

Azure

Fundamentals

In AZURE, we are having both on-prem and public/private cloud.

## Cloud Pricing Models

- ① Fixed cost (Ex: App Services, Virtual Mach, Azure SQL)
- ② Pay as you go

(Ex: Cognitive Services)

Azure Function Apps (serverless tier)

Cosmos DB (serverless offering)

Azure SQL DB (serverless offering)

- \* All Azure Serverless services use consumption based pricing. Serverless mean "infrastructure" will be managed by the Azure, scaling up & down based on the input size, increasing the computation power can be some serverless services.
- \* Serverless  $\Rightarrow$  Infra is managed by Azure itself

## Cloud Benefits

- \* Availability
- \* Scalability
- \* Reliability
- \* Predictability

## Azure Security

- \* Azure offers multi-layered security across datacenters, infrastructure networks, operations
  - $\rightarrow$  Physical security
  - $\rightarrow$  Firewall
  - $\rightarrow$  DSCB
  - $\rightarrow$  Key Vault
  - $\rightarrow$  Conditional access
  - $\rightarrow$  Microsoft Defender

## some services in Free tier

- \* Azure Virtual Machines
- \* Azure SQL database
- \* Azure BLOB storage
- \* Azure Cosmos DB
- \* Azure APP Service
- \* Azure Functions
- \* Azure Event Grid

limited usage only

Azure site: portal.azure.com

cloud shell, directories & subscriptions, notifications settings and support and help icons are present on the home page of Azure.

\* To watch the utilization of services, we need to check the monitoring service.

## services comes under Tools:

- \* virtual machines
- \* storage management/account
- \* networking services

## PaaS

- \* Azure AppService

## SaaS

- \* Accessing Software through online.

- \* Software is maintained by Microsoft.

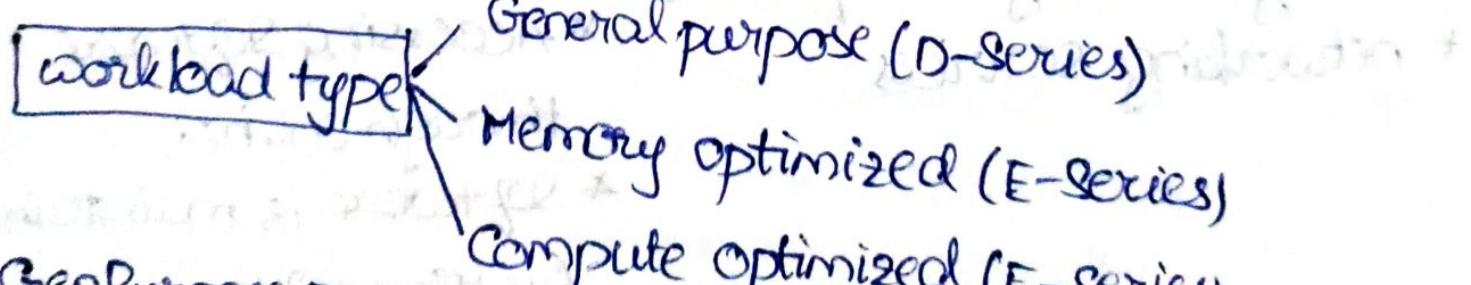
## Virtual Machines

We can create VM's in Azure in 4 ways.

- ① Azure Virtual Machine (normal)
- ② Azure Virtual Machine with preset configuration
- ③ Azure Arc virtual machine
- ④ Azure VMware solution virtual machine.

By using Azure Virtual Machine with preset configuration we can set a predefined configuration for VM, such that it can configure to dev/test or Production servers or with any preset config.

For dev/test preset, we only have basic Microsoft defender and basic necessities. If we want to make the application live we made fit to production workload environment.



Gen Purpose Ex: Enterprise applications, relational DBs, analytics  
Mem optimized Ex: Large in-memory workloads applications  
Compute optimized Ex: Batch processing, web servers, gaming

## Resource Group?

whatever services needed

whatever resources needed by a service are grouped as a resource group.

For VM  $\Rightarrow$  Load Balancer, security group, disc, IP address are underlying resources under a resource group.

While creating a virtual machine we need to attach a resource group for it. And we also need to select the region of the VM. Cost and resources availability depends on the region.

If we choose a farther region then we need to use a long network, so in turn the cost also increases, so the nearer region recommendable.

While creating virtual machines, we will have an option to choose "availability options", which tells us how many copies of our data to be stored, so that in case of any disaster (A region can have multiple availability zones) 3 options available under "Availability Options"

- ① Availability zone
  - $\rightarrow$  Physically separate resources within an Azure region
- ② Virtual Machine Scale Set (Scaling up or down VM's across zones)
  - $\rightarrow$  Distribute VM's across zones
- ③ Availability Set (~~Same~~ same data replicated on multiple VM's on same fault domain)
  - $\rightarrow$  Automatically distribute your VM's across multiple fault domains

we also need to select "security type" for the virtual machine

① Standard (Basic level)

② Trusted bunch virtual machines

\* Image selection (Hardware & software) component group be selected for virtual machine.

Example: ubuntu, centos

\* VM architecture : ① ARM64

② x64

\* Auth type for the virtual machine can be selected.

① ssh public key

② Password

\* we can also choose

→ username

→ ssh public key source (similar password / private key)

→ key pair name (we have to provide stored passwords)

\* we can choose inbound port rules for the VM

→ we have to select which virtual machine network ports are accessible from the public internet. Some of the inbound ports that we can access from

① HTTP (80) If we want to give SMTP access

② HTTPS (443) for VM, we need to choose SMTP

③ SSH (22) inbound port:

We will have more details in Network

\* we can choose

① VM disk encryption

② OS disk type

↳ Premium/Standard SSD

↳ Premium/Standard HDD

Internally we are having two types of storage

① Locally redundant storage

↳ Data is replicated within a single Availability Zone or Datacenter

② Zone-redundant storage

↳ Data is replicated to 3 availability zones.

③ Delete with VM [Delete data of VM, when VM is down]

④ Ephemeral OS disk

↳ If we want a disk for one-time use and if we restart the VM there should be no previous data, we use this OS disk.

In networking stage of virtual machine, we need to choose the details of subnet and public IP address, we can also choose or create multiple inbound rules by checking Advanced option under 'NIC network security group'. we can also select multiple inbound ports. [HTTP (80), HTTPS (443), SSH (22)]

Inbound rules is nothing but a way of getting info into the virtual machine. we need to select a destination port ranging from (0 - 65535), choose a protocol (TCP, UDP, ICMP) we can select a service like MySQL, MongoDB or any app that we want to open a port and run app

\* We have to choose inbound rules and outbound rules

Default for Inbound: Reject all ports

Default for outbound: Accept for all

\* We can choose 2 types of load balancers

① Application Gateway:

It is HTTP/HTTPS web traffic load balancer with URL based routing, SSL termination, session persistence and web application firewall.

② Azure Load Balancer:

Supports all TCP/UDP network traffic, port forward and outbound flows.

There is no requirement of load balancer if we are running an application on 1 VM.

\* There is an option to

① auto-shutdown

② Backup of data

③ Guest OS updates (Based on image we select)

↳ There will be a case images will be update from the day we create VM. To get all updates up-to-date for the VM based on the base image we use this option.

\* We also having the monitoring options for the VM.

Based on the rules declared we can ~~get~~ get the alert notification from Azure.

- \* If we want to provide any instructions to the VM to install in VM by default without giving any manual installation, we can declare the pre installation details for the software to be installed as "customdata" in VM configuration.
  - This customdata will be executed by the Azure while creating the VM
- \* Basically custom data stage is nothing but passing a cloud init script, configuration file or other data into the virtual machine while it is being provisioned. The data will be saved on the VM in a known location.
- \* After configuring the VM we need to download private key of VM and create a virtual Machine.
- \* we can connect to VM using ssh by using private key as a key, using similar command.

```
"ssh -i <privatekeypath> azuruser@20.39.188.135"
```

```
ssh -i <privatekeypath> username@ipaddresspublic
```

Instead of storing large amount of documents in local servers, we can use storage accounts which is provided by Azure

### Some of the services in Azure:

Instead of Phy servers use VM's

Instead of Phy storage use "storage accounts"

Manage cloud resources through

- ① CLI
- ② Powershell
- ③ Azure Resource Manager
- ④ Terraform
- ⑤ SDK's

} used to automate/manage or create the cloud resources of Azure.

CLI & Powershell used for infrastructure management only if the particular CLI & Powershell are authorized by the Azure Account

"az vm list"  $\Rightarrow$  list all the virtual machines

we can use similar commands through CLI to interact with Azure

\* To create any resource we must have a resource group  
so to create any storage account we must have a resgroup  
Create a resource group

az group create --location westus --resource-group nai

az group create --location <locations> --resource-group cres-gp-one

## Create a storage account

```
az storage account create --resource-group <res-grp-names>  
    --location <locations> --sku <typeofstorage>  
    --name <storage acc names>
```

SKU is nothing but Stock Keeping Unit

- ↳ used to identify unique product or service
- ↳ used to differentiate between diff type of resources
- ↳ Each SKU has its own pricing and features

"standard-LRS" ⇒ Example for SKU

⇒ Standard Locally Redundant Storage

## Delete a Resource group

```
az group delete --resource-group <resgrpname>
```

all the resources under this resource group will be deleted

## Azure Active directory

For an cloud account there will be one administrator and consider we are in a team with 5 dev & 3 testers. They need to perform dev & test at different level without root access. So, Azure AD create multiple users and assign privileges for those users. Multiple security levels of account access control for the users done by Azure AD. We can give,

[we can invite external user through mail]

① Users (we can have sign in logs)

↳ can assign roles

↳ There will be some default roles under Azure, we can choose one.

One way to restrict the access for users)

If we are having an AZ account and we are creating another user under Azure AD and If we try to login through that user it will be unsuccessful because we created a user but didn't assign a role for the user attaching to any resource group. [we can do similar to group access restriction]

so under the options we need to go to "Access Control (IAM)". Identity and access management of Resource group and assign the role for newly created user using "Add role assignment"

Select a role for user and declare the users. Then the user can only perform only dedicated roles

### Key Vault

If we want to store some sensitive data we need to use key vault service of Azure

We can create a new user or new group or add new members under a group we can do it at

Home > Home / Users > users

Not every user have the access to create resource group , it depends on the role assigned to the current user

We can create groups under Home > Home / Groups > Groups / All Groups > New we can add users into that group. This groups used to assign permissions in large scale.

we can check sign-in logs under

Home > Home | users > users > Sign-in logs

we can invite external users through

Home > Home | users > users > Invite External user

secret and confidential information will be stored under key vault. we can create one, it will be given under the key vault > Create key vault

we need to pass details like

- ① Subscription
- ② Resource group
- ③ Key vault name
- ④ Region
- ⑤ Pricing tier

Standard

Premium

(includes support for HSM backed keys)

- ⑥ Days to retain
- ⑦ Purge protection

HSM  $\rightarrow$  Hardware Security Module

deleted vaults

↳ Default is disabled

↳ key vaults can be deleted permanently during retention period

↳ Enable

↳ can't delete permanently during retention period.

we can store

- ① Keys
- ② Secrets
- ③ Certificates

under key vaults

- \* we can download the key of key vault can be downloaded as PEM value file.
  - \* single line secrets can be declared through UI, multi line secrets can be created through command line.
- 

### Azure Advisor

- \* we can get the details related to cost of the resources that we are using and we also get suggestions of how to reduce cost and how to use resources efficiently.
- \* we get information of what best practices that we go for security. (Ex: suggest Microsoft defender, firewalls)
- \* If the application that we runs use only 1GB of RAM, but we allocated 2GB of RAM then advisor suggests to decrease the RAM allocation to decrease the cost of the cloud resources. under utilization details information given.
- \* we can get security information such as if we try to open many ports than required for a application then advisor gives security suggestion, to close un necessary ports to escape security breaches.
- \* And provide the Reliability information, and reliable suggestions for the applications.

Azure Advisor provides information about

- ① Cost
- ② Security
- ③ Reliability
- ④ Operational excellence
- ⑤ Performance
- ⑥ All Recommendations.

## Azure Service Health

\* To know current ~~of~~ status or health of our Azure services (Eg: Virtual Machines)

### Service Health

- ① Service issues
- ② Planned Maintenance
- ③ Health advisors
- ④ Security advisors
- ⑤ Health history
- ⑥ Resource health.
- ⑦ Health alerts

## Azure Monitor

Azure Monitor, monitor our resources such as virtual machines, containers, networks, applications

→ Activity log [can create new alert rules]

→ Alerts

→ Metrics

→ logs

→ Change Analysis

→ Service Health

[we can give the metrics that needs to be monitored]

[can give static threshold rule or dynamic threshold for creating an alert rule]

- \* Azure Monitor checks every  $m$  minutes for a ~~long~~  
period of  $n$  minutes. It means for every  $m$  minutes  
we check past  $n$  minutes
  - \* For every Alert rule we can also choose an action  
group or create one and send a notification alert to  
user. Either through Email/SMS message/Push/Voice
- Networking & Storage & Compute  $\Rightarrow$  IaaS  
 Azure App Services  $\Rightarrow$  PaaS
- ↳ To deploy application on Azure
  - ↳ we can host a web application
    - ↳ static web application
    - ↳ web app with a database
  - ↳ we can build, deploy & manage powerful  
web, mobile, and API apps which are sharing  
a single back end engine

Azure App Services

we can choose a plan type  $\rightarrow$  Free (Personal projects)  
 $\searrow$  Standard (Production app)

Region to Host

SCH declaration [GitHub, Azure Devops, other]

↳ Branch and repo details  
 We can give the app location during App service  
 declaration during deployment

All the necessary dependencies for running the application such as load balancers, storage to store code, executable cores all will be provided by Azure App Service

If we have a VM and we want another VM which is similar to this VM, we need not to enter whole details manually. Consider we need to create VM<sub>2</sub> with the same structure as VM, then we can export the template of the "virtual machine" into a json format and use that json format as an architecture for the VM<sub>2</sub>.

- \* Refer Virtual machine Service for performing this action.
- \* we can't do the same methodology using Cloudshell

we can Manage Azure resources using Azure Powershell

we can also manage Resources using Azure CLI

we can also check the cost or monitoring the cost under "cost management + Billing", where we can see the cost management options like cost analysis, cost alerts and we can also set the budget, under the cost analysis we can see the current cost overall and with respect to each service. And an forecasted cost for the month and gives information costs per each & every region we can do cost analysis here. Based on the budget we can create alerts. and details declared or displayed here.

## Function APP

we can create a function to be implemented when a particular event taken place. That will be Function app. For example, if we having Image compression application running, Then all the images that are uploaded through the application directly will be passed to the function in Function App. and store that image at another location as directed by the Function App.

In Function APP, we can declare

- Input - will be code or container image
- Runtime Stack (Runtime executable language)  
Ex: Python
- Version (of the Runtime)
- Region
- OS (linux or windows)
- Hosting options (place where we host functions)
  - ↳ Based on Consumption (Serverless)  
resource allocation
  - ↳ Functions Premium  
(Scaling based on resource consumption by a function)
  - ↳ App service plan
  - ↳ Fully isolated and dedicated environment

If we want to store application logs (Function App logs) then we need to enable Application Insights.

- \* we can provide the code through github to Function App, and if we want to enable continuous deployment and use webhook to trigger the function app or if there any new commit it reexecute again
- \* If we don't want to maintain infrastructure manually then we need to choose serverless

### SQL databases

- \* similar to on prem database, we can use this service as database in the cloud.
- \* Azure Cosmos DB is fully managed NoSQL and relational database service for building scalable and high performance applications.

- \* we can use this for
  - Cosmos DB for NoSQL
  - Cosmos DB for PostgreSQL
  - Cosmos DB for MongoDB
  - Cosmos DB for Apache Cassandra
  - Cosmos DB for Apache Gremlin

## Three modules of Azure fundamentals

### Module 1:

Covers basic concepts of cloud computing, such as benefits, models and types of cloud services. It also introduces the core principles and terminology of Azure, such as regions, availability zones, resource groups and subscriptions.

### Module 2:

Describes the main components and features of Azure architecture and services, such as compute, storage, networking, databases, analytics. It also explains how to use the Azure portal, CLI, Powershell and SDK's to interact with Azure resources.

### Module 3:

Explains how to manage and govern Azure resources using tools like Azure monitor, Azure Advisor, Azure Policy, Azure Role Based access Control & Azure Blueprints. It covers the topics of identity, privacy, cost management in Azure.