**AZURE 104**

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**Azure Portal**

Azure provides 3 administration tools to choose from

1. The Azure Portal

2. The Azure CLI

3. Azure PowerShell

* We can use the **Azure GUI portal website (portal.azure.com)** to create, configure, and alter our Azure subscription resources.
* We can locate the resources needed and execute any changes. We have wizards and tooltips to guide through various administrative tasks.
* Please note that we cannot use the portal to perform repetitive tasks like creating 12 VMs etc.
* We need to use other tools to avoid errors, and it will also be a time-consuming process to do on the portal.

The Azure portal can be divided into 3 sections.

1. **Left** — A list of resources and services to create and manage your Azure environment.

2. **Center** — A dashboard that you can tailor to meet your (Public or Private dashboards)

needs.

3. **Top** — A search bar to quickly find resources and services, a notification icon, access

to a web-based command line, and more.

● Let’s try to create a resource and see how to use the Portal. For example, let us

● Click on the Burger menu on the left top select Resource grouGroup click on it. You will get a new Panel.

create a resource group called demystify.

● Click on the **+Create** icon. On the new Panel, add the name of the resource group

and choose the desired location.

● Click Next, and you will get a new panel to add Tags. Tags are helpful for accounting

and segregation but not mandatory.

● Click NEXT, and at this point, Azure will validate all the options chosen.

● If there is any error, it will put a red dot on the tab where the error occurred, and you

will need to go back to the tab and fix it before proceeding.

● If validation passed, you would see the Validation passed with a green tick message.

At this point, you can click CREATE, and the resource will be created.

● You can also click on “Download a template for automation” and download the

template and save it to the library additionally for future use.

● You will get a notification when the resource is created. You can also click the bell

icon on Top Right to view the notification.

● If we go back to the Resource Groups, we can see this new resource group. This is a

simple example of the usage of the Portal. We can use the portal for lots of activities.

**We can use the Azure Portal for**

● Creating/ Modifying/ Deleting resources

● Billing and accounting

● Help and Support – Contact Microsoft

● Online Help

● Health and Service Dashboards

● Security Center

● Access AAD and create applications

● Azure Monitor

● Access Documentation

● Azure Marketplace for third party products and solutions

● Access Cloudshell (On top right)

**Azure CLI**

Azure provides 3 administration tools to choose from

1. The Azure Portal

2. The Azure CLI

3. Azure Powershell

● Azure CLI is a cross-platform command-line program to connect and execute

administrative commands on Azure resources.

● **Sample command:** az VM create --resource-group WLRG --name

WLVM1 --image UbuntuLTS

● Azure CLI can be accessed inside a browser via Cloud Shell or with a local install on

any OS like Windows/Linux or MacOS and Docker. It can also work with multiple

clouds.

Let’s see an example.

First, we invoke the MSI installer either in the command line or by downloading. Here is the

command line below:

Invoke-WebRequest -Uri https://aka.ms/installazurecliwindows

-OutFile .\AzureCLI.msi; Start-Process msiexec.exe -Wait

-ArgumentList '/I AzureCLI.msi /quiet'; rm .\AzureCLI.msi

Then we sign in with the login command

az login

*A new browser page will open (https://aka.ms/devicelogin), and we enter the authorization*

*code displayed on the terminal.*

Some of the common commands are as follows:

**Sl No Azure CLI command group Resource Type**

1 az group Resource group

2 az keyvault Key Vault

3 az SQL server SQL databases

4 az storage account Storage accounts

5 az vm Virtual machines

6 az webapp Web applications

Let’s take Storage accounts as an example and work with Azure CLI

**Step 1:**

Create a resource group for Storage accounts

az group create --name StorageRG --location westus

**Step 2:**

Create a Storage account

az storage account create --name WLblobSA123 --resource-group

storageRG --location westus

--sku Standard\_RAGRS --kind StorageV2

**Step 3:**

Finally delete to clean up the test

az storage account delete --name WLblobSA123--resource-group

storageRG

**Azure Powershell**

Azure provides three administration tools to choose from

1. The Azure Portal

2. The Azure CLI

3. Azure Powershell

● Azure PowerShell is a module that allows us to connect to Azure subscriptions and

manage resources.

● Azure Powershell uses AzureRM command modules, and it has now added Az

command modules as well.

● If we used the *New-AzureRmVM* command to create a VM via the AzureRM Module,

we would change to the *New-AzVM* command to create a VM via the Az Modules.

**How to use Powershell in Azure Portal?**

● First, click on the cloud shell icon on the top right. If you are doing this for the first

time, you will be prompted to create a Storage account to host the cloud shell files.

● You can accept a default storage account and file names or choose your own.

● By default, Cloudshell launches in **BASH MODE**.

● You need to choose Powershell from the dropdown and you will be prompted for a

confirmation.

● Once you hit on the confirm button, you will get the Powershell command line to

execute Powershell commands.

**How to use Powershell in your local installation?**

● Windows OS comes with Powershell installed. You can select Windows Powershell

and hit enter once the Powershell window is launched; type az login.

● A new browser will be launched to select an already logged-in session or log in to a

new session.

● After getting a successfully logged-in message, you can close the browser and go

back to your Powershell screen and continue working with Powershell commands.

**Working with Powershell:**

For example: To create VM, we launch Powershell either inside a browser or by installing

locally on any OS and then run the **New-AzVM** command that creates a virtual machine in

our subscription as follows:

New-AzVm -ResourceGroupName "WLRG" -Name "WLVM1" -Image

"UbuntuLTS" ...

**Azure Resource Manager**

● Azure Resource Manager provides a management layer to ***create, update, and delete***

resources in your Azure account.

● We use management features, like access ***control, locks, and tags, to secure and***

***organize your resources after deployment.***

● When a user sends a request from any of the tools, APIs, SDKs, the Resource

Manager receives the request and **authenticates/authorizes** it.

● Then it sends to azure services to take action. Since it acts as a central point, it leads

to consistent results.

**Benefits of Resource Manager:**

● Declarative templates so we don’t have to worry about the current state.

● Allows group deployments

● Define dependencies so the correct order of deployment is done.

● Apply tags to organize resources logically

● Allows for redeployment and have confidence that same results will be achieved

● Applies access-control via RBAC natively.

**Scopes**

When we deploy, they are done at 4 levels.

1. **Management Groups** – At this level, we can combine multiple subscriptions to apply

changes at an Organizational level. We can connect Organizations with a hierarchy

where there is one management group at the root level. This is called Nesting.

2. **Subscriptions** – Subscription is a logical container used to provision resources. We

will be billed at the subscription level. We can have multiple subscriptions.

3. **Resource Groups** – We can create multiple resources in a resource group. We can

logically group resources at a resource group level. We can delete an entire resource

group, and all resources will be deleted within the resource group. We can even

move a whole resource group with all objects within it.

4. **Resource** – This is the lowest manageable item in Azure resource. Examples of Azure

resources are *Virtual machines, storage accounts, web apps, databases, virtual*

*networks, and tags. Resource groups, subscriptions, management groups are also*

*examples of resources.*

**Azure Pricing**

Azure is one of the market leaders in Cloud services and has some of SQL and Windows’s

best pricing. It can leverage several features to save costs, and Azure provides several tools

that can help calculate costs and cost-effectively plan our infrastructure and service.

*Some of the available tools are:*

**● Azure Pricing Calculator**

**● Cost Management Center**

**● Migration planning – Estimation, Workload, and right-sizing**

**● Billing Data API & Advisor**

**● DB & Cosmos DB Capacity calculator**

*Some of the features that we can leverage to save costs are as follows:*

● **Azure Hybrid Benefit –** We can use our existing SQL and Windows licenses to save

on costs.

● **Spot Virtual machines** - This feature allows us to take advantage of the unused

CPU at a significantly lower cost at almost 90% savings.

● **Reservations** - We can commit to 1-year or 3-year and choose to pay upfront or

monthly to buy RIs.

● **Azure Dev/test pricing** – For development environments, we can get special

discounted rates

***Ways to optimize Cost***

Please see the self-explanatory chart below for ways to optimize cost

**FAQs:**

● Are there any other ways to save costs?

o **EA – Enterprise Agreements** – With this, we can get good pricing offers from

Azure.

o **Price Match with AWS** – This might not be known to all, but we can ask MS to

do a price match.

**Azure Security Center**

**Introduction:**

In today’s world, Security has been a biggest concern for any application hosted/built in

either on-premises or cloud and it is the foremost duty of a developer to prevent unwanted

access to applications and prevent all other security issues. So security in the cloud is

foremost important and it should also provide accurate and timely information about

security.

**Azure Security Center:**

The Azure Security Center in Azure Cloud is a unified infrastructure security management

system that can be used to strengthen the overall data security and provide advanced threat

protection across various workloads such as Azure cloud or other cloud providers or even

on-premises.

When an application is being moved to Azure IaaS, the customer has more responsibility on

securing the data when compared to moving to PaaS. So the security center offers various

tools that can be used to harden the network and secure the various cloud services.

The security center can be used to address the 3 major security challenges:

**● Strengthen the environment:** The security center assesses the whole azure

environment and all the resources deployed and it understands the security status of

the same. By doing so, it provides detailed security related information.

**● Protect against modern threats:** Today we have various threats that can easily take

over the application. So a security center can be used to provide various threat

prevention recommendations by assessing the deployed workloads and also provides

timely security alerts.

**● Secure the environment faster:** Since the security center is natively built in azure

cloud, it can be used to quickly secure the cloud environment and also protect

against various threats.

**Key Pointers:**

● Since the Security center is natively part of Azure, various PaaS services SQL

Database and storage accounts can automatically be monitored by the security

center without making any additional deployment.

● Also the security center can be used to protect not only azure services but also

applications deployed in other cloud providers or even in on-premises.

● To perform these, a log analytics agent needs to be installed in the external

application.

● The Azure VMs are auto-provisioned in the security center when they are deployed

and do not require any additional installations.

● The log analytics agent installed in the external system and azure will be collecting

various information and the same will be processed in the security engine to provide

detailed recommendations and actions to secure the data and the workload.

● It is also very important that these recommendations should be considered and

necessary actions should be taken. By doing so, the environment can be highly

secured and malicious activities can be prevented.

**Environment assessment:**

● The security center continuously monitors all the resources deployed in the cloud

and provides various recommendations to secure it.

● Based on the recommendations, it also displays the necessary action to be taken to

secure the resources.

● Also based on the analysis, it provides a security score which as per recommendation

should be 100%. Below is the image of the security center portal.

● The details here are filtered based on a subscription in which it displays the security

posture of various resources in the subscription.

● The red bar on the right denotes that the particular security recommendation

“**Remediate vulnerabilities**” was not implemented and some resources may be

affected due to this.

● If a recommendation is clicked, it displays further more information about the

recommendations, severity of it and total number of affected resources.

● Also it is the ***user’s/Administrator’s*** choice whether to perform or skip a particular

security center’s recommendation.

● It is not mandatory to perform all the recommendations and Microsoft does not

produce any discounts/credits if the security score is kept 100%.

● If a user chooses to skip a recommendation, he/she can go inside the

recommendation and give “Exempt” to overcome this recommendation.

● It is also possible to enforce a particular recommendation and by doing so, it will be

creating a template deployment which will make sure to use the “**DeployIfNotExist**”

policy and create the resource with this security recommendation.

All these recommendations and security alerts provided by the security center provides a

great insight of what all security threats may occur to the resources and how to prevent it

well before-hand.

**Cost of Azure Security Center:**

The azure security center itself is a free service but to have more features other than

providing recommendations and actions, a paid service called the azure defender is available

and it can be used to extract below additional details.

**Azure Advisor**

Azure has 5 pillars called the Azure well-architected framework which provides best

practices to help build and deliver great solutions.

To enable customers to follow these best practices and optimize the cloud deployments,

Azure has a free tool called Azure advisor. Azure advisor analyses the configurations and

usage logs and offers recommendations which are customized and can be executed.

● On each of the 5 pillars, we will be given recommendations to optimize. Please see

below.

● If we click on each of these recommendations, we can see what the

recommendations are.

● If we further click on each of the line items, we will give the list of resources that are

not compliant and will provide manual and in some cases remediation action which

can be deployed directly.

● You can also note from the above that these recommendations are setup with the

help of Azure policies.

● We can see the Policy definition and we can exempt the policy itself from being

flagged as non-compliant.

● We can enable the deny action also in which case the resource will be prevented

from being created.

● Here we have the policy which is audit and hence the resource is created and marked

as non-compliant.

**Sample remediation code:**

{

"properties": {

"allowBlobPublicAccess": false

}

}

We can download these recommendations as a CSV or PDF file.

*Azure Advisor also has 2 features in preview. One feature is alerts which are yet to be*

*generally available (GA). The other feature is the Advisor score which gives us on a*

*percentage basis if we are following best practices.*

**Azure Active Directory**

Microsoft introduced **Active Directory** in the year 2000 which to this day is one of the best

products from its stable.

Any Enterprise with Windows servers would be running the Domain Controllers in a

***Domain/Tree/Forest*** organization setup with multiple DCs playing different roles **(*called***

***FSMO – Flexible single master operation)*** and in multiple locations for load balancing and

reducing latency and increasing fault tolerance.

Before this, Microsoft had NT4 where there was a single ***PDC (Primary Domain Controller)***

backed by a ***BDC (Backup Domain Controller)*** to provide Enterprise Identity Management.

Windows 2000 and beyond uses the Active Directory and it uses **LDAP** (***Lightweight***

***directory access Protocol)/Kerberos*** for authentication. Here all resources like computers,

printers, etc are all considered objects.

This concept changed with Azure Directory which like most cloud service providers also uses

REST API in the background.

Any service invoked on the Azure cloud is with REST APIs and this is the foundation for ***AAD***

***(Azure Active Directory)***. Therefore, AD on the client premises and AAD on the cloud will not

work seamlessly.

Let’s look deeper and compare the two and in that process understand AAD better.

● **Communication** – As discussed, AD uses LDAP and AAD uses REST API

● **Authentication** – Cloud based protocols for AD/ AAD uses Kerberos and NTLM

● **Access Setup** – AD uses Admin/data owners and AAD organizes users into groups

● **Network Organization** – AD uses Forest/Domain/Tree/Organizational Unit (OU)

whereas AAD uses users and groups

● **Desktops** – AD uses GPO (group policy object) and AAD can use Microsoft intune to

join desktops

**Azure AD Connect**

In situations where we want to enable a hybrid environment where we have both AD

on-premises and AAD on Azure cloud, we need to use Azure AD connect which syncs data

between the two directories.

AD connect will allow us to synchronize user accounts and passwords. There are several

methods of synchronization.

● **Hash Synchronization** – Here only a hash of the password is stored on cloud

● **Pass-through authentication (PTA)** – Here the authentication is forwarded to the

on-premises server

● **Federation** – Federation services provides authentication across several external

identities in addition to providing on prem access

**AD Features**

**Default Domain** – The default domain is based on our email id. If our email id is

addition of .onmicrosoft.com.

**Usernames** – Any user name we create will have the suffix of our domain name

**Custom domain name** – If we want to use our own company name, then we should

**App registrations** – We can register our applications here and grant access to the

application/users.

**License Management** – We can perform license Management here. We can track all

acquired licenses and assigned licenses and make sure we don’t overuse and pay

heavy penalties

**Enterprise applications** – we can see all the enterprise applications and assign them

to our users. When a user logs in, he/she can see only the applications assigned to

them.

**Security** – This is one of the key areas. Under security, we can see the following

o **Azure AD Conditional Access –**We can add conditional access policies like

restricting users from logging in from outside office network or even outside

country

o **Azure AD Identity Protection –**We can assign user risk / sign-in risk and the

system will dynamically assess risk and react like unusual geography of login

**o Azure Security Center**

**o Identity Secure Score –** We are given a security score which tells us our

overall security posture

demystify@gmail.com. Then our domain name will be

demystifygmail.onmicrosoft.com. It is a combination of user and domain and then

create a custom domain (for example demystify.com) and then we can create a user

smith@demystify.com

**o Named locations –** If we readily identify safe locations like cities where

headquarters and branch offices are located, we can create named locations

and allow these under conditional access policies.

**o Authentication methods –** We can enable additional authentication methods

like FIDO2 Security Key/ Microsoft Authenticator

**o Multi Factor Authentication (MFA) –** We can configure MFA and add

multi-factored authentication. Please note that this setting is outside of the

azure portal and a link will take out to the GUI. Sample screen looks like this.

**Azure Role-Based Access Control (Azure RBAC)**

● The policy of any organization is to follow the principles of least privileges. One must

not be given access beyond what is necessary to perform a role in the organization.

● The principles apply for cloud resources also. Let’s take the example of a VM

operator. His role dictates that he must be able to **start/stop/restart/create/delete**

VMs.

● So, we use Azure **RBAC** to grant just that access. In our case, we will grant the

operator the RBAC role of VM contributor.

● Azure **RBAC** is an authorization system. It uses Azure Resource Manager behind the

scenes. Azure RBAC provides fine-grained control of access to Azure resources at

various levels.

● The Policies can be applied with a boundary like being able to do so in a set of

resource groups called scope.

*Let’s see some examples where we use Azure RBAC:*

● Grant access DBA group to manage databases in 2 resource groups.

● A user can manage all resources in a resource group like VM, web apps, storage

account, Vnet/Subnets.

● Grant one application to access to create resources.

**How Azure RBAC works**

We assign Azure roles to make RBAC work. A role assignment consists of three elements:

security principal, role definition, and scope.

**1. Security principal**

A *security principal* is an object that could represent a user or a group or a service

principal or managed identity and requests access to Azure resources. We can grant

access to any of these entities.

**2. Role definition**

A *role definition* is a collection of permissions and is called a *role*. A role definition

will list the operations that can be performed. It could be something like read, write,

and delete. We could grant access at a high level like owner, or even more specific

roles like the VM operator where the access is limited to VM operations only.

Azure has *built-in roles* that you can use. For example, we have a contributor role

where we can create all objects but we cannot grant. If we want to grant access to

only certain resources, we will create a custom-defined role.

As you can see below, we can apply policies against the data stored within the

scope’s resources. For example, the secret within a key will be data, and we can

dictate whether the data can be read or not.

**3. Scope**

*The scope* is the set of resources to which we apply the access to. Let’s say that we

grant a VM operator role to a person, but we don’t want that person to be able to

stop VMs in production, then we apply the scope to non-production subscription or

resource group only.

A scope can be applied at the four levels:

**a. Management group**

**b. Subscription**

**c. Resource group**

**d. Resource**

● Scopes follow a hierarchical structure, and they follow a parent-child relationship.

● Scopes applied at a higher level are inherited by the resources below it.

● For example, a policy with a scope of Management groups will be inherited by all

subscriptions under it.

● Likewise, a policy scoped at the RG level will be inherited by all resources under it.

**4. Role assignments**

We assign the role to the user or group. When we assign the role, the user gets the

privileges. And we simply remove the role assignment when we want to revoke the access.

Under IAM, for every resource, we can see the roles under the roles tab.

**5. Deny assignments**

Earlier RBAC had only allowed, but now it can be denied assignments also. If there is a deny

assignment, the user will be blocked from doing the action. Deny assignments take

precedence over role assignments where a given user has both allow and deny but deny will

be the end action.

**6. License requirements**

RBAC feature is free and included with our Azure subscription.

**Azure Policy**

● Every organization has a set of standards which are set up. Some of these could be

best practices for smooth functioning or cost optimization.

● Others could be mandatory compliance adhering to Government laws and/or

governing bodies like **ISO** or **HIPAA**.

● Azure Policy is a free service in Azure that we could use to define, assign, and

manage standards for resources.

● Let’s say that **GDPR** policy mandates that data should not leave the country. T

● Then we can create a policy that could prevent or just mark as non-compliant if data

were stored outside the country.

● Once such a policy is set, it would even point to such previously created resources

which are non-compliant.

● With quite a few built-in policies under categories such as *Storage, Networking,*

*Compute, Security Center, and Monitoring,* it is very convenient to select the policy

that suits us and use them simply.

Here are the steps to using Azure Policy

**Step 1: Policy Definition**

● First, we create a policy definition.

● We could also use existing definitions.

● We could take multiple policies and create a policy definition.

**Step 2: Policy Initiative**

● Once the policy definition is done, we need to create the initiative definition.

● We can select any number of policies we need and create a group to add the

policies.

● We can initiative parameters and policy parameters

● We then create the initiative definition

**Step 3: Assign Policy/Initiative**

● We could either assign a policy or an initiative. It is better to assign initiative as we could assign multiple policies.

● Here we also select the scope. We can assign to an entire subscription or

resource groups within a subscription.

● Also, we could exclude resources. Let’s say we selected subscription 1 but we

want to exclude one Resource group. Then we use the exclusions. In the

example below, 5 resources are excluded from the above-selected resource

group.

● We select the initiative definition. In our case below, we selected

HITRUST/HIPAA, and this initiative will have lots of policies as per the

regulatory compliance for the HIPAA act.

● If we planned to enable it at a later time, we could mark the policy as

disabled.

Common use cases for Azure Policy

**● Implementing Governance**

**● Regulatory compliance like GDPR/HIPAA/PCI DSS**

**● Security**

**● Cost**

**● Management**

All Azure Policy data and objects are encrypted at rest.

Once set up, we can see the non-compliant policies, and we will be able to remediate.

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**How are policies evaluated**

The following are the times or events that cause a resource to be evaluated:

● During the standard compliance evaluation cycle, which occurs once every 24 hours.

● A policy or initiative is newly assigned to a scope.

● A resource is created, updated, or deleted in a scope with a policy assignment.

● A policy or initiative already assigned to a scope is updated.

**Some built-in Policies available**

In Azure Policy, we get several built-in policies that are available by default. For example:

● **Allowed Locations** (Deny): We can allow only certain locations like the USA if the

company operates in the USA.

● **Not allowed resource types** (Deny): If a particular resource type like CosmosDB is not

allowed, then we cannot create the same.

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**Azure Service Health**

● Azure Service heath is a personalized dashboard that shows the service issues that

affect you.

● It is able to dynamically do this to all the regions that we have resources in and all

the resources that we have allocated for our subscriptions.

● We could even configure and add/remove regions or services or simply add all of

them.

● The other features of Service health include cloud alerts that can notify us of any

active issues or upcoming maintenance configured by us.

● Once we subscribe to an issue, we will get details and updates and we will get

incident RCA.

● With Service Health, we get guidance and support during service incidents.

Here are some details:

**Service Issues**

● This panel shows us any current issues that are on-going for the

**regions/resources** where our resources exist.

● You can see that 3 subscriptions are selected with 9 regions and 184 services.

● You can also see the past incident at the bottom that has been resolved.

● We can get complete details and also download the RCA (Root Cause

Analysis) for the issue.

**Health History**

● We can see the health history and we can get details like Summary/ Issue

updates/RCA.

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**Health Alerts**

● We can set health alerts to be notified for the services we choose and for the

regions which are of interest to us.

● Here we have selected to be alerted via the Action group when there are

issues with VMs and VNets for all regions.

● Once set up, we will get an email when any issue occurs. We could also select

the type of event. In this case, we have selected all events.

**FAQs**

1. **What are the permissions needed to view Service Health?**

To view Service Health events, users must have the reader role on a subscription.

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2. **How does Azure Service Health compare with Azure Status page?**

○ We use Azure status page for a global view of the health of all Azure services.

○ It serves as a quick reference for incidents with widespread impact. You can

access this page at https://status.azure.com.

○ Service Health keeps us informed of the health of our environment with a

personalized view of the status of our Azure services.

○ It provides us richer features including alerting and RCAs.

3. **What is the difference between Resource Health and Service Health?**

Service Health provides information about the health of individual cloud resources,

such as VMs etc. Service Health provides a personalized view of the status of our

Azure services and regions

4. **If a service is down, should we contact Microsoft?**

We need to check Service Health first to see if there is a known incident affecting us.

If there are any outages reported also, we need to monitor for updates. If there is no

issue listed, we need to create a support ticket.

5. **What is the cost for Azure Service Health?**

Service Health is available at no additional cost.

6. **What are the SLAs for Azure service health?**

Since Service Health is a free service, it does not have an SLA.

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**Azure Key Vault**

Best practices dictate that we never hard-code sensitive information like password-strings

etc., in our code. If we do so and store the code in Github, the information could be leaked

and misused. Even the connection strings like urls for databases or even IP addresses or our

servers must be protected.

Azure has a secret store called Azure Key Vault, which stores our secrets and passwords. One

could never be able to read the secret but will be able to use it with the right set of

permissions.

Azure Key Vault is a **PaaS platform in Azure. It** is integrated into Azure Active Directory. We

can store secrets, Keys, and certifications and have multiple versions stored. We have audit

logs as a feature. Azure Key vault is **FIPS 140-2** compliant.

**Secrets**

● We can store up to 25kb in size.

● We can store plain text passwords, connection strings, JSON, XML, and more.

● We can have an activation date and expiry date.

● We can create as enabled or not if we don’t have immediate use etc

**Keys**

● A Key is typically asymmetric in the **PKI (Private Key Infrastructure)**. Here we have a

public key and a private key. The public key is known to all, and anybody can use it to

encrypt the data. But the private key is known only to the owner, and only the

private key can decrypt the data.

● Azure will generate the private and public keys, but the private keys will never be

disclosed.

● We could also use symmetric keys for storage and SQL data, and in this case, the

symmetric key would be wrapped with an asymmetric key making it secure.

● The key type could be **RSA/EC** and **2/3/4 kb** in size.

● We can have an activation date and expiry date.

● We can create as enabled or not if we don’t have immediate use etc.

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**Certificates**

● We could either generate our keys or import keys.

● Keys could either be self-signed or use a CA (Certification Authority) like Digicert or

GlobalSign, etc.

● We can have validity between 1 month to 10 years.

**Audit**

Since all activity takes place within the Azure Key vault, we can audit all types of usage. We

can see who is using and type of activity.

**Versioning**

It is always recommended to keep changing the secrets. This will help protect in case the

secrets were leaked to limit the damage. To do this, we can create a new version. Also, we

need to automate the process so that we don’t forget to do it.

Azure Key Vault has a **unique versioning engine.** We can rotate secrets and keys, and new

versions are created. When we have used an older version of the key to encrypt, we will be

able to point to the older version and decrypt the data.

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**Access Policy**

We can set access policies at the key vault level and more granularly at the **Key/Secret** and

Certificate level.

We can enable access to:

● Azure Virtual Machines for deployment

● Azure Resource Manager for template deployment

● Azure Disk Encryption for volume encryption

The above will allow the usage of the key vault for the VMs/ disk and other deployments to

be attached automatically.

Also, we can have access granted via the key vault policy or via RBAC.

**FAQs**

1) **We want to have a different set of access for different secrets to the same**

**individual. How do we achieve it?**

Create another key vault and grant access.

2) **Is Key Vault regional or global?**

Though Key Vault is global, use key vault in the region where your data resides to

reduce latency.

3) **When do we choose the access policy and when to choose RBAC?**

There are two Access planes – one is the Management plane, and the other is the

Data plane.

**a. Management Plane**

i. This ties to the key vault level

ii. Operations are create/update/delete of Key vaults/ access policies /

tags etc

iii. They don’t involve with what’s inside the key vault, i.e., the actual

content

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iv. This is controlled by RBAC only

**b. Data Plane**

i. This deals with secrets/Keys/Certificates

ii. Example for Keys - encrypt, decrypt, list, delete, backup, etc

iii. Example for Certificates - get, list, create, import, update, delete,

recover

iv. Example for Secrets - get, list, set, delete, recover, backup, restore,

purge

v. This can be controlled by either RBAC or Key Vault access policy

**4) My RBAC roles for Key vault management are not working. What could be the**

**problem?**

a. Please see the permission model below is selected for Vault access Policy and

not Azure RBAC. Please change to RBAC and retry.

**5) Please list RBAC roles for key vault Management?**

a. Key Vault Administrator

b. Key Vault Certificates Officer

c. Key Vault Crypto Officer

d. Key Vault Crypto Service Encryption User

e. Key Vault Crypto User

f. Key Vault Reader

g. Key Vault Secrets Officer

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**Azure BLOB**

***Azure Storage has 5 types:***

*Azure Blob storage Used to store Binary/Text data*

Azure File storage File Shares

Azure Disk Storage Persistent data storage

Azure Queue storage Messaging Store and Queuing

Azure Table storage NoSQL Datastore

**Blob Storage:**

● Scalable

● Use REST API, CLI, ARM template to create a storage account

● Blob is typically a file, can be image, file, video

● Common scenarios – backup/restore, upload large files, logging

● It can be used for DR purposes

● The newest version of ADLS (Azure Data Lake Storage) is built on top of Blob Storage

called ADLS Gen2

● Endpoint for Blobs is https://\*.blob.core.windows.net

● For a blob, the base URI includes the name of the account (myaccount), the name of

the container(mycontainer), and the name of the blob(myblob). Here name will as

follows:

○ https://myaccount.blob.core.windows.net/mycontainer/myblob

● You can use Storage Explorer to view/upload/copy files

**Limits:**

● No limits to the number of objects

● Max size of a single object in a container is about 5TB

**Blob types**

● Block Blob – Large objects that are broken and each block is uploaded in parallel. It is

optimal for Streaming

● Append Blobs – We use these where we keep updating and appending to the files.

For example, logging.

● Page Blob – Stores the VHD VM disks. Max size is 8TB

**Access levels**

● **Private (no anonymous access)** – This is the default. A valid token is needed to

access data.

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● **Blob (anonymous read access for blobs only)** – Globally accessible with reading

access

● **Container (anonymous read access for containers and blobs)** – All blobs in the

container can be read and listed. Access is at the container level, and hence it is for

container level, and every blob can be read.

**Access Tiers**

● There are 3 access tiers – **Hot/Cool and Archive**.

● As you move from Archive to hot, the pricing will go up, and as you move from Hot to

Archive, the cost of accessing will go up.

● You need to decide based on how often you access and balance between storage

cost and access cost.

● **Cool** – Use this for more than 30 days but less than 180 days

● **Archive** – This is for anything accessed for more than 180 days. Please note that it

will take several hours to access the data.

● To recall, you need to “rehydrate” the blob by changing the access tier to Hot or Cool.

This can also be set at blob level only, whereas COOL/HOT is at the account level.

**Zone Replication**

***Storage can be replicated for availability. Here are the options:***

● **Locally redundant storage (LRS)** – 3 copies stored in a single Datacenter. Single point

of failure if the data center is unavailable. Cheapest option.

● **Zone-redundant storage (ZRS)** – 3 copies in 3 zones in the primary region. Also

recommended to replicate to the secondary region.

● **Geo-redundant storage (GRS)** – Here, the secondary copies are stored in another

region, which protects us against a region-wide outage. Basically, it is LRS plus an

additional copy in a secondary region. The primary copy process is Synchronous,

while it is asynchronous for secondary.

● **Read-access geo-redundant storage (RA-GRS)** – Compared with GRS, the secondary

copy will also be available only for READ access.

● **Geo-zone-redundant storage (GZRS)** – Here, it is the same as LRS except that the

secondary copy will be in a zone in another region, which is the twin region of our

primary region. Basically, it is ZRS plus a single copy in the secondary region. The

primary copy process is Synchronous, while it is asynchronous for secondary.

● **Read-access geo-zone-redundant storage (RA-GZRS)** – Same as GZRS, except that

you will be able to read data from your secondary region also. *(If it is not RA, then we*

*need to remember that data is available but not readable until Microsoft fails over to*

*the secondary region in case of a regional failure or if we manually failover)*

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**LRS ZRS GRS RA-GRS GZRS RA-GZRS**

**Node** ✓ ✓ ✓ ✓ ✓ ✓

**Datacenter/zone** × ✓ ✓ ✓ ✓ ✓

**Region** × × ✓ ✓ ✓ ✓

**Read-access** × × × ✓ × ✓

**SLA** 99.90% 99.90% 99.90% 99.90% 99.90% 99.90%

**Durability** 11 9's 12 9's 16 9's 16 9's 16 9's 16 9's

**Lifecycle Management**

● You can use lifecycle management to move your data from one access tier to

another.

● For example, you can move from Hot to Cool after 30 days and then from Cool to

Archive after 180 days and then delete after 1 year.

**Soft Delete**

● If you enable this feature, the blob will not be deleted but will be marked for

deletion.

● You specify the number of days, like 90, and after 90 days, the blobs will be deleted.

● This protects against malicious or accidental deletion.

● Please note that you will pay for the 90 days of storage.

**Built-in Roles for Blob storage**

**Role Access**

***Storage Blob Data***

***Contributor***

Read, write, and delete Azure Storage containers and blobs.

***Storage Blob Data***

***Owner***

Provides full access to Azure Storage blob containers and data

operations

***Storage Blob Data***

***Reader***

Read and list Azure Storage containers and blobs.

***Storage Blob***

***Delegator***

Get a user delegation key, which can then be used to create a

shared access signature for a container or blob that is signed with

Azure AD credentials.

**Azure Storage Firewalls and Virtual Networks**

● We can have a layered security model and specify the IP addresses from which

access will be allowed.

● Also, we can specify Vnets/subnets from where access will be allowed.

*● Time-bound access – SAS Signatures*

● A Storage account key gives complete access to your data.

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● If there is a need to provide access for a short/limited period, we can create a **SAS**

**Signature** with a start and end time, and the data can be accessed during that

window only.

● We can specify allowed *services/service types/permissions (Read/Write/List etc)/Start*

*and expiry date/time/ Allowed IP address range*

**Use Case Scenarios:**

*● A Company wants to store more than 5TB of data. The cost must be minimized –*

*Solution – Azure Blob Storage using Import/Export Service.*

*● A Company wants to use Azure Storage. The Data has various usage tiers. Tier 1 –*

*Used regularly and needed immediately in the first 30 days, Tier 2 – Not used after 30*

*days, Tier 3 – Not used after 180 days, and Tier 4 – Can be deleted after 1 year. –*

*Solution – Implement Lifecycle Management*

*● A Company plans to move 500MB of data to Azure Blob. What is the best Method –*

*Solution – Download Storage Explorer (or use Storage explorer on the portal) with*

*SAS and transfer data*

*● When creating a storage account, what tiers can we choose – Hot, Cool, Archive.*

*Answer – Hot and Cool only. Archive Tier is at Blob level only.*

*● You want to protect your storage account against accidental deletion. What do you*

*do? Solution – Enable Soft Delete*

*● With Soft delete enabled, a file is deleted. 2 snapshots are also deleted. What can be*

*recovered? Answer – The snapshots and file can be restored.*

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**Azure File Storage**

**File Storage:**

● It is one of the 4 storage solution offerings by Azure.

● One of the best use cases is the offering of fully managed file shares.

○ The file share is accessible over **Server Message Block (SMB)** protocol or

**Network file system (NDS)** protocol.

○ Can mount Azure file shares either on Cloud or on-premises.

○ SMB file shares are accessible from Windows, Linux, and MacOS, whereas

NFS file shares are accessible over Linux or MacOS clients.

● The file share concept can be extended to caching on Windows Servers with Azure

file Sync. This allows for fast access closer to the location it is being used.

**Use Cases:**

● The Company has headquarters in New York and a branch office in California. Users

in California are seeing latency accessing the data which is created in New York.

○ **Solution** – Use Azure File Sync, which will cache the data closer to the

California location.

● The Company wants to migrate its application. The application has data residing on

file shares mounted.

○ **Solution** – Use Azure files for Lift and Shift scenarios. Create a file share and

mount it as a drive, and the application can be migrated and will point to this

file share mounted as a drive.

● One of the clients wants high availability and has had an issue with file servers being

down often.

○ **Solution** - Use File shares. If a server crashes, place a new Server, and it will

automatically get the data from the cloud with Azure File Sync setup

**FAQs**

**● What ports does file share use?**

○ SMB protocol uses 445

○ NFS protocol uses 2049

**● How do we back up Azure file shares?**

○ Please take snapshots.

**● What versions of SMB are there, and what to choose?**

○ SMB 2.0 and SMB 3.0 are mostly used

○ SMB 3.0 is the preferred version since it provides encrypted access.

○ If a client does not support SMB 3.0, downgrade to SMB 2.0

**● Can I use Import/Export Service with Azure files?**

○ You can import into Azure files, but you cannot export from Azure files. With

Blobs, you can import and export.

**● There is a requirement to use Azure files for IO intensive workloads like hosting**

**Databases and HPC. Is this possible?**

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○ Yes, please use Premium file shares as they are stored on SSD. Please note

that replication has to do with the LRS only.

**● Is the storage unlimited, or are there limitations?**

○ Azure files work with Quotas. When you create a file share, you need to

specify a quota like 100GB. You can alter if needed.

**Tips**

**● Can I use SAS to map a drive?**

○ It is possible to map a drive with SAS.

**● Can we provide share level permissions? What are inbuilt roles?**

○ *Storage File Data SMB Share Reader* – Allows READ access

○ *Storage File Data SMB Share Contributor* – Allows read, write, delete access

○ *Storage File Data SMB Share Elevated Contributor* - Allows read, write, delete,

and modify Windows ACLs.

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**Azure Disk Storage**

● VMs in Azure use two types of disks. One is an operating system disk, and the other

is a temporary disk.

● The operating system with and without customization is stored as an image and

loaded when the VM is built.

● Both the image and the operating system disk are virtual hard disks and are stored in

a Storage account.

● The temporary disk will be stored as part of the hardware itself to provide faster

access.

● The virtual hard disks use .vhd files and are stored as page blobs. Please see the blob

types below:

**Blob types**

● **Block Blob** – Large objects that are broken and each block is uploaded in parallel.

Optimal for Streaming

● **Append Blobs** – We use these where we keep updating and appending to the files.

For example, logging.

● **Page Blob** – Stores the VHD VM disks. Max size is 8TB

We can also specify additional disks to store application data etc. These are called data disks.

Azure offers different kinds of disks broadly classified as Managed and Unmanaged storage.

**Unmanaged Disks**

● This is the traditional type of disk. Here we create the storage account and specify

the storage account when we use the disk.

● If we have too many disks, then there will be contention, and VMs will throttle,

which will impact the performance.

**Managed Disks**

● This is the latest and recommended type to allocate. If we have unmanaged disks,

Azure gives us the option to migrate to managed disks.

● We don’t need to specify a storage account or manage the storage account. Azure

takes care of management, including scalability. We just need to give the size and

performance tier.

● These are the types of managed disks.

o **Standard HDD** – These are standard magnetic drives and are the cheapest.

We can offer Recovery services to replicate locally or be geo-redundant

o **Standard SDD** – These are more consistent and reliable, and suitable for web

servers.

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o **Premium SSD** – These are backed by solid-state drives and deliver high

performance, low latency, and useful workloads that are I/O intensive, like

production and performance-sensitive ones.

o **Ultra disk** – This is the latest type, which has a max iops of 160K. But these

can be used as data disks only and not OS disks.

**Azure Backup Service**

● Azure provides an Azure backup service to perform backups.

● We need to install an extension and need to specify the frequency.

● The snapshot will be taken for the OS disk as well as the **data .disk**

● The snapshot taken here is different from the image. The disk is prepared to create

an image, and no activity is allowed, and sysprep is done.

● Here, we allow the system to run in snapshotting, and we take either

application-consistent snapshots or file consistent snapshots. These snapshots are

moved into recovery service vaults.

● We can set up a recovery service vault to replicate to another region.

For example, we are in the US East, and we replicate to the US West, which protects

from entire East US failure.

**FAQs**

**● A company has SAP Hana and other top tier databases like SQL and Oracle. What is**

**the recommended disk type?**

o Please use Ultra disks for data disks. Use Premium SSD for OS disk.

**● A company has a disk requirement of more than 32TB. What are the available**

**options?**

o Please use Ultra disks or use mirroring with striping.

**● A company wants more than 50,000 IOPS but does not want to use Ultra disks.**

**What can be done?**

o Please use mirroring with striping. If one disk has 20K iops and you do striping

with 2 disks, you will get 40K iops, and with 3 disks, you will get 60K IOPS

**● Will the disk be deleted when we delete a VM?**

o No, you need to delete disks explicitly.

**● I had allocated 100 GB, but now I want to add 100 GB more. Can I do that on my**

**existing machine?**

o Yes, deallocate VM and update disk.

**● Can we cache data?**

o Yes, disk caching can be set to NONE or READ ONLY or READ/WRITE. For log

disks, use READ ONLY.

**● Can Multiple VMs read the disk on a given VM?**

o Yes, we can enable disk sharing.

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**Azure Queue Storage**

**Queue Storage:**

● This component of Azure storage is for messaging store and queuing.

● Simple and cheap

● The preferred workload of more than 80GB when compared to the Service Bus

queue.

● Can Scale and message node failure will not affect Service since other nodes will

process.

● Can add more worker nodes if there is a burst

**The architecture of Queue storage**

● We create a storage account.

● Within the storage account, we create Queues.

● For example, we create 2 queues, one incoming order and one outgoing payment.

● There will be messages which we will store under the queues.

● These messages will be read at least once and processed by the applications.

● **URL format:** Queues are addressable using the following URL format:

**http://<storage account>.queue.core.windows.net/<queue>**

● The following URL addresses a queue in the diagram:

**http://myaccount.queue.core.windows.net/incoming-orders**

**Use Cases**

● Provides a decoupling architecture. This allows for asynchronous communication.

● Let’s take an example of a Purchase system integrated with a Shipping system.

● In the traditional model, both the purchase and shipping system is integrated.

● When a customer places an order, the purchase system sends the order to Shipping,

and it has to get an acknowledgment.

● If there are too many orders and the shipping system does not acknowledge, it will

break the system.

● In asynchronous communication, we decouple, and the purchase system does not

wait for an acknowledgment.

● It will send a message, and the shipping system might check for the message queue

every 5-10 minutes and process the orders. Here we use the Azure queue storage.

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**FAQs**

**● Can we have ordering like FIFO for messages?**

o No

**● Does Queue storage support transactions?**

o No. Each message is independent. If 20 of 30 messages are read, and the

operation fails, this is not an all-or-nothing situation to have a transaction

concept to rollback 20 and process from the beginning.

**● Does Queue Storage push messages?**

o No, it would help if you fetched the messages.

**● Can we lock messages for exclusive access?**

o Yes, you need to acquire a lease during which period you have exclusive

access.

**● What is the lease duration?**

o 30 seconds default lease duration

o 7 days max for lease duration

o Can be renewed

o The level is a message

**● Can we use batches for processing?**

o Yes

**● Does Queue storage provide dead lettering?**

o No

**● What are the limits?**

o Max queue size – 500GB

o Max message size – 64KB

o Max number of queues – no limit

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**Azure Table Storage**

**Table Storage:**

● This component of Azure storage can be used as a **NoSQL** Datastore.

● It stores data in a key-value pair. We have a partition key and a row key. These are

default columns. We can add columns as needed.

● We can query or insert data using Storage Explorer.

*Table Storage architecture*

● **URL format** for Azure Table Storage accounts:

**http://<storage account>.table.core.windows.net/<table>**

● In the Storage account, we create an account (Sally)

● Under the account (Sally), we create a table (customers)

● Under the table (customers), we insert rows called Entities.

● Entities contain properties that are a key-value pair.

● Therefore Storage *Account -> Table -> Entities -> Properties*

**Use Case**

● Use Table storage for storing semi-structured data

● Use this for creating an app that needs a flexible data schema.

**FAQs**

**● How much can we store?**

o We can store Petabytes of data.

**● Is availability a concern?**

o With GRS, data is replicated 3 times within a region and another 3 times in an

additional region. So it is highly available.

**● What is Cosmos DB table API?**

o Cosmos has several APIs like Mongo/SQL/Gremlin, and one of the supported

APIs is Table API. Both Azure Table storage and Cosmos DB table API have the

same data model and support the same operations like query insert via SDK.

Using the Cosmos DB table API will increase the performance like single-digit

ms latency, scalability, global distribution, etc.

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**Azure Archive Storage**

**Archive Storage:**

● Use Azure archive storage for rarely accessed data.

● Lowest priced storage tier

● Automatic encryption of data

● Seamless integration with Hot and cool storage tiers

● Secure data transfer with HTTPS.

● Minimum **180** days storage requirement – If we move before that, we pay early

deletion fees for the number of days falling short.

**Use Cases**

**● Archival**

o Healthcare and other regulations like SOX (financial records etc.) require that

information be stored for multi-year periods. This provides long term

compliant storage.

**● Long term Backup Retention**

o There might be a requirement to store Database, server, desktop data for

multi-years. This provides long-term storage freeing up local disk space.

**● Magnetic tape replacement**

o If your organization has a VTL (Virtual tape library), you can move the least

accessed data to archive storage.

● Other use cases are Security/Public safety data and other digital media content

retention.

**FAQs**

**● What types of storage can be stored in Archive Storage?**

o Only Blob storage

**● What are the retrieval options?**

o There are two options.

▪ *Standard Priority (Default)* – up to 15 hours

▪ *High Priority (Max 10 GB)* – less than 1 hour

**● What are the fees associated with Archive Storage?**

o The fess is as follows:

▪ Data Retrieval – Standard – 1.3220$/GB

▪ Data Retrieval – High Priority – 6.6097$/GB

▪ Write Operation – 6.6097$/10000

▪ List/Create container operation – 3.3049$/10000

▪ Read Operation – Standard – 330.4813$/10000

▪ Read Operation – High Priority – 3304$/10000

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**Azure Virtual Machines**

There are 3 major delivery models when it comes to Cloud services. They are:

**1. SAAS – Software as a Service**

**2. PAAS – Platform as a Service**

**3. IAAS - Infrastructure as a Service**

● Azure Virtual Machines are part of the **IAAS** offering from Azure.

● As customers, we are responsible for managing the virtual machine, and just the

hardware will be provided to us by the cloud provider. We can *start, stop and delete*

the virtual machine.

● If we find that the capacity is insufficient or too high, we can change to a different

machine type. We can install any software as we like.

● Also, please note that this is the most expensive of the three offerings.

● We can create **Windows or Linux VMs**, and there are multiple locations throughout

the world where resources can run from.

● When we create a VM, we need to attach a virtual hard disk, and the location that

we specify is where the hard disks are stored.

***Here is the SLA table:***

**SI No. VM Disk SLA**

1 2 or more VMs across 2 or more AZs 99.99% at least 1 VM

2 2 or more VMs in a same Availability

set

99.95% at least 1 VM

3 Single VM Premium or

Ultra disk for all

disks

99.9%

4 Single VM Standard SSD 99.5%

5 Single VM Standard HDD 95%

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***Please see below details for VM types:***

**Sl No Type Sizes Short Description Best for**

1 GP

(General

Purpose)

B, Dsv, Dasv, Dav,

Av2, DC, Dsv

Balanced CPU to

memory

Testing/ Dev, small DB, low

traffic servers

2 Compute

Optimized

F, Fs, Fsv2 High CPU to

memory

Medium traffic servers,

batch processes, app

servers

3 Memory-

Optimized

Esv, Ev, Eav, Mv2,

M, DSv2 , Dv2

High memory to

CPU ratio

RDBMS servers

4 Storage

Optimized

Lsv2 High disk

throughput and IO

Big data/ DB warehousing/

Large DB

5 GPU NC, NCv2, ND,

NV

Specialized VMs

for heavy graphics

Model training with deep

learning

6 HPC

(High-perf

ormance

Compute)

HB, HBv2, HC, H Fastest and most

powerful CPU

Real-time processing

**FAQs**

1. **How do I resize a VM?**

You can first run the list-vm-resize-options and see available sizes. If you find the size,

you can run the resize command

az vm resize --resource-group WLRG --name WLVM1 --size Standard\_DS3\_v2

Else you need to deallocate the VM, which will allow you to use any size. You need to

deallocate, resize and start a VM.

az vm deallocate --resource-group WLRG --name WLVM1

az vm resize --resource-group WLRG --name WLVM1 --size Standard\_DS3\_v2

az vm start --resource-group WLRG --name WLVM1

2. **What are Azure Dedicated hosts?**

We usually shared the physical hardware with other tenants. If we want exclusively

to use the physical server, then we can choose dedicated hosts.

3. **What are Azure Spot instances?**

This feature allows us to take advantage of the unused CPU at a significantly lower

cost at almost 90% savings. If there are workloads that can tolerate disruption and

can be restarted, then we can choose this option. If there is another bidder who bids

more than our price, we will be vacated on 30 seconds’ notice. So we need to be

prepared with proper scripts to save the data or any other process from exiting

gracefully.

4. **How can we save costs on VMs other than Spot instances?**

There are two other ways we can save on costs.–

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5. **Reserved Instances** – We can commit to 1-year or 3-year and choose to pay upfront

or monthly to buy RIs. We have the flexibility to change size if needed.

6. **Azure Hybrid Benefit** – If you have a license already, you can use the license on Azure

and get this benefit.

7. **What are Azure Images?**

If there is a custom image that we want every VM to have when created, we can

choose to create a standard VM and sysprep and then create an image. We can then

use this image to create VMs.

8. **How can we make VMs highly available?**

We had discussed in the excel above with SLAs. We can use multiple machines either

in availability or in more than 1 availability zone. In addition to this, we can use Azure

VMSS (Virtual machine scale sets). VMSS is automatically created from a central

configuration using a standard template. More VMs will be added during peak and

will be brought down when the demand goes down based on our auto-scaling

options.

9. **How can we back up VMs?**

We have 3 options:

a. **Azure Backup** – We can create recovery vaults and configure Azure Backup to

back up our VMs

b. **ASR (Azure Site Recovery)** – Here, our VMs are replicated to another region,

and our entire production region fails; we can failover to the backup areas

with the click of a button

c. **Managed Snapshots** – If we have managed disks, we can take a snapshot of

our disks, a read-only copy. We leveraged this feature for quick backups in

dev and test environments.

10. **How can we monitor VMs?**

Under Monitoring tabs, we have metrics to see various parameters. We can also set

alerts. We can also Log analytics by enabling the Logs option in Monitoring. We need

to create a log analytics workspace.

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**Azure App Service**

Azure App Service allows us to run applications on the cloud. Here are some features:

● HTTP based Service for hosting web applications, REST APIs, and mobile backends.

● Supports .NET, .NET Core, Java, Ruby, Node.js, PHP, Python

● Run and Scale on Windows/Linux

*App Services run under an app service plan. An app service plan is the logical abstraction*

*that represents one or more VMs that runs the app service. It consists of compute*

*resources like CPU, memory and disk space. We pay for app service plans and not the app*

*service.*

*Also, we can have more than one app service running inside an app service plan. The*

*number of app services that can run inside an app service plan depends on the app*

*service plan. Also, the amount of resources like CPU, RAM and disk space depends on the*

*app service plan.*

**Plan Compute**

**type**

**Custom**

**Domain**

**Scaling Workload Space Backup**

**/**

**Restore**

**No of Apps (max)**

Free Shared

No

No Nil No 10

Shared Shared Yes Yes Dev 1GB No 100

Basic Dedicated Yes Yes Dev/Test 10GB No Unlimited

Premium Dedicated Yes Yes Prod 250G

B

Yes Unlimited

Isolated Isolated Yes Yes Prod 1TB Yes Unlimited

*Let's look at some features of App services:*

**Deployment Slots** This concept is used for zero downtime deployments. There will be a

production slot and a Staging slot. New version of the Production

deployment will be done in the Staging slot. Either all at once

deployment or in stages(canary) will be done.

**Deployment Center** This allows for Continuous integration/ Continuous deployment (CI /

CD)

**Custom Domains** By default, the website will be xxxx.azurewebsites.net. We can buy a

domain in your company name and use that name.

**SSL Settings** You can certificates and ensure encrypted data transmission

between client and Server

**Scale up (App Service**

**Plan)**

You can increase the size of your VM if you need more resources

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**Scale out (App Service**

**Plan)**

You can also increase the number of instances. You can either do this

manually with a slider or set up rules/schedule to scale automatically

on schedule or CPU usage (like >70%)

**FAQs**

1. **How does app service plan work?**

App service plan is supported by Service Fabric. Service fabric replaces instances if an

existing one fails. Also, it adds instances if there is a requirement.

**2. What are the types of App Services?**

There are 4 types of services as follows:

**Sl no Type Purpose**

1 *Web App (previously Azure*

*Websites)*

Hosting websites and web

applications

2 *API App* Used for hosting the RESTful APIs

3 *Logic App* Used for business process

automation, system integration and

sharing data across clouds

4 *Mobile App (previously delivered*

*by Azure Mobile services)*

Used for hosting mobile app back

ends

**App Service**

● HTTP based Service for hosting web applications, REST APIs, and mobile backends.

● Supports .NET, .NET Core, Java, Ruby, Node.js, PHP, Python

● Run and Scale on Windows/Linux

**Features**

● **PAAS** – Patches/OS Maintenance done by Azure

● Support for Containerization and Docker

● Serverless

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● **Deployments Slots** – Swap application content in Prod and avoid downtimes

● Grouped under App Service plans with following tiers

**Plan Compute**

**type**

**Custom**

**Domain**

**Scaling Workload Space Backup/**

**Restore**

**Others**

Free Shared

No

No Nil No

Shared Shared Yes Yes Dev 1GB No

Basic Dedicated Yes Yes Dev/Test 10GB No

Premium Dedicated Yes Yes Prod 250GB Yes

Isolated Isolated Yes Yes Prod 1TB Yes Private

Endpoints

**App Service types**

1. **Webapps** – Websites/Online Apps

2. **Webapps for Containers** – Containerization

3. **API apps** – backend data

*Can add – Vnet Integration / Hybrid Connections /Security, but these are not asked in the*

*exams.*

**Tips**

● When you move an App service from one RG to another, the App Service plan

doesn’t change.

● Destination RG cannot contain App Service resources like Web app or App Service

plan.

● **.Net** Core application can be deployed on Windows or Linux OS

● **ASP .Net** app CANNOT be deployed on Linux OS. Only Windows OS

● Multiple Web Apps can be hosted on a single App Service plan.

● Web App and App Service plans must exist in the same region.

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**Application Service Environments**

● There are 3 components for hosting *web apps/ Docker containers/ Mobile apps* and

functions. There are app service plans which host the app services.

● When we host the regular app services, the apps are directly exposed to the internet,

and the resources are shared.

● Some organizations prefer to host the services in the internal network, and security

features like firewalls and security groups could be applied to protect the apps.

● For such scenarios, there is a feature called the **Azure App Service Environment**,

which provides a fully isolated and dedicated environment for securely running App

Service apps at a high scale.

● **App Service environments (ASEs)** provide very high scaling with isolation and secure

network access with high memory utilization.

● We can create multiple ASEs within a single Azure region or across multiple Azure

regions, making it ideal for horizontally scaling stateless application tiers when we

have high **requests per second** (**RPS**) workloads.

There are three types of workloads available when choosing the workload tier. They

are *Dev/test, Production, and Isolated.*

● Of these, the isolated offering provides the ASE environments which host

applications within the client’s VNets. As stated, we have fine-grained control over

inbound and outbound application network traffic.

● While the other category of app services has a fixed suffix of azurewebsties.net, we

can create our own domain name.

● Also, ASEs come with powerful computers, which is twice as powerful as the regular

app service plans. They also come with **1TB** Storage as compared to **50GB** of space

for the regular ones.

● We can host up to 100 instances which are sufficient to host a miniature web service

hub. We can expect the service to cost us about **250-300$** per month, which is very

cheap for the services being provided.

**Steps to creating App Service Environment**

● In the first screen, we select if the service is public-facing or internal

● Then we select whether we are hosting Windows-based or Linux-based OS.

● On the second screen, we select the Vnet where we want to host the service. *(Since*

*services are being created in our private infrastructure, it takes much longer time to*

*create)*

● Then we can DNS resolution. We can create our own private zone and use that name.

This is not possible when choosing the other app service plans.

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**Steps to creating Web Apps under ASE**

● Please note that the process is similar except that we drop down the region and

select the ASE which we just created.

● Also, the below screen shows various features under ASE and pricing under each of

the pricing tiers I1 and I2, and I3.

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***Note:*** *The Private link vnetLink (wlase1.appserviceenvironment.net/vnetLink) is also created*

*below. You can go to the Resource group and click on “Show hidden types” to see this*

*resource.*

***Note:*** *Please see the App Service plan as I1:1 in the screenshot below to identify the isolated*

*service plan.*

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**Azure Container Registry**

**What is a Container Registry?**

A Container Registry is a central repository to store and distribute container images. A

container image includes all the data needed to start a container - **for example**, the

operating system, libraries, runtime environments, and the application itself.

We first build an image, and then we push the image to the repository. When needed, we

pull the image into the target environment. With versioning as a feature, we have multiple

versions of the container, and the different versions like the stable version would be used for

Production.

Versions being tested would be in non-production regions. In the example below, v2 is a

stable version, and the developer makes changes and creates v3. Once v3 is tested, it would

be then pulled into Production.

**Providers**

Few providers provide the container registry services, and they are:

**● Docker Hub**

**● Azure ACR (Azure Container Registry)**

**● AWS ECR (Elastic Container Registry)**

**● Github Container Registry**

**● Google Container Registry**

**Amazon**

**ECR Docker Hub**

**GitHub**

**Container**

**Registry**

**Azure**

**Container**

**Registry (ACR)**

**Public**

**Repository**

No YES YES

No

**Private**

**Repository**

Yes YES YES

Yes

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**Pricing (Public**

**Repository)**

$0 $0 $0

**Pricing (Private**

**Repository)**

$ $$$ $$

Storage:

$0.10 per

GB, Data

Transfer:

$0.09 per GB

>= $7 per

user/month

Storage: $0.25

per per GB,

Outgoing Data

Transfer: $0.50

per GB

Storage: $0.09

per GB

**Authentication** AWS IAM Password or

Access Token

Personal Access

Token (PAT) PAT

**MFA for Image**

**Push/Pull**

Yes NO NO

NO

**SLA Availability** 99.9% N/A N/A 99.9%

**General**

**Available**

YES YES Beta

YES

**Immutable**

**Images**

YES NO NO

YES

**Image**

**Scanning**

YES YES (paid plans

only)

NO

YES

**Regions** Choose

between one

of 25 regions

worldwide

Not Known Not Known

33 regions

**Rate Limits** Pull: 1,000

per second,

Push: 10 per

second

Pull: 100/200

(Free Plan),

unlimited (Paid

Plan)

n/a

Pull: 1,000 per

second, Push:

100 per second

**ACR Service Tiers**

ACR is available in 3 service tiers, also called SKUs.

1. **Basic** – Cost Optimized for developers

2. **Standard** – All features of Basic plus increased storage and image throughput. For

Production

3. **Premium** – highest amount of storage and concurrent operations. It also includes

geo-replication, content trust, and private link

**ACR Roles**

**Role/Permission Create/Delete ACR Push Pull Signature Signing**

*Owner* X X X

*Contributor* X X X

*Reader* X

*AcrPush* X X

*AcrPull* X

*AcrImageSigner* X

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**FAQs**

1. **Can we change Service tiers?** –

Yes

2. **What is geo-replication?**

With this feature, a replica of the ACR will be created for DR purposes and local use.

3. **How can we secure the images in ACR?**

There is a concept called CONTENT TRUST. With this, images will be signed with

certificates. To enable this feature, enable registry content trust. It is available under

**Policies -> Content Trust -> Enabled and then save.**

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**Azure Container Instance (ACI)**

● Containerization is the buzzword today. Instead of spinning Physical servers and

installing all the dependencies, and installing the application, we can create a

container containing all the required dependencies.

● We then package and create an image and deploy it into a container.

● **Docker** is one of the platforms where we can run these containers in the Open

source world. Azure has two solutions. One of those is the ACI.

● ACI is a great solution in scenarios where we need to run isolated containers.

Examples are simple applications, task automation, and build jobs.

● The drawback of ACI is that it cannot be used for full orchestration like multiple

containers, auto-scaling, and coordinated application upgrades. Please consider AKS

for such scenarios, which is the other offering from Azure.

● In simple terms, for Production, use **AKS (Azure Kubernetes Service)**, and for simple

and isolated containers, use ACI.

● One of the other best use cases for ACI is where we have production issues, and we

need to troubleshoot AKS, ACI comes to our rescue where we deploy the

trouble-making container in ACI and try to debug.

**Advantages of ACI**

*● Fast Startup times*

*● Container access*

*● Custom Sizes*

● *Persistent Storage* – We do this by mounting Azure file shares.

● *Virtual Network deployment* – When deployed in a Vnet, ACI can securely

communicate with other resources in the Vnet.

**FAQs**

**1. What are probes in ACI?**

o You can configure the liveness probe. We check the liveness probe to see if

the container is healthy. If the container is not healthy, we need to restart.

There are common scenarios when containers run for a long time.

o You can configure the readiness probe. Here we might have a scenario where

the container (maybe DB for the backend) is just coming up. We run the

readiness probe and send requests to the container only if the probe

succeeds.

2. **How can we monitor ACI?**

We use Azure Monitor. Here are the available metrics at this time.

o CPU Usage measured in millicuries (One millicore is 1/1000th of a CPU core)

o Memory Usage in bytes

o Network bytes received per second.

o Network bytes transmitted per second

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3. **What are container groups?**

● Similar to AKS for orchestration, we can use container groups to combine and

manage containers. They get scheduled on the same host machine.

● The concept is similar to pods in Kubernetes. The use case for this is in

scenarios where we want to divide a single functional task into a smaller

number of container images. An example is a front-end container and a

back-end container.

● The front end might serve a web application, with the back end running a

service to retrieve data.

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**Azure Kubernetes Service (AKS)**

**What is Containerization?**

● In the traditional computing system, we had to install an Operating system and install

all dependencies for an application to work. Only a single OS could be installed.

● Then came Virtualization where we could install multiple OS by introducing another

layer between the hardware and the OS and this was called Virtualization. So only

physical machines appeared as multiple systems.

● Then came a lightweight alternative to virtualization, which was called

Containerization. This removed the drawback of having a full machine, and this had

only the necessary components.

● Containers will encapsulate an application with its operating system. This would

contain all the dependencies that were needed for an application to run. So we take

the container and run it on any operating system, and it will run.

● Some of the containerization options are Docker, which is the most popular and

sometimes equated to containers. But there are others like **LXC/LXD, ContainerD,**

**Rocket**.

**Orchestration**

● Orchestration is the system that is used to manage the deployment of containers. We

use Orchestrators as tools to achieve this. Some of the performed activities are

automating the maintenance of those applications, replacing failed containers

automatically, and managing the rollout of updates and reconfigurations of those

containers during their lifecycle.

● The popular tools are *Docker Swarm by Docker, Nomad by Hashicorp, Flocker, and*

*Kubernetes.*

● Kubernetes, also stylized as K8s, is an open-source container orchestration system. It

is used for automating computer application deployment, scaling, and management.

It was originally designed by Google and influenced by Google’s Borg System and is

now maintained by the Cloud Native Computing Foundation. It is a cluster

management software for Docker containers mainly but supports others also.

**AKS**

Kubernetes has become very popular, and many cloud service providers offer a

Kubernetes-based platform or infrastructure as a *PaaS or IaaS offering. Google has GKE*

*(Google Kubernetes Engine), AWS has EKS (Elastic Kubernetes Service), and Azure has AKS*

*(Azure Kubernetes Service)*

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**Components of AKS**

**1. The Cluster**

o The Cluster contains 2 components

▪ Control Plane – this consists of kube-apiserver, etcd, kube-scheduler

and kube-controller-manager

▪ Nodes that run the applications

**2. Persistent Volumes**

o Since the nodes are added and removed on-demand and the storage

associated with it is temporary, we need to create storage outside of the

cluster. Hence we create persistent volumes.

**3. Node**

o We create Node pools in Kubernetes (as shown below). Here we choose a VM

size, and that will be the unit size of the nodes within the pool.

o We can add node pools as needed. The first node pool created is the **system**

**node** pool which hosts critical system pods like coreDNS and tunnel front.

o We then add user node pools for application support and create different

pools based on the application requirements.

o Pods will be created within the nodes, and the max pod setting is configured

at the node pool level.

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**4. Containers**

o We store our code that is going to be run inside containers. There are readily

available pre-built containers stored in container repositories or we can

create our own containers.

o One or more programs can be run from the containers

**5. Pods**

o Nodes create Pods, and kubernetes use Pods to run instances. Usually, only

one container is run within a pod, but multiple containers could run in a pod

if there was a requirement from the application.

o We scale based on pods. When we can scale, we simply use pod replicas. A

new pod will be spun up in another node, and we now have an additional

pod. Same way, we can remove the pods to scale down.

**6. Deployments**

o We don’t launch pods directly. Instead, we create deployments.

o A deployment will state how many replicas should run and the system

manages that.

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**Sample Deployment yaml file**

apiVersion : apps/v1

kind: Deployment

metadata:

name: wl-app

spec:

replicas: 1

selector:

matchLabels:

app: wl-app

template:

metadata:

labels:

app: wl-app

spec:

containers:

- name: wl-app

image: wl66293099.azurecr.io/wl-app

ports:

- containerPort: 3000

**7. Ingress**

o By default, Kubernetes provides isolation between pods and the outside

world. If you want to communicate with the service running in the pods, you

need to open the communication. This is called Ingress.

o You can achieve this communication in several ways. The most common ways

are Ingress controller or a load balancer. Please see the sample service.yaml

file which creates an external load balancer. We get the IP of this service and

connect.

apiVersion: v1

kind: Service

metadata:

service.beta.kubernetes.io

name: wl-app

spec:

type: LoadBalancer

ports:

- port: 3000

selector:

app: wl-app

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**Azure Virtual Network**

A **Vnet** is the fundamental building block for a private network in Azure. Vnets allow azure

resources like VMs to communicate securely to each other, to the internet and on-premises

networks. A **Vnet** is the representation of our own network in the cloud. We can logically

isolate resources within our Vnet.

**Benefits of Vnet**

● **Isolation** – As discussed, the components of a Vnet are isolated. We can connect to

other Vnets or On Premises with Vnet Peering or VPN or Express route

● Access to the public network

● Access to VMs within the Vnet

● **Name resolution** – We can resolve to other components in the Vnet and address

them

● **Security** – We can secure the components at various levels in the Vnet

● Connectivity

**Components of Vnets**

● **IP addresses**

**o Public and private IP addresses**

▪ The Vnets are configured with a range of IP addresses. The Notation is

in CIDR.

▪ By default, Private IP addresses are assigned to the resources with

which communication takes place between the resources

▪ Optionally, Public IP address can be assigned to the resources

▪ Please note that we will pay for Public IPs if they are not assigned. This

is to conserve Public Ips

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**● Subnets**

o A Subnet is a subcomponent of Vnet. All resources must exist in a subnet. A

default subnet is created when a Vnet is created.

o Access can be restricted at a subnet level also

o Let's say we have 2 tiers in an application called Front end and Back end. We

can create 2 subnets and configure access in such a way that internet traffic

will flow to the front end subnet and from there to the back end subnet.

**● NIC - Network interface card**

o A NIC is the networking component which allows traffic flow. A single NIC will

contain the public and private address.

**● NSG - Network security group**

o These are the rules that are assigned to allow traffic to flow. The NSG can be

assigned at a NIC level or a subnet level. It is recommended to apply at any

one level only.

o If there is no NSG, then traffic will be allowed in and out

o We set inbound and outbound rules

o **Priority** – All rules are assigned a priority and the lowest number is taken first.

If rule 100 says allow and 101 says deny, then the result is allow.

o **Default Security rules** – There are 6 default rules that can neither be removed

or modified.

**FAQs**

1) **What is Vnet Peering?**

Vnet Peering allows two Vnets either in the same region *(Default Vnet Peering) or*

*Globally (Global Vnet Peering)*

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**2) What are the pre-checks for Vnet Peering?**

a. Peering is non-transitive. If Vnet A is peered with Vnet B and Vnet B with

peered with Vnet C then it does not mean that Vnet A and Vnet C are

connected

b. The Address ranges cannot overlap between the Vnets

c. When peered, adding or deleting address range is disabled. If we need to add

address range, we need to delete the peering and add the address range and

then add peering again.

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**Azure DNS**

**What is DNS?**

Think of the phone directory that is used at home. It is difficult to remember a string of

numbers and hence the phone directory will list the phone numbers with names of

persons/businesses.

● Coming back to the IT world, computers communicate with IP addresses. The DNS

(Domain naming system) is a friendly name given to the computer.

● For example, a web server has an IP address of **53.102.94.86.** Instead of using the IP

Address, we assign a host name as web1. In a domain, the **FQDN (Fully qualified**

● This is facilitated by DNS Servers which are setup in a hierarchy. At the top most level,

we have the ROOT and under the root, we have the top level domains (TLD)

examples of which are **.ORG, .COM, .NET, .IN etc.,**

● In addition to this, we have domain registrars where we purchase a domain name.

● Examples are **Godaddy, Namecheap and Amazon too via Route53**. When a user tries

to the **ROOT** and then to the **.COM server.**

● DNS works with a concept of Zones. We can set up Private or Public zones. Public

zones are used when we want the internet to be able to resolve our names.

● However when we want to enable internal communication, we create private zones.

● Please note that zones can also be configured with a “**Split-horizon**” view which

allows a private and public DNS zone to share a name.

**FAQ**

1) **What is IP 168.63.129.16?**

This is actually called a Wire Server and has an IP address of 168.63.129.16. and it

facilitates communication between Azure resources. It also serves as a DNS and

DHCP server by default. Please ensure that this IP is not blocked.

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**domain name) will be web1.demystify.com.**

to connect to a server demystify.com, the DNS resolves this to the IP address by going

*Connection-specific DNS Suffix . :*

*lhlv032okq5e3g5zezobyk5bwf.bx.internal.cloudapp.net*

*Description . . . . . . . . . . . : Microsoft Hyper-V Network Adapter #2*

*Physical Address. . . . . . . . . : 00-0D-3A-8E-15-4C*

*DHCP Enabled. . . . . . . . . . . : Yes*

*Autoconfiguration Enabled . . . . : Yes*

*Link-local IPv6 Address . . . . . : fe80::7dbd:c33b:1ab:8e7f%7(Preferred)*

*IPv4 Address. . . . . . . . . . . : 10.0.1.4(Preferred)*

*Subnet Mask . . . . . . . . . . . : 255.255.255.0*

*Lease Obtained. . . . . . . . . . : Saturday, March 13, 2021 7:06:42 PM*

*Lease Expires . . . . . . . . . . : Wednesday, April 20, 2157 9:38:31 AM*

*Default Gateway . . . . . . . . . : 10.0.1.1*

*DHCP Server . . . . . . . . . . . :* ***168.63.129.16***

*DHCPv6 IAID . . . . . . . . . . . : 117443898*

*DHCPv6 Client DUID. . . . . . . . : 00-01-00-01-27-DE-C5-9A-00-15-5D-00-04-01*

*DNS Servers . . . . . . . . . . . :* ***168.63.129.16***

*NetBIOS over Tcpip. . . . . . . . : Enabled*

2) **Can I buy my domain from Azure?**

No, Azure is not a domain registrar. You need to buy from a domain registrar and you

can create a zone in azure and add the records for DNS resolution.

3) **How do we configure VMs to use private zones?**

We can configure auto registration and for Vnet that we link with the Virtual Network

Link on the DNS Zone, the DNS registration will be done automatically when the VM

is created.

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4) **How do I use my custom website?**

We need to create a public zone and add an alias record. Once verified with the

registrar, we can start using our custom name.

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**Azure Firewall**

**What is a Firewall?**

A Firewall is a security device for the network that monitors both incoming and outgoing

traffic. Based on a set of security rules, it will either allow or deny the traffic. It acts as a

barrier between our network and traffic from external sources like the internet. The

objective is to block malicious traffic which include hackers and viruses.

**Azure Firewall**

● Azure Firewall is a **network virtual appliance (NVA)** which is a managed network

security device on the cloud.

● The function is to protect our network resources on the cloud. There are two types of

firewalls and they are classified as either Stateful or Stateless. Let’s say that you allow

a certain incoming traffic *(say port 80).*

● When the same traffic returns, it is automatically allowed if it is stateless. On the

other hand, Stateful traffic will need a specific rule for the outgoing traffic also, else

the traffic will be blocked.

● Azure Firewall is a fully stateful firewall. So, we need to allow both incoming as well

as outgoing traffic.

● Azure Firewall has built-in high availability and is highly scalable. We can create,

enforce, and log application and network connectivity policies across subscriptions

and virtual networks from a central location called **Firewall Manager.**

● We need to set up a static public IP address for the virtual network resources

allowing outside firewalls to identify traffic originating from the virtual network. It is

fully integrated with **Azure Monitor** for logging and analytics.

● A typical setup for the firewall is done via a hub and spoke model where the Vnet

which hosts the firewall will act as a hub and the other Vnets will act as a spoke.

● The On premises and Internet is also connected to **Azure Firewall.** In this way, all

traffic will enter via the firewall and the rules setup via the policies will then allow or

deny the traffic.

● Please note the subnet that hosts the firewall must be named as Azurefirewallsubnet

else it will not function

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● Please see below the subnet created for the Azure firewall named as

**AzureFirewallSubnet.**

● As discussed, the rules are set up in a central location using the Firewall Manager.

You can see the pol1 being assigned to **fwvnet1 Virtual Networks**. We can assign the

same policy to other networks and it is easier to manage centrally.

● A Policy consists of rule collections which in turn contains individual rules. Here we

specify if the rule is to allow or deny.

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● We assign a priority from **0 to 65535** and the lowest number takes the priority while

processing the rules.

● We could place the rule collection within a group called the rule collection group.

Also, the rule is available as a tab called Network rules on the main panel.

● We specify the source type as either an IP address or IP Group. We can give a range

of IP addresses for Source and Destination. We can give **\*** to indicate all.

● We can specify Protocol and Port numbers. In the example below, we have given

Google a DNS server with IP of **8.8.8.8** and port of **53** which will allow DNS

resolution.

● We can optionally enable intelligence-based filtering called Threat Intelligence and

the mode can be set to OFF/Alert only or Alert and deny. Microsoft threat

intelligence feed provides a list of IP addresses and domains and these recorded are

included as rules to allow or deny

*This is the Network Rule tab which lists the rules.*

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*We can also set up DNS servers for DNS resolution on the DNS tab.*

*Finally, we can see the topology of the Vnet and the firewall subnet on the Network watcher*

*blade under the Topology tab.*

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**Azure Load Balancer**

● Azure provides load balancing at **Layer 7** which is the application layer via Azure

Application Gateway. This is typically http traffic.

● Azure also provides load balancing at Layer 4 which is a transport layer consisting of

**TCP and UDP** protocols. This is the Azure Load Balancer.

● We could use the Azure Load balancer for both public facing as well as internal

application. The load balancer is set up with a backend pool which distributes traffic

to a set of VMs or VM Scale sets.

Here are the steps to create a load balancer:

**Step 1: Create Load Balancer**

We create a load balancer with the following options:

● Name for the load balancer

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● Internal or Public load balancing

● SKU type could be Standard or Basic. Since Basic does not have an SLA,

Standard SKU type is recommended for Production workload which has SLA

of **99.99%.** *Standard SKU* comes with many more additional / better features

than Basic SKU like https.

● **Regional or Global** – This is a new feature and is available for Public Load

balancers

**Step 2: Create Backend pool**

● We create a backend pool where we attach VMs or VMSS

● VMs/ VMSS have to be in the same location.

● We could add multiple backend pools

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**Step 3: Add Health Probe**

● We need to add a health probe

● We can configure **TCP/HTTP/HTTPS** as protocol

● We add a port number

● We add an interval and unhealthy threshold which is the interval for checking

where the probe passes a health check. The unhealthy threshold is the

number of times a probe is allowed to fail consecutively after which the

instance will be marked as unhealthy and traffic routing will be stopped.

**Step 4: Add Load Balancing rule**

● We create a load balancing rule

● We specify frontend IP address and Protocol (TCP or UDP) and Port

● We specify the Backend port and pool

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● We specify health probe

● We can also specify session persistence. If this option is enabled, the traffic

will be routed to the same VM.

*Azure Load Balancer can also be configured to use as follows to map traffic to the available*

*servers:*

**● 2 tuple (Source IP, Destination IP)**

**● 3 tuple (Source IP, Destination IP, Protocol)**

**● 5 tuple (Source IP, Source Port, Destination IP, Destination Port, Protocol)**

Please see how the traffic is routed based on the 5 tuples.

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**Azure Application Gateway**

One of the main benefits of the Cloud is elasticity on-demand.

In a traditional datacenter, if there is a peak load requirement of 100 cores from 10-11 am

when users login, the machines will always need to have the capacity of 100 cores.

However, in the cloud environment, we will have a single VM with 50 cores at all times and

add another VM with 50 cores between 10-11 AM alone. This has reduced consumption by

almost 50%.

**But how do we now distribute the load between the two VMs?**

The solution is Load Balancing.

Load balancing can be done at 2 layers in the OSI model. One is at Layer 4 where we will use

the Azure load balancer. Here a combination of source and target ip and TCP/UDP Protocol

will be used to achieve routing.

The other routing type is at Layer 7, which is the Azure Application gateway. Here the

application gateway uses a front-end IP address which is resolved from FQDN via DNS. It has

an optional WAF (Web application firewall).

**OSI LAYER and the load balancing options within Azure**

**How does the Application gateway work?**

**Step 1:** User sends a request to a website with **FQDN (fully qualified domain name)** – for

return the IP address.

**Step 2:** The application gateway will be configured with a listener, a logical entity checking

for connection requests. The listener is configured with a front-end IP address, protocol, and

port number for connection requests.

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example, https://demystify.com/videos. The query will be sent to a DNS server, and it will

**Step 3**: The application gateway also has a backend Pool/s. The backend pools could be VMs

or **VMSS (VM Scale Sets)** or external servers, or Azure App servers. Based on routing rules

set up, the traffic will be routed to the appropriate backend servers.

In the above example, you can see the routing rules being processed with url based routing.

the url and sends the traffic to the Video Serving Pool.

**Application Gateway with WAF**

There is an optional feature WAF that can be additionally added to the application gateway.

WAF is based on **Core Rule Set (CRS).**

We need to set up a WAF Policy that has rules. There are two types of rules. One is Managed

rule sets which Azure preconfigures. The other is custom rules. Some of the features of WAF

are

● Some of the features that WAF provides are preventing SQL injection**/ XSS/ http**

protocol violations.

● It also protects against crawlers and scanners. We also can allow or block traffic

coming in from certain countries/regions in preview, and it is called **Geo-filter traffic.**

● WAF can be set up in two modes which are Detection or Prevention.

● When WAF is added, the traffic will be evaluated before Step 3 above against the

WAF rules.

● If violating traffic is found in Detection mode, the warning will be issued, and traffic

continues to flow. In Prevention mode, the traffic will be blocked.

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So when the users type the url https://demystify.com/videos, the gateway sees the videos in

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**Azure Traffic Manager**

Azure provides the following services for Delivery.

*● CDN*

*● Front Door*

*● Traffic Manager*

*● Application Gateway*

*● Load Balancer*

While Load Balancers and Application Gateways operate at **Layer 4 and 7,** Traffic Manager

operates at a DNS level.

This service will distribute traffic to *public-facing azure services at a global level.* The public

endpoints provided are having high availability and quick response.

We can use Traffic Manager to route traffic to regional application gateways at a global level,

which could have a load balancer setup for multiple VMs at a database tier utilizing all the

services.

Here are some more scenarios:

**Application Gateway** - to load balance between your servers in a region at the application

layer.

**Front Door** - optimize the global routing of your web traffic and optimize top-tier end-user

performance and reliability through quick global failover.

**Load Balancer** - Network Layer Load Balancing

**How does a Traffic Manager work?**

The Traffic Manager uses DNS for resolution. It uses this to find the name server. Then it

locates the endpoints (which are not disabled) and routes the traffic based on the routing

methods specified.

**Routing Methods:**

Here are the routing methods which we can configure:

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**Routing**

**Method Scenario**

**Priority** *When we have several endpoints, and we want to use one location preferentially,*

*we can use this method having a primary service endpoint for all traffic.*

*We can configure one or several multiple backup endpoints in case the primary is*

*unavailable.*

**Weighted** *When we want to split and route traffic to different locations, we should use this*

*method. We have to set weights to accomplish this.*

*Let’s say we want to route traffic equally, we set the weight of 1 and 1 to both the*

*endpoints*

*If we give weights of 1 and 2, then the ratio will be 33:66 and one-third of traffic*

*will go to the first endpoint, and two-thirds of traffic will go to the second*

*endpoint.*

**Performance** *Let’s say that we have 3 locations like Las Vegas, Houston, and Jersey City on 3*

*sides of the country. We would like end-users to use the "closest" endpoint for the*

*lowest network latency.*

*For example, users in New York should connect to Jersey City, which is the closest*

*location. Then we should select this routing method for the lowest latency by*

*choosing the closest endpoint.*

**Geographic** *Let’s say that there is a requirement that data from a country (Saudi Arabia) has a*

*mandate that data should not cross borders with sovereignty laws.*

*We can use this method to direct users to specific endpoints based on where their*

*DNS queries originate from geographically.*

*So if a user from this country tried to access it, he would be routed to the servers in*

*his country only.*

**Multivalue** *If there multiple servers and we wanted to select multiple servers to select any of*

*the available servers, we can select MultiValue.*

*When a query is received for this profile, all healthy endpoints are returned. We*

*can limit the servers returned by setting a max value.*

**Subnet** *Use this method to map sets of end-user IP address ranges to a specific endpoint.*

*When a request is received, the endpoint returned will be mapped for that*

*request’s source IP address.*

**FAQs**

1. **What is the name of the website that will be created when we configure Traffic**

**Manager?**

Azure will always use azurewebsites.net as a suffix. We cannot change it

You need to create an alias in your DNS zone and point to the Traffic Manager.

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2. So how do we use our website like demystify.com?

**Azure Express Route**

**Connectivity to Azure**

● There are several ways to connect to Azure. Broadly classifying them, we could either

use the internet or have a direct connection.

● While connecting via the internet, we need to use a VPN to connect our

infrastructure on premises with the cloud using a **VPN** gateway which encrypts our

traffic by creating a tunnel.

● We could choose either a client-to-site VPN which is only one client system

connected to the **cloud or site-to-site** VPN where we connect two sites.

● This setup depends on the public internet and we must secure and could have

reliability issues.

● Hence it is better to use a dedicated connection between our infrastructure and the

cloud with an **Express Route connectivity.**

● We need to locate a connectivity provider. There are several choices available based

on location.

● For example, in India, we have *BSNL/AIRTEL/SIFY and in the USA, we have AT&T/*

*SPRINT/ VERIZON and many more.*

● Express Route connectivity allows us to connect to 2 Microsoft cloud services –

**Microsoft Azure Services as well as Microsoft 365 services.**

● Also, we can see from the above diagram that there is an active-active redundant

pair of cross connections setup for high availability. We can add further redundancy

by adding up to 16 Express route connections.

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● Express route has the following bandwidths to choose from based on our

requirements:

**● 50 Mbps, 100 Mbps, 200 Mbps, 500 Mbps, 1 Gbps, 2 Gbps, 5 Gbps, 10 Gbps**

● If we have multiple subscriptions, we can connect all of them to a single Express

route connection.

● You can have upto 10 Vnet connections on a standard Express route connection and

upto 100 for Premium connection. However please note that all connections will

share the same bandwidth.

We could even have a site-to-site VPN for adding redundancy. If there were issues with the

Express route, we can failover to the S-2-S VPN.

**FAQs**

1) **If I have a 100 Mbps circuit, what is ingress and egress capacity?**

You will have an incoming capacity of 100 Mbps and outgoing capacity of 100 Mbps.

**What is the routing protocol?**

Express route uses BGP (Border gateway protocol)

2) **What happens if there is any maintenance?**

There won’t be any impact. Express route uses an active-active setup and only the

circuit will be maintained at a given time.

3) **So where does the connection land on the Azure cloud?**

We connect to one of the Vnets in a subscription. We can connect upto 10 Vnets in

each of the 10 subscriptions max. We need to go for Premium if we would like to add

more.

4) **How do we plan for Disaster recovery?**

Microsoft recommends 2 Express connectivity to avoid a single point of failure. We

could also set up a Site-to-site VPN instead of a second circuit.

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**Azure VPN Gateway**

This is one of the methods that allows inter-site connectivity. Express route is the preferred

connection as it has higher bandwidth and is in active-active mode. Smaller enterprises can

choose VPN gateways or one could use VPN Gateway as a backup to Express route

connectivity.

The VPN gateways are set up over the Public internet. Hence the traffic needs to be

encrypted. **IPSEC** is used as the tunnelling protocol which creates a secure tunnel through

which the data travels. Even if the traffic is intercepted, it cannot be decrypted.

**VPN Gateways types**

● **Site-to-Site VPN Gateways**

o Here the On-premises will be a site and Azure VPN will be another site. We

can connect multiple VNets.

● **Point to Site VPN gateways**

o Here we connect a single client machine from on-premises to the Azure VNet.

o We can use the same connection on multiple clients by exporting the

configuration from the existing client.

● **Internal Gateway between Azure networks**

o This is a special use case where we want to encrypt traffic between Azure

Vnets.

**VPN Gateway Architecture**

***Steps to establish VPN Gateway***

**1. GatewaySubnet**

a. We need to create a subnet with the name “**gatewaysubnet**” for the setup

b. If we are creating a Vnet, this subnet gets created automatically.

Please see the diagram below which shows the gateway subnet. This was created implicitly

when the wlvnet1 was created as part of the Vnet gateway creation.

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**2. Local Network Gateway**

a. We need to obtain a Public IP address from the on-premises admin team and

use that as the endpoint.

b. See the IP address given as **53.24.54.23**. This is the ip address of the router

on-premises

**3. Virtual Network Gateway**

**a.** We need to create the virtual network gateway with the following inputs

**i. Gateway type** – in our case, we are going to use VPN

**ii. Vpn type** – could be either Route-based or Policy-based. Please note

that we cannot change the type once it is created.

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We need to delete the gateway and recreate it to make the change.

Policy based is the most common type

**iii. SKU** – There are several SKUs. Please note that Basic is considered

legacy and not recommended.

**iv. Subnet** – As mentioned, the name should be GatewaySubnet.

**4. Connection**

a. Once the prerequisites are fulfilled with the creation of Gateway Subnet,

Local Network Gateway and the Virtual Network Gateway, we can create

connection as follows

i. **Connection type** – the options are Vnet-to-Vnet, Express Route or

Site-to-Site. In our case, we choose Site-to-site which uses the IPsec

tunnelling protocol by default.

ii. **Bidirectional Connectivity** – Connections are usually unidirectional.

We can select bidirectional to choose 2-way communication

iii. **Shared Key(PSK)** - We need to create a password here and need to

share this with the on-premises admin to configure from their side.

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**5. On-premises setup**

a. Once the setup is complete, we can download the configuration to be shared

to the on-premises admin.

b. We need to get the router model and select the same from the dropdown list

and download the configuration and share with the admin along with the

shared key.

**Topology**

We can check for the topology from the network watcher – topology blade.

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**Azure CDN**

**What is a CDN?**

CDN stands for **Content Delivery network**. It is an architecture of distributed network of

servers that can efficiently deliver web content to users.

CDNs will cache the content on edge servers in the POP (point of presence) locations

keeping the content closer to the users thereby minimizing latency. This is made possible by

using the existing network infrastructure of the CDN provider.

*and Bangalore, India.*

The Servers are located in NY and we have a user logging in from Bangalore, India. The data

needs to traverse the network and this will cause latency.

The solution here is to use CDN and use the Bangalore location to cache the data. Now, the

user will be able to retrieve the data from Bangalore.

*Please note that the data is not stored permanently on the edge location. This is to ensure*

*that data does not go stale and it is current.*

So we may set a cache interval of 24 hours and every day, the data will be retrieved from the

Origin Server (NY, USA) and cached on the edge locations.

Also, if the data is not available (first time accessing) or if the cache has been marked as

invalid, the data will be fetched from Server and sent to the user and cached on the edge

location.

The next time, the request will be fulfilled by the edge server. This also reduces the load on

the Origin server.

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*Let's say that a company demystify has a headquarters in NY, USA and branches in CA, USA*

**FAQs:**

1) **How long is the data cached on the edge Server?**

The TTL (time to live) by default is 7 days. This can be configured as per the

application requirements. Once TTL expires, the cache will be marked as invalid.

2) **What type of azure servers can serve as Origin Servers to get source data?**

Azure Web App, Azure Cloud Service, Azure Storage account, or any public web

server.

3) **What are the CDN products available?**

Azure has its own product. Besides that, it has tied up with Akamai and Verizon.

Here are the offerings:

**a. Azure CDN Standard from Microsoft**

**b. Azure CDN Standard from Akamai**

**c. Azure CDN Standard from Verizon**

**d. Azure CDN Premium from Verizon.**

Please note that not all products might be available at all locations. You will need to check

the product availability for your location.

**4) What are some of the additional features?**

**a. Dynamic site acceleration(DSA)**

**b. Video streaming optimization**

**c. Customizable, rules based content delivery engine**

**d. HTTPS support with CDN endpoint**

**e. Compression encodings**

**5) Who are the market leaders for CDN? - PFB**

**Top Competitors Market Share # Websites**

jQuery CDN 38.60% 19,13,841.00

CloudFront 24.57% 12,18,186.00

BootstrapCDN 8.88% 4,40,178.00

Amazon S 37.79% 3,86,324.00

Vimeo CDN 5.71% 2,82,933.00

CDN JS 4.16% 2,06,402.00

OSS CDN 3.59% 1,78,093.00

CloudFlare 2.56% 1,27,104.00

Microsoft Ajax CDN 1.97% 97,471.00

Akamai 1.67% 82,949.00

MaxCDN 0.49% 24,381.00

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**Azure Monitor**

● Azure Monitor is a free service that helps increase performance and availability. We

could collect telemetry data from Azure as well as on-premises.

● We could collect the metrics and logs from our resources like VMs. We could even

collect more detailed logs by enabling guest diagnostics and collect OS level

information.

● We can also integrate additionally with **SIEM and ITSM** tools. We could also send

data via event hubs or other services.

● Metrics are available at each resource level or they can be collectively seen at the

Azure Monitor. This way Monitor acts as a central location for all our monitoring

needs like Metrics, logs, alerts and activity logs.

● We also have a section on Insights where we can see more intelligent information for

various resources like *Applications, VMs, Storage Accounts, Containers, Networks,*

*SQL (Preview), CosmosDB, KeyVault, Azure Cache for Redis.*

● We could also see a map of our application and understand how the different

components work together.

At a high level, we do the following:

1. **Monitor & Visualize Metrics**

2. **Query & Analyze Logs**

3. **Setup Alert & Actions**

*Here are some of the components which make up the Azure Monitor*

1) **Inputs** –

a. **Logs** – these are the logs generated by various resources like VMs/ Databases

etc.,

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b. **Metrics** – Metrics provides numbers like *CPU percentage, Network data*

*in/out* which helps us understand performance.

The metrics are stored in a time series DB which helps understand real time

scenarios. With metrics, we can set triggers to scale the resources up and

down. Please see a metric chart below on CPU percentage usage:

**2) Insights**

a. With Insights, we can get a deeper view into the resources. We could see a

map of the resources and get an overall view. Please see below some insights:

**APPLICATION MAP:**

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**STORAGE OVERVIEW**

**KEYVAULT INSIGHTS**

**3) Analyze**

a. **Log Analytics** – We can work with log data from multiple sources with log

analytics. We can perform complex queries with *KQL (Kusto Query Language)*.

We can analyse and act on that data.

b. **Metric Analysis**

**4) Visualize**

a. **Metrics explorer** – interactively work with metric data with metric explorer

b. **Workbooks** – We can use a combination of text, metrics, log queries and

parameters into interactive reports. There are several built-in workbooks

available for use.

c. **Dashboards** – We can add metric graphs and queries output and create

dashboards

**5) Respond**

a. **Alerts** - When there is any issue, then we will get alerts proactively and we

can automatically run *functions, runbooks, webhooks or logic apps.*

b. **AutoScale** – With the metric as inputs, we can set up the system to scale up

or down automatically.

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**Azure Sentinel**

Azure Security Centre provides us with basic visibility and Analytics but Azure Sentinel goes

beyond this and provides complete cybersecurity whereby it is able to provide **visibility/**

**analytics and Hunting/ Incidents** and finally responding to the incidents with automation.

**Initiating Sentinel**

● To initiate the Sentinel service, we need to create or connect **Log Analytic**

**Workspaces**. Once done, you will see the Sentinel Panel.

**Here are the phases of Azure Sentinel:**

**1. Collect data**

a. Azure Sentinel can collect data at cloud scale across the enterprise, both

on-premises and in multiple clouds.

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b. There are **98** data connectors available as of today like **Azure/ AWS** etc and

we can connect to these sources and receive the data. **Examples** of Azure

data are *azure sign-in activity from Azure AD.*

2. **Create Alerts**

a. Once the data is collected, we can run queries against the data. We focus on

what is important using the analytics and create suitable alerts.

b. There are prebuilt workbooks available which can be selected and used to get

insights.

**Workbooks selection**

● We need to select the template and save it and we will be able to get the details.

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**3. Automate and Orchestrate**

**a.** We build automation rules which will automate incident configuration. We

could trigger playbooks to handle security alerts.

**b.** We create rules which will trigger the playbooks to be run automatically

based on the conditions

**Hunting Feature**

**Azure Sentinel** has the hunting feature where we could go further and search for various

activities like listing of storage keys or high **DNS queries** etc.,

This will help us identify attacks targeted and we could go and proactively block the

malicious activity.

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**Sentinel Community**

There is a sentinel community where we can get different types of resources like *Workbooks,*

*Analytics rules, Hunting queries, and Playbooks.*

**Azure Sentinel pricing**

Billing is based on the volume of data ingested for analysis. Azure Sentinel offers a flexible

and predictable pricing model and we could pay either with **Capacity Reservations or**

**Pay-as-you-Go**.

With Capacity Reservations, we can get as much as **60%** less as compared to Pay-as-you-Go.

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**Advanced Threat Protection**

Azure has a product called Azure defender for SQL which is a unified package for advanced

SQL security capabilities. This is designed for the database offerings viz., *Azure SQL*

*Database, Azure SQL Managed Instance, and Azure Synapse Analytics*.

Some of the functionality of the tools include

**● Discovering and Classification of sensitive data**

**● Identifying and mitigating potential database vulnerabilities**

**● Detection of anomalous activities that could be a potential threat**

The tool does 2 major activities. One is *Vulnerability assessment and the other is Advanced*

*Threat Protection.*

Under ATP, the following features are available:

**● Detect anomalous activities**

o Unusual/potentially harmful attempts to access or exploit your database.

**● Continuous monitoring of database for suspicious activities**

**● Immediate security alerts on**

o Potential vulnerabilities

o SQL injection attacks

o Anomalous database access patterns.

**● Recommend action on how to investigate and mitigate the threat.**

**How to Enable ATP:**

● We can enable/disable different type of alerts under ATP

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Under Security settings of the SQL server, we can enable ATP.

● We can see the ATP alerts in the Security Center as it is integrated with it.

● The MYSQL Database server can be configured under Security Option.

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**Azure Information Protection**

AIP helps us classify and protect our documents based on the sensitivity of the data. AIP is

based on **Azure Rights Management (RMS)** which is a cloud based protection technology.

We can look at the lifecycle of data below:

**Lifecycle of data**

**1) Identify/Classify/Tag**

a. In this phase, we identify the data that needs to be protected. There are

two types of data in an organization. *Structured and unstructured*.

b. Data that resides in a database can be classified as structured. Data that

resides on the servers and user systems can be classified as unstructured.

We identify the unstructured data

c. Then we classify the data. Simple classification could be Public data which

is *non-personal and non-confidential.* Likewise we could have confidential

data.

d. Then we need to tag the data

**2) Share and Protect**

a. Once the data is classified and tagged, we encrypt the data. We could

either use cloud key or we could use our own keys

b. Then we grant or revoke access to the data. We could grant *viewing/*

*editing* permissions to different groups as needed

**3) Usage tracking**

a. With RMS, we could track the usage of data

b. We can see who accessed the data from which location and when

c. We can grant or deny access

**4) Revoke access**

a. Once we revoke the access to the data, the users who had access before

cannot access the same data going forward.

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● Below diagram shows the Labels and also the Global Policy.

● The Labels are available as default as seen below. We can create custom labels if

needed to suit our needs.

**AIP lifecycle:**

Here are the practical steps to the same

1) **Subscribe AIP** – We need to have suitable licenses like *AD Premium P1/P2*. There are

other enterprise licenses also like E5.

2) **Azure AD** – We need to integrate with our AD

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3) **AIP Label and Policy** – We need to create labels and then add them to our Policies.

There is a global policy available by default. We can further customize or add our

own Policy.

4) **Install AIP client** – We need to install AIP client on all servers that we want to

manage

5) **Create custom label** – We create custom labels if needed

6) **Revoke Access** – We review and revoke access ending the life of the data managed

**AIP Scanner**

For On-premises setup, we need to install AIP Scanner which does the following:

**1) Discover**

**2) Protect**

**3) Classify**

4) **On-prem repository** – Any folder/drive like c: etc is considered as a repository

***Requirements for AIP Scanner – Windows Server and SQL server***

**Steps for setting up AIP scanner**

**1) Create Profile**

● Settings like manual / automatic scan

● Policy enforcement

● Add Repositories like c:/, f:/docs

**2) Install SQL server**

**3) Run Powershell command and setup AIP Scanner**

● Install-AIPScanner -Sqlinstance “instance name”

-Profile “profile-name”

**4) Setup Access token**

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**Azure DDoS Protection**

**What are DoS and DDoS?**

**DoS** stands for **denial of service** and **DDoS** stands for **distributed denial of service**.

**Scenario:**

*Let’s say that you have a web server serving web traffic and you are a medium enterprise*

*handling* ***1000*** *requests per second. If any malicious entity sends* ***100,000*** *requests per*

*second, your server will be busy trying to respond to the 100K requests and unable to serve*

*the regular customers. This is called* ***Flooding****.*

*Often the load will be so heavy that it will cause the server/machine to crash. This is called*

***denial of service*** *where customers are denied service by rendering the server unusable.*

*Imagine the same* ***100K*** *requests coming from multiple servers where malicious entities do a*

*coordinated attack with multiple servers. This is called* ***distributed denial of service*** *where*

*multiple servers hit a given target to bring it down. We have seen attacks feeding as much as*

***800 Gbps*** *which can bring the biggest servers down.*

**Azure DDoS**

**It** provides protection against DoS attacks with always-on monitoring and automatic network

mitigation.

There are two levels of Service – One is **BASIC** and the other is **STANDARD**. Basic plan is free

and enabled by default. After all, Azure needs to protects its resources😊

Basic plan, like the name says, provides only basic services *(always-on monitoring and*

*automatic network mitigation).*

Standard protection provides multiple features. This could cost you as much as **3000$** to

protect about 100 resources like

*● Azure firewall, App Gateway/WAF*

*● VMs, AKS*

*● SQL, CosmosDB, Storage, App Services etc.*

*● Vnet*

● So, let’s say that a **DoS/DDoS** attack occurs. The Cloud is resilient usually due to the

elasticity and if you have good autoscaling, then the cloud resources will keep scaling

up like VM spinning up, App Service scaling up etc.

● As a result, you will have a lot of traffic and you must be aware that while ingress

traffic is not charged, consumers pay for egress traffic.

● So you will land with a huge compute bill and egress data charges.

● If we had the DDoS standard protection plan, we would be issued credit for the

excessive charges if the plan failed to protect us.

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**Here’s the list of services provided.**

**Some of the features of DDoS Standard protection are:**

● **DDoS Rapid response** – We can engage the **DDRT** (DDoS Rapid Response

Team) for attack investigation and analysis

● **Cost Guarantee** – As discussed, we will be issued a service credit for the

application scale out and excess data transfer

● **Attack alerting/Metrics** - Alerts can be configured to be notified at the

start/stop and logging will be done and metrics provided.

● **Extensive Mitigation Scale** – This works at a global scale and is highly scalable

and can mitigate over 60 types of attacks.

● **Multi-layered protection** – It can protect at different layers (layer 3/4/7)

● **Adaptive tuning** –Let's say there is unusual traffic from an IP and it is

determined as anomalous by the DDoS cognitive services, ddos protection

will automatically deny traffic from the IP and block it.

In addition, we can have our own monitoring to alert when a DDoS attack occurs.

*We can set up this rule in Azure Monitor to notify us that ddos mitigation has started. We*

*can set up an action group and take actions like notifications, isolating the resource for*

*forensics etc.,*

AzureDiagnostics

| where Category == "DDoSProtectionNotifications"

| where type\_s == "MitigationStarted"

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