Azure

# Introduction

## Cloud Computing

Cloud Computing is the delivery of computing services – servers, storage, databases, networking, software, analytics, intelligence and more – over the internet (“the cloud”) to offer faster innovation, flexible.

You typically pay only for cloud services you use, helping to lower the operating costs, runs the infrastructure more efficiently and scale as the business needs change.

<https://azure.microsoft.com/en-in/overview/what-is-cloud-computing/#benefits>

Benefits: -

1. Don’t need to manage data centers.
2. Don’t need to buy physical hardware upfront.
3. Create resources on demand on the cloud.
4. Only pay for how much we use.
5. It’s the future of computing.

## Resources and Resource groups

Whenever we create a product or service (VM, app service, SQL database, storage account etc.) that available in azure, we called those as **resources.**

**Azure Resources Groups** are logical collections of virtual machines, storage accounts, virtual networks, web apps, databases, and/or database servers. Typically, users will group related resources for an application, divided into groups for example production and non-production — but you can subdivide further as needed.

## Regions

Azure has multiple regions where the datacenter is present. Remember choosing the closest region based on the user availability will be good.

Also, they are some applications which is used across the world, in that case it’s very hard to specify region to select, so we can use the **content network delivery** service to handle those long-distance signals.

Also, there would some services is not available in some region.

## Subscriptions

All the resources get billed under subscription (Pay-As-You-Go, Azure for Students) etc.

# Cloud Concepts

## Benefits of cloud

### High availability

In public cloud like azure availability is a big concern, but azure provides like:-

1. Azure storage accounts by default backup to 3 location.
2. Geo redundant storage where the data is clustered in different regions.
3. Any many more.

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### Scalability

Scalability based on the future requirement the size of the storage increase automatically.

For example: -

1. Blog storage by default it will be 1 GB but based on the increase of the file size the storage also increases.

### Disaster Recovery

If one region goes down due to some disaster, then we can use the data from the different region.

For example: - Replication technique in azure storage account. But the cost will be double as we are storing data in both the regions.

### Elasticity

Elasticity is basically adapting to changes in workload by provisioning or deprovisioning resources in a automate manner.

For example:- Resizing the VM based on the user increase like from 1cpu to 2cpu system etc.

### Fault Tolerance

Using Availability sets and zones we can achieve.

## Cloud service model

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## Cloud model types

### Public cloud

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### Private cloud

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### Hybrid cloud

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## Economics of scale

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# Azure Core services

## Virtual Machines

**Don’t Use Cloud**

In general, if we don’t use cloud then the company will build physical server and then host VM’s using Hyper-V, VMware.

**Disadvantages: -**

Company is responsible for

1. the physical server.
2. Tools of virtualization like Hyper-V, VMware
3. Storage.
4. Maintenance.

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**Using Cloud**

Virtual Machines is the service which is known as **IAAS (Infrastructure as a service)** on the azure platform.

**Benefits**

1. Don’t need to manage the underlying physical server.
2. Don’t need to buy the physical server.
3. Pay only the running cost the virtual server.
4. Terminate the virtual server at any point of the time.
5. Hosting different types of workloads on the server.
6. Deploy both windows and Linux based servers.

### While deploying any VM’s in azure, what goes along with VM’s

NSG (Network security group) which works as firewall, its decided what request flows into VM.

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### After creating the VM, along with VM we will get the below things also

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### Generation 1 and 2 in virtual machines

The cost is same for the generation.

<https://docs.microsoft.com/en-us/azure/virtual-machines/windows/generation-2>

### Installing IIS on the VM

From the VM server manager install IIS and browse localhost to check, its installed successful or not.

Also enable port 80 in the VM from networking add inbound port rule, for using localhost from outside.

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### Virtual Machines Types

<https://azure.microsoft.com/en-us/pricing/details/virtual-machines/series/>

### Azure Pricing calculator

<https://azure.microsoft.com/en-us/pricing/calculator/?cdn=disable>

### State of VM’s

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Always use the D:\ drive for temporary, as whenever the VM restart it loses the data.

### Creating a Linux VM

Steps is almost same as we have done for Windows VM.

Use putty to connect and download nginx

<https://www.putty.org/>

**sudo apt-get update**

**sudo apt-get install nginx**

### Availability Sets

It allows to achieve a SLA of 99.95 % , it provides fault domain(protects against hardware issue) and update domain (helps in rebooting process).

Note:- For the existing VM we can’t add availability sets, need to create a new one.

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Note :- Availability sets comes under one center, whereas Availability zones comes under different datacenters which makes the SLA percentage more.

### Availability Zones

It allows to achieve SLA of 99.99 % even more than availability sets. Availability Zones is basically a datacenter or collection of datacenters.

While create a VM we can specify the availability zones to deploy the VM

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Availability zones is making the application high available because this helps us for datacenter failures.

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Also, all region will not have availability zones

### Workload

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### Scale sets

Scale sets helps to automatically increase/decrease the instances of the VM based on the CPU utilization percentage.

#### Scale out

Scale out is increase of VM instance based on the CPU utilization.

#### Scale In

It is opposite of scale out where based on the decrease on the CPU utilization, the instance of the VM will remove.

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## Networking

### IP Addressing

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### Virtual Network

Azure Virtual Network is the home for Virtual Machine, further each Virtual network will have different Subnet.

**Points to remember: -**

1. Communication between two VM of different subnet will be done via private IP address.
2. Communication between VM to the user will be done via public IP address.
3. We can see that the second VM don’t have any public address, because this VM is particular assign for database and the first VM for web application setup (so it needs a public IP address).

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### NSG (Network Security Group)

It controls the flow of traffic into and out from the Virtual Machines.

NSG can be attached to the: -

1. Network interface of the VM or
2. it would be linked to the entire subnet (So, if it attached to the subnet then it will affect all the VM’s present in that subnet.

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**NSG has two rules:** -

1. Inbound Security Rules: - Is used to control the flow of traffic into the VM.
2. Outbound Security Rules: - Is used to control the flow of traffic out from the VM.

**Some Default Rules: -**

1. If we have multiple VM’s in the same virtual network, NSG automatically allows the communication between the VM’s.

**And also if we want to communicate to the VM via port for example 80 , then we need to set the below Inbound security rules:-**

1. Priority.
2. Port enables.
3. Protocol – TCP/UDP.
4. Source (IP address for outside or anywhere) and destination (IP address VM or Entire Virtual Network)

**For VM RDP connection, never use Source as any instead use the client IP address**

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### Application Security Group

Suppose we want to use different network traffic differently for both database servers and Web servers, we can divide the subnet of both database and web servers differently and then apply NSG on to the subnet or we can attach different NSG of all the servers differently.

Now using the application security group, we can assign the VM to the group itself. SO, we can create webservers application security group and so on for database servers.

Application Security group is nothing but a logical grouping for the type of trier like webservers and database servers

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### Network Connectivity Options

**This section is for advance course**

#### Virtual Networking peers

Is basically used to connect between two virtual networks

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#### Point to Site VPN Connection

Client Workstations wants to connect to the virtual networking using VPN via internet.

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#### Site to Site VPN connection

On premise data wants to connect to the virtual networking using VPN via internet.

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## Storage

**Storage Account is a place on the azure cloud where we store the data.** Data like objects (videos, files etc.). Storage Account is separate from the VM so that if anything happens to VM we should not lose any data. **Blob** is a example of storage account in azure.

### Service Types

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#### Blob storage

This is basically the object level storage like videos, disk files of VM. All is store as VHD (Virtual Hard disk)

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#### Table

Storing the data in a table, use this when we very simple structure of table and quick access of table from the application.

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#### File Share

File share in the storage account. We can file share that can be access by different users or different VM’s. We connect using SMB.

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#### Queue

Queue service is use for receiving and sending messages between different component.

### Creating a storage account

Create a storage account from the marketplace.

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After creating the storage account

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### Types of Storage account

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### Storage account – Replication

This enables high availability of data that stored in storage account

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### SQL databases

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**Benefits of PAAS for SQL server:-**

1. We no need to worry of managing the underline VM.
2. No backup and packing

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### SQL Data Warehouse

Although both Azure SQL DB and Azure SQL DW are cloud based systems for hosting data, their purpose is different. The biggest difference is that **SQL DB is specifically for Online Transaction Processing (OLTP)**. This means operational data with a lot of short transactions like INSERT, UPDATE and DELETE by multiple people and/or processes. The data is most often highly normalized stored in many tables.  
  
On the other hand **SQL DW is specifically for Online Analytical Processing (OLAP)** for data warehouses. This means consolidation data with a lower volume, but more complex queries. The data is most often stored de-normalized with fewer tables using a star or snowflake schema.

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### CosmosDB

1. CosmosDB is a **multi-model database** where we can have different types of API like :-
2. Core (SQL) for no SQL database.
3. Azure Table.
4. MongoDB.
5. Cassandra.
6. Gremlin (graph).
7. CosmosDB gives the features of **single digit millisecond data access.**
8. ComosDB is **globally distributed** due to that it helps to access data based on the user region for fast access and if any region DB is not available, we can use the data from other region.

**Even though we have high availability due to multi region accounts then we have to pay for cost.**

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## Web Apps

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### App service plan

Before creating any app service (web apps) we need to define the app service plan.

<https://azure.microsoft.com/en-us/pricing/details/app-service/windows/>

## Load Balancer

Load balancer is basically used to distribute the traffic on the VM’s

### Backend pool

Backend pool is nothing but VM’s. We will create a backend pool for associate the VM’s and then link that to the load balancer.

### Frontend IP

This is IP which is exposed to the users which will use to browse.

### Health Probe

Is used by the load balancer to understand whether the VM’s are healthy or not. Means at regular intervals the load balancer will use the configuration of the health probe to decide whether VM is healthy or not.

### Load Balancing Rules

Here all the rules is specified for the Load balancer whenever any request comes from the Fronded IP then which port no we need to pass the request for that VM’s.

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Point to Remember: -

1. For the VM we should remove the public IP address, as the communication will be done via private IP address from the load balancer and the load balance will use a public IP address (which will create) for the communication from the client.

## ARM Templates / Resource Manager Template

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## Azure Traffic Manager

It’s a DNS based routing service. This allows us to route traffic on either to Azure base resources or to the on-premise environment.

**Different between Load balance vs Traffic Manager is :-**

* the load balancer handle traffic in the same region, whereas Traffic Manager handle traffic in different regions.
* The load balancer is IP based routing tool whereas traffic manager is DNS based routing tool.

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**Routing Methods: -**

1. Priority: - It’s basically set some priority to the azure services, based on the high priority the traffic will route respectively and for any issue to that it will move to the next priority service.
2. Weightage: - We can specify the percentage of traffic should go to which service respectively.

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## Other Tools we can use to work with Azure

### Power Shell

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| //To create a storage account  // Please add the resourceGroupName and StorageaccountName  $location="Central US"  $resourceGroup=""  $storageAccountName=""  $skuName="Standard\_LRS"  $storageAccount=New-AzureRmStorageAccount -ResourceGroupName $resourceGroup -Name $storageAccountName -Location $location -SkuName $skuName  //To create a container  $ctx=$storageAccount.Context  $containerName="demo"  New-AzureStorageContainer -Name $containerName -Context $ctx -Permission blob  //Adding a blob to the storage container  Set-AzureStorageBlobContent -File "Filelocation+name" -Container $containerName -Blob "filename" -Context $ctx |

### Azure CLI

<https://docs.microsoft.com/en-us/cli/azure/install-azure-cli-windows?view=azure-cli-latest&tabs=azure-cli>

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| // To create a storage account  az storage account create --location "Central US" --name yourstorageaccountname --resource-group yourresourcegroupname --sku "Standard\_LRS"  // To create a container  az storage container create --name "Yourcontainername" --account-name= yourstorageaccountname --account-key=yourstorageaccountkey  // To upload a file  az storage blob upload --file "Filelocation+FileName" --container-name "Yourcontainername" --name "Filename" --account-name=yourstorageaccountname --account-key=yourstorageaccountkey |

### Azure Cloud shell

## Azure Functions

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## Azure Logic Apps

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## Azure Monitoring

Monitor is used to set alerts for any resource is stop, delete etc.

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## Azure Log Analytics

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## Azure Kubernetes Service

Kubernetes is a container orchestration software. A software or a platform that can allow to manage the containers and the VM’s that are hosting those containers.

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## Azure Content Delivery Network

Its helps by accelerating almost any website by caching its files in server around the world.

**Benefits: -**

* + - It improve page load speed.
    - Handle higher traffic loads.
    - Blocks spammer.
    - It reduces the bandwidth consumption.
    - Sometimes it also does load balancing between multiple servers.
    - Also protects websites from DDOS attack (Distributed Denial of service attack).

**Why we use CDNs, means what the problem we use CDNs?**

Problem is something called latency, it’s the annoying delay that occurs from the time that I hit enter to request a webpage to getting the web page to load onto my browser. And that delay is affected by several factors. In all cases though a big part of it is the delay by the physical distance between you and the web sites hosting server.

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## Azure Advisor

It’s the tool which gives recommendation for Cost, security, performance etc. for the resources deployed to azure.

## Application Insights

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## Azure DevOps

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<https://azure.microsoft.com/en-in/services/devops/>

## Azure DevTest Labs

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## Azure Machine Learning

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## Azure HDInsight

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## Azure Cognitive services

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## Azure IoT Hub

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# Security Privacy Compliance and trust

## Azure Active Directory

Azure active directory has prime responsibility of storing the database for users, groups and service principal so that the users can authenticate and authorize using Azure AD to access the resources on azure platform.

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