots

AZURE MANAGEMENT TOOLS:- Below are the part of AMT

(AZURE MANAGEMENT TOOLS) -



POWERSHELL- Install power shell locally, create a resource group and virtual machines access and used the cloud shell & review Azure Advisor recommendations

AZURE CLI:- Install the Azure CLI locally, create a resource group and virtual machine , use the cloud shell and review azure recommendation

WHEN ALL MODULE INSTALLED, WE NEED ADVISOR (AZURE ADVISOR)

- Probably we are not use / or using VM upto the capacity.
- Only one VM is in use , another one is not use much.
- ALSO, when deploy (100 VM) It is not possible to Analyze all VM.

* (So the solⁿ) is AZURE ADVISOR) *

~~FREE~~

AZURE ADVISOR!- Analyze deployed Azure resource and makes recommendation on best practices to optimise Azure deployment

- Reliability
- Security
- Performance
- Cost &
- Operation Excellence

(FREE)(RESOURCE)

AZURE ADVISOR!— Analyzes deployed Azure resource and make recommendation on best practices to optimize deployment

- | | |
|---------------|---------------------------|
| 1 Reliability | 4 Cost |
| 2 Security | 5 Operational Excellence. |
| 3 Performance | |

AZURE MONITOR!— Azure monitor maximizes the availability and performance of application and services by collecting, analyzing and acting on telemetry from cloud and on-premises environments

- Application Insight
- Log Analytics
- Smart Alerts
- Automation Actions
- Customized Dashboard's

AVAILABILITY & PERFORMANCE

- HOW MUCH RAM USE?
- HOW MUCH CAPACITY PROCESSOR USE?
- IF LOAD INCREASED?

* Alert are charges like CPU Util > 90%

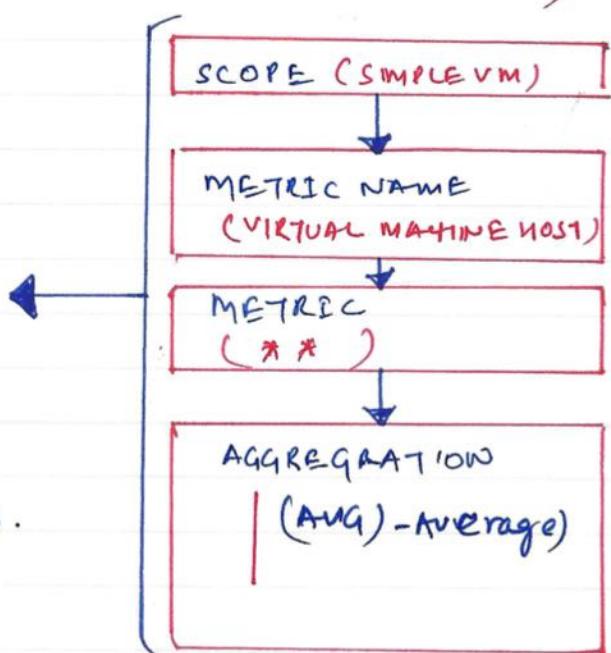
Go → Resource → Powershell | RG → VM Group

MONITORING → METRICS

(choose metric as per requirement.)

METRICS ARE LIKE!— *

- I. CPU CREDIT REMAINING
- II. Data Disk Bandwidth
- III. Data Disk IOPS Consumption
- IV. Inbound Traffic
- V. Disk Write Bytes
- VI. Network In Total
- VII. Percentage - CPU.
- VIII. Percentage - CPU - Percentage - CPU.
- IX.



* AZURE SERVICE HEALTH:- Evaluate the impact of Azure services

Issues with personalized guidance and support, notification and issue resolution updates.

In case any Azure service is down, then it will reflect in (service health) → once issue resolved it will reflect the update on the same.

* (UNPLANNED OUTAGE / PLANNED OUTAGE) *

* AZURE RESOURCE MANAGER (ARM) TEMPLATES -

(* It is a JSON file) → It is declarative

Azure resource manager (ARM) templates are JavaScript object. This can be used to create and deploy Azure infrastructure without having to write program commands.

Declarative Syntax	→ (1) No need to write programs
Repeatable Result	
Orchestration	→ (2) No need to write sequences of powershell etc.
Modular Files	
Built-in-validation	
Exportable code	

* Beauty of ARM!:-

(1) If you implement ARM and it runs partially go in case we re-execute it will do new changes without repeating to all.

(2) ARM is control by parameter file (Same template used in multiple environments).

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MODULE

SECURITY:- The coming docs will cover the below section

AZURE SECURITY FEATURES	AZURE NETWORK SECURITY
<ul style="list-style-type: none">SECURITY CENTERRESOURCE HYGIENEKEY VAULTDEDICATED HOSTS	<ul style="list-style-type: none">DEFENSE IN DEPTHNETWORK SECURITY GROUPSFIREWALLSDDOS PROTECTION.

01 AZURE SECURITY CENTER : In azure we are creating a

resources.,(VM machine, storage) and all these resource need to be secured. The security the resource's are from-

- (1) Protect from malware.
- (2) Protect from unauthorized Access.
- (3) Protect from potential attacks / hackers.

WHEN POSSIBLE? IF their is some problem in our infrastructure.

AZURE SECURITY CENTER is imbuilt in Microsoft Azure. and it is monitoring the services like (Virtual machine, App service) Database, storage). It provide treat protection to both Azure and on-premise Data center. (in case deployed in other virtual machine).

Protect ~~X~~ AZURE VIRTUAL MACHINE, NON-AZURE VIRTUAL MACHINE
and On-premise Data center

3 THING HELP BY SECURITY: → next slide

MICROSOFT SECURITY CENTER (AZURE) This will help you.

- (1) Provides security recommendation - It will help to assign and give up recommendation
- (2) Detect and Block Malware:- It will help to analyze the malware attack, immediately send alert and protect us from such kind of malware attack.

It will detect & block - Malware as well.
- (3) ANALYZE AND IDENTIFY POTENTIAL ATTACKS:- It will help to analyze potential attack & help to identify the same.
- (4) JUST-IN-TIME ACCESS CONTROL FOR PORT'S:-

Suppose we have a virtual machine, now how we need to do ~~RDP~~ RDP (Remote Desktop) to that virtual machine so for doing the RDP on virtual machine. We need to open the window port no (#3389) and we are using SSH login in Linux (Port #22).

Instead open these both port parametrically. We can configure in such a way that on-demand. When we need to do RDP or SSH system to that virtual machine. That time only port will be open. And these ports will close automatically after few time-frame.

02. AZURE SECURITY CENTER - CAPABILITIES:- (RESOURCE HYGIENES)

(i) POLICY COMPLIANCE:- with help of policy we install some (agent, s/w)

which basically help analize the virtual machine. and submit the report in (log analysis).

As soon we created a Azure machine, the agent software is installed in the same and this is done under policy compliances.

(ii) CONTINUOUS ASSESSMENTS:- Assess new deployment resource to

ensure that they are configures properly. As soon new VM created with help of (AGENT S/W) install and helps in assessment.

(iii) TAILORED RECOMMENDATION:- Recommendations based on existing workload with instruction on how to implement them.

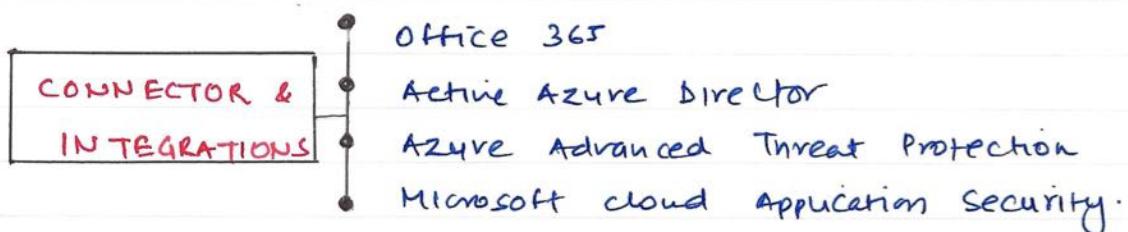
(iv) THREAT PROTECTION:- Analyze attempted threats through alerts and impacted resource reports.

EXAMPLE @ PORTAL'S

Controls	Max Scores	Current Scores	Potential Score Increase	Unhealthy Resource	Resource Healthy	Action
① → Enable MFA	10	0	+18% (10 points)	10+1	—	—
② → Secure Management Ports	8	0	+14% (8 points)	5 of 5	—	—
③ Encrypt data in transit	4	3.11	+2% (0.89 points)	2019	—	—

AZURE SENTINEL:-

Azure sentinel is a security information management (SIEM) and security automated response (SOAR) solution that provides security analytics and threat intelligence across an enterprise.



①

COLLECT:-

Collect data of all user, devices, application & Infrastructure

②

DETECT:-

Under Post-Processing detecting the threats (Based on AI/ML)

③

INVESTIGATE:-

Investigation of threats.

④

RESPOND

Responded by invoking some kind of work flow

03. AZURE KEY VAULT:-

Azure key vault store application secrets in

a centralized cloud location in order to securely control access permissions and access logging.

- (1) ✓ STORING SECRETS BACKED BY HARDWARE SECURITY MODULES (HSM)
- (2) ✓ SECRETS MANAGEMENT
- (3) ✓ KEY MANAGEMENT
- (4) ✓ CERTIFICATE MANAGEMENT

* AZURE DEDICATED HOSTS:- Azure dedicated hosts provides physical servers that host one or more Azure virtual machines that is dedicated to a single organization load.

- * This will help to allocated dedicated hardware to specific Subscription \rightarrow (VM, storage will allocated dedicated).

* BENEFITS:-

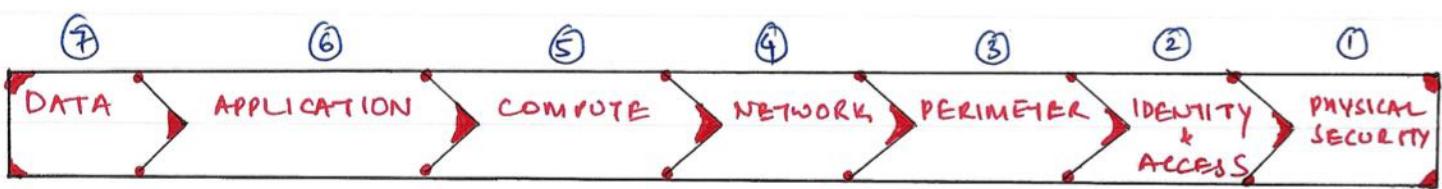
- * Hardware isolation at the server level.
- * Control over maintenance event timing.
- * Aligned with Azure hybrid use benefits.

* SECURE NETWORK CONNECTIVITY:-

(How the virtual machine is secured - ?) by —

Q1. DEFENSE IN DEPTH — A layer approach to secure computer system. or virtual network.

- Provides multiple levels of protections.
- Attacks against one layer are isolated from subsequent layer



- * Hacker is majorly interested in. (password, credential detail) so the protection required at each level.
- * Hacker need to hack each layer starting from Physical security to the Data Point.

SHARED SECURITY MODEL:- Azure provide shared security model. In this certain thing is take by microsoft and certain thing is take care by customer.

(Ex- Below are the detail around the type of model)

Responsibility	On-premises	IaaS	PaaS	SaaS
Data Governance and - - Right Management	Customer	Customer	Customer	Customer
client endpoints	Customer	Customer	Customer	Customer
Account & access management	Customer	Customer	Customer	Customer
Identity & directory Infrastructure	Customer	Customer	M/C	M/C
Application	Customer	Customer	M/C	Microsoft
Network control.	Customer	Customer	M/C	Microsoft
Operating System.	Customer	Customer	Microsoft	Microsoft
Physical hosts	Customer	Microsoft	Microsoft	Microsoft
Physical networks	Customer	Microsoft	Microsoft	Microsoft
Physical Data Center	Customer	Microsoft	Microsoft	Microsoft

(# M/C = Microsoft / customer)

NETWORK SECURITY GROUP - NSG filter network traffic to and from, Azure resource on Azure virtual network.

- * Set inbound & outbound rules to filter by source and destination IP address , ports and protocols.
- * Add multiple rules , as needed , with subscription limits
- * overrides default rule's with new higher priority .

AZURE FIREWALL:- Firewall as a services (faas) that grants/denies

Server access based on originating IP address , in order to protect network resource.

- I. Applies inbound and outbound traffic filtering rules.
- II. Built-in high availability
- III. Unrestricted cloud scalability
- IV. User Azure monitor logging

Azure Applicatce gateway → also provides a firewall , web-application firewall (waf) . waf provides centralized , inbounded protection from web applications.

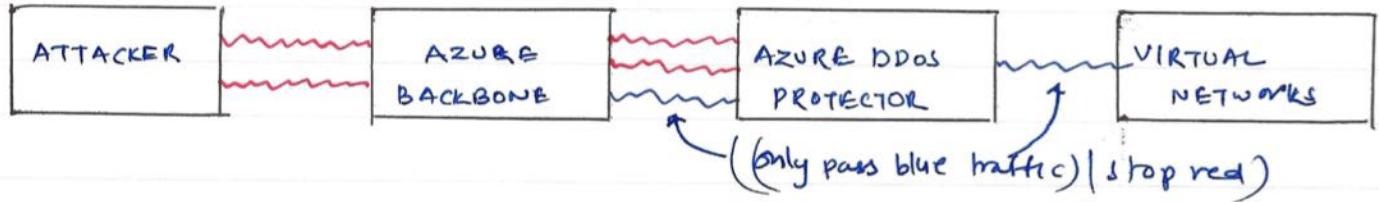
AZURE DDOS (DISTRIBUTED DENIAL OF SERVICES) PROTECTION

If a service requested from multiple location across globe to a specific server, which lead slow or unresponsive . So Azure is designed to handle such situation and block such kind of request.

THE BASIC VERSION OF DDOS IS FREE

* It will automatically detected that traffic is not coming from a ~~greedy~~ needy user. but from a (bot) and it will blocked . Azure backbone is pre-program to handle such situation.

- I. Ensuring for server availability to access our request
- II. Basic Service tier is automatically enable
- III. For standard service tier adds mitigation capabilities (It will help to get more detail from where attack happens.)



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MODULE #AZ-900, IDENTITY, GOVERNANCE, PRIVACY & COMPLIANCE.AZURE IDENTITY SERVICES:-

1. Authentication versus Authorization.
2. Azure AD, MFA, SSO, and conditional Access.

AZURE GOVERNANCE FEATURE:-

1. RBAC
2. Resource locks and tags
3. Policy, Blueprints and CAF.

AZURE PRIVACY & COMPLIANCE!-

1. Privacy statement and online services Terms
2. Trust center and compliance documentations
3. Azure sovereign regions.

1. AZURE IDENTITY SERVICES - OBJECTIVE DOMAIN:-

- Explain the difference between authentication & authorization
- Define Azure Active Directory
- Describe the functions & usage of Azure Active Directory
- Describe the functionality and usage of Conditional Access, - multiple-factor (MFA) and single-sign (SSO).

* Authentication

- Identifies the person or services seeking access to a resources.
- Request legitimate access credentials.
- Basis for creating secure Identity & access control principles.

(The process of identifying the person to be (claimed) is called Authentication)

Authorization.

- Determines an authenticated person's or service's level access
- Define which data they can access, and what they can do with it.

(Based on Identity, provide the access to the services is called Authorization).

* AZURE ACTIVE DIRECTORY (AAD) - IS an Microsoft Azure cloud-based identity and access management services

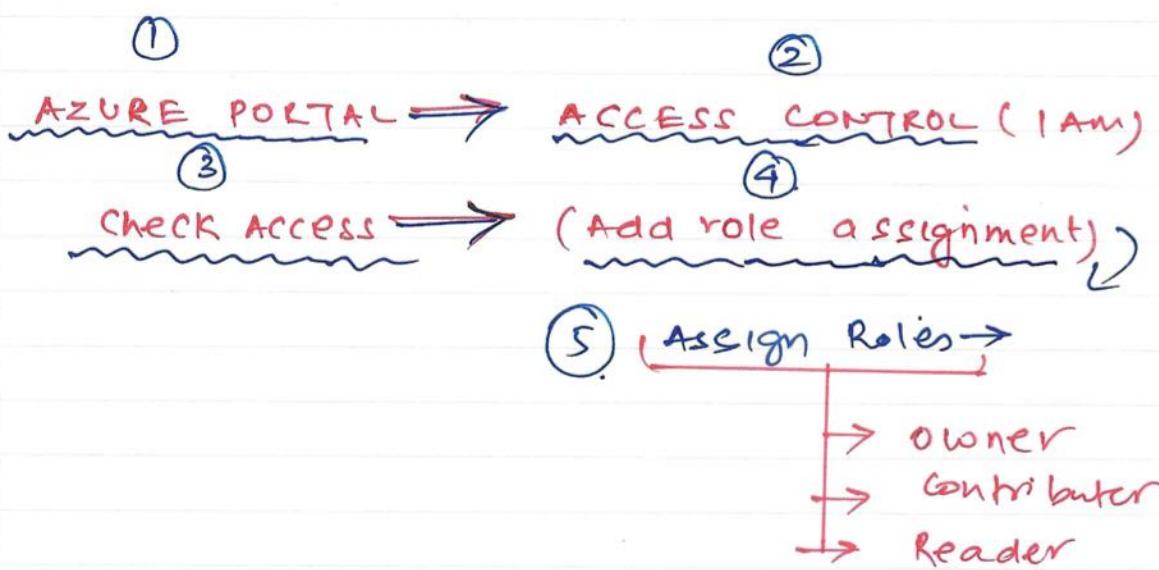
- 1 Authentication (employee sign-in to access resources)
- 2 Single-Sign-On (SSO)
- 3 Application Management
- 4 Business-to-Business (B2B)
- 5 Business-to-Customer (B2C)
- 6 Device Management

* CONDITION ACCESS - is used by Azure Active Directory to bring signals together , to make decisions , and enforce organizational policies .

- + User or group Membership
 - IP Location
 - Devices
 - Application
 - + Risk Detection
- ↙

RISK Detection → with help of ML/AI Azure detect the pattern

of login like (city / country) If two login attempt done from random location It will auto detected risk detection .



AZURE GOVERNANCE METHODOLOGIES

* RBAC (ROLE-BASED ACCESS CONTROL)

- fine-grained access management
 - Segregate duties within the team and grant only the amount of access to user that they need to perform their jobs.
 - Enable access to the Azure portal and controlling access to resources.
- * Giving role to particular security principle protects the resource.

* RESOURCE LOCKS : protect your Azure resource from

accidental deletion or modification, Manages locks at subscription ,resource group, or individual resource level with Azure portal.

LOCK TYPES	READ	UPDATE	DELETE
✓ Can Not Delete Readonly	YES YES	YES NO	NO NO

- * mostly services are not able to re-call.
- * resource lock help to prevent from accidental deletion .

AZURE PORTAL > SUBSCRIPTION > SEARCH SEARCH WINDOW > RESOURCE LOCK

(ADD > (define) lock type → Readonly. > OK) ✓
① Read only.
②

TAGS:-

- * Very useful for rolling up billing information
- * Define (KEY+VALUE) To define tag for my resource for getting the billing information.
- * Provides metadata for your Azure resources.
- * Logically organizes resource into a taxonomy.

AZURE PORTAL:- Example:-

AZURE PORTAL > LEFT SIDE EXPLORE SECTION > TAG'S.

AZURE POLICY:- Azure policy help to enforce organizational

standard and to access compliances at-scale, provides governance and resource consistency with regulatory compliance, security cost and management.

- Evaluates and identifies Azure resource that do not comply with your policies.
- Provide built-in policy and initiative definitions, under categories such as storage, networking, compute, security center and monitoring.

AZURE PORTAL EXAMPLE:-

AZURE PORTAL > SEARCH > POLICY >

Policy Definition
Assignment
Definition
Exemption

AZURE BLUEPRINT'S:— makes it possible for development team to rapidly build and stand up new environment.

Development team can quickly build trust through organizational compliance with a set of built-in components (such as networking) in order to speed up development & delivery.

1. — Role Assignments
2. — Policy Assignments
3. — Azure Resource Manager's Templates
4. — Resource Groups.

CLOUD ADOPTION FRAMEWORKS:—

- **STRATEGY** - Define business justification & expected outcomes
- **PLAN** - Align actionable adoption plan to business outcomes.
- **READY** - Prepare the cloud environment for the planned changes.
- **MIGRATE** - Migrate & Modernize existing workloads.
- **INNOVATE** - Develops new cloud-native or hybrid solutions.
- **GOVERN** - Govern the environment & workloads
- **MANAGE** - operational management for cloud & hybrid soln.

* AZURE PRIVACY:- Microsoft committed to ensuring the privacy of organizations through ~~com~~ Microsoft contractual agreements, and by providing user control & transparency.

COMPLIANCE:- Microsoft respect law and regulations and provide comprehensive coverage of compliance offerings.

Microsoft provides the most comprehensive set of compliance offering (including certification and attestations) of any cloud service provider. Some compliance offering including -

- CJIS (CRIMINAL JUSTICE INFORMATION SYSTEM)
- HIPAA (HEALTH INSURANCE)
- CSA STAR CERTIFICATION
- ISO / IEC 27018
- EU MODEL CLAUSES
- NIST (National Institute of Standards & Technology).

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MODULE #**AZURE PRICING , SERVICE LEVEL AGREEMENT & LIFECYCLES****(1) AZURE SUBSCRIPTIONS:-**

- * Subscription Options

(2) PLANNING & MANAGING COSTS

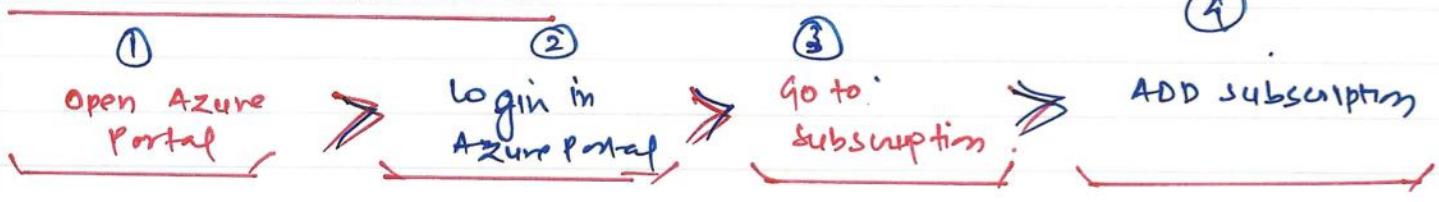
- * Available products & services
- * Pricing & TCO calculators.

(3) SERVICE LEVEL AGREEMENTS

- * SLA?
- * Calculating your cloud uptime

(4) SERVICE LIFE CYCLE

- * Preview & general availability features

AZURE SUBSCRIPTIONS:-**choose subscription** —

1. Free Trial
2. Pay-As-You-Go
3. Azure students.

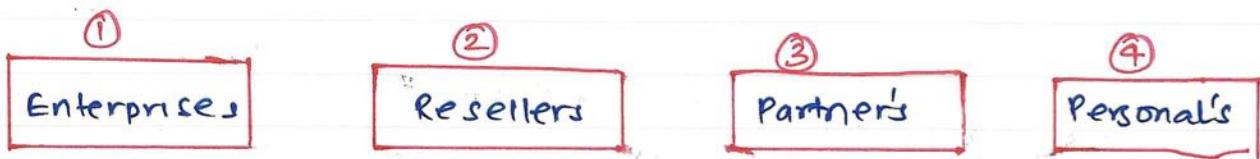
Choose your subscription as per your work requirement and activated

(12 month) + (\$200 credit) + (Always free)
(25+ services)

AZURE PURCHASING:-

Three main customer types on which the available purchase option for Azure products and services are contingent are -

- Enterprises
- Web direct
- Cloud solution provider (CSP's)

FACTOR AFFECTING COSTS:-

① RESOURCE TYPE	② SERVICES	③ LOCATIONS
① - virtual machine		
② - App services		
② - (Based on services)		
② - Type of customer		
③ - Infrastructure location.		

AZURE PURCHASING:- Three main customer type of which

the available purchased option for Azure products & services are configured are -

- 1 → Enterprises
- 2 → Web-Direct
- 3 → Cloud solution provider (CSP's)

FACTOR AFFECT COSTS:-

* RESOURCE TYPE - (virtual machine → CPU/RAM/storage.)
virtual resource allocated with virtual machine.

* SERVICES - Depend on type of service like (Enterprises, web-direct, cloud solution partners).

* LOCATION - cost vary between locations that offer Azure product, services and resources.

* Bandwidth - Data moving in-and-out of Azure datacenter.

Some inbound data transfer are free, such as data going in Azure data center. for outbound data transfer - such as data going out of Azure datacenter - pricing is based on zones.

(AZURE > PRICING CALCULATOR) > (CHOOSE SERVICE)

→ Once service selected (along with region) the price will be allocated in bottom.

(→ Pricing change as location change.)

EXPLORE TCO (TOTAL COST OF OWNERSHIP) :-

A tool estimate cost saving you can realize by migrating to Azure.

A report compares the costs of on-premises infrastructure with the cost of using Azure product and service in cloud.

S.NO	AZURE RESOURCE	ON-PREMISES COST	AZURE COST
1.	COMPUTE	0Y.	7Y.
2.	DATA CENTER	93Y.	0Y.
3.	NETWORKING	21.	42Y.
4.	STORAGE	4Y.	50Y.

$$\text{Example cost} = (\$30,702,492) \quad (592,612)$$

MINIMIZING costs:- (PM-UU-CEA)

- * 1) PERFORM - Perform cost analyses. Use (Pricing / TCO calculator)
- * 2) MONITOR - Monitor usage and Azure Advisor
- * 3) USE - Use via free trial customer (spending limits)
- * 4) USE - Use Azure Reservation & Azure Hybrid Benefits (HUB)
- * 5) CHOOSE - choose low-cost locations and regions
- * 6) KEEP - Keep up-to-date with latest subscription offer.
- * 7) APPLY - Apply tag to identify cost owner

EXPLORE SUPPORT - OPTION!:-

Every Azure subscription included free access to billing and subscription support, Azure portal products and services documentation, online self-help documentation, white paper and community support.

(→ ALSO reach to me , in case any support required around the technology.)

	-SCOPE	TECHNICAL SUPPORT
BASIC	Available to all Microsoft Azure accounts	
DEVELOPER	Test & Non-production Environment	Business hours access to supports Engineering via email .
STANDARD	Production workload Environment	24x7 access to support Engineer via phone/email
PROFESSIONAL	Business-critical Dependencies .	"

MICROSOFT SLA:-

- * Performance targets are expressed as uptime and connectivity guarantees
- * Performance - targets from 99.9% (3-9) to 99.99% (4-9)
- * If a service fails to meet the guarantees, a percentage of monthly service fees can be credited.

SLA	DOWNTIME/MONTH	DOWNTIME/YEAR
99.9%	43.2 minutes	8.76 hours
99.95%	21.6 minutes	4.38 hours
99.99%	4.32 minutes	52.56 minutes