Microsoft Azure VMs

An Azure virtual machine gives you the flexibility of virtualization without having to buy and maintain the physical hardware that runs it. However, you still need to maintain the virtual machine by performing tasks, such as configuring, patching, and installing the software that runs on it.

Azure VM

- Azure Virtual Machines supports the deployment of Windows or Linux virtual machines (VMs) in a Microsoft Azure datacenter.
- You have total control over the configuration of the VM. You are responsible for all server software installation, configuration, and maintenance and for operating system patches.
- Because of the level of control afforded to the user and the use of durable disks, VMs are ideal for a wide range of server workloads that do not fit into a PaaS model.
- Microsoft offers a **99.95 percent connectivity service level agreement (SLA) for multiple-instance VMs deployed**. That means that for the SLA to apply, there must be at least two instances of the VM deployed within an availability set.

Azure VM

Azure Virtual Machines is priced on a per-hour basis, but it is billed on a per-minute basis. For example, you are only charged for 23 minutes of usage if the VM is deployed for 23 minutes.

The cost for a VM includes the charge for the Windows operating system. Linux-based instances are slightly cheaper because there is no operating system license charge.

The cost, and the appropriate licensing, for any additional software you install is your responsibility. Some VM images, such as Microsoft SQL Server, you acquire from the Azure Marketplace may include an additional license cost (on top of the base cost of the VM).

Lab -2

CREATE VIRTUAL MACHINES

Azure PowerShell

Azure PowerShell

- ✓ Azure PowerShell is a command-line interface (CLI) tool that allows users to manage and automate Azure resources using PowerShell scripting language.
- ✓ It provides a set of cmdlets (commands) specifically designed to interact with Azure services and resources.
- ✓ Azure PowerShell interacts with the Azure management API to execute commands and manage resources.
- ✓ It can be installed as a module within PowerShell and provides a consistent and intuitive way to manage Azure resources across different Azure services.

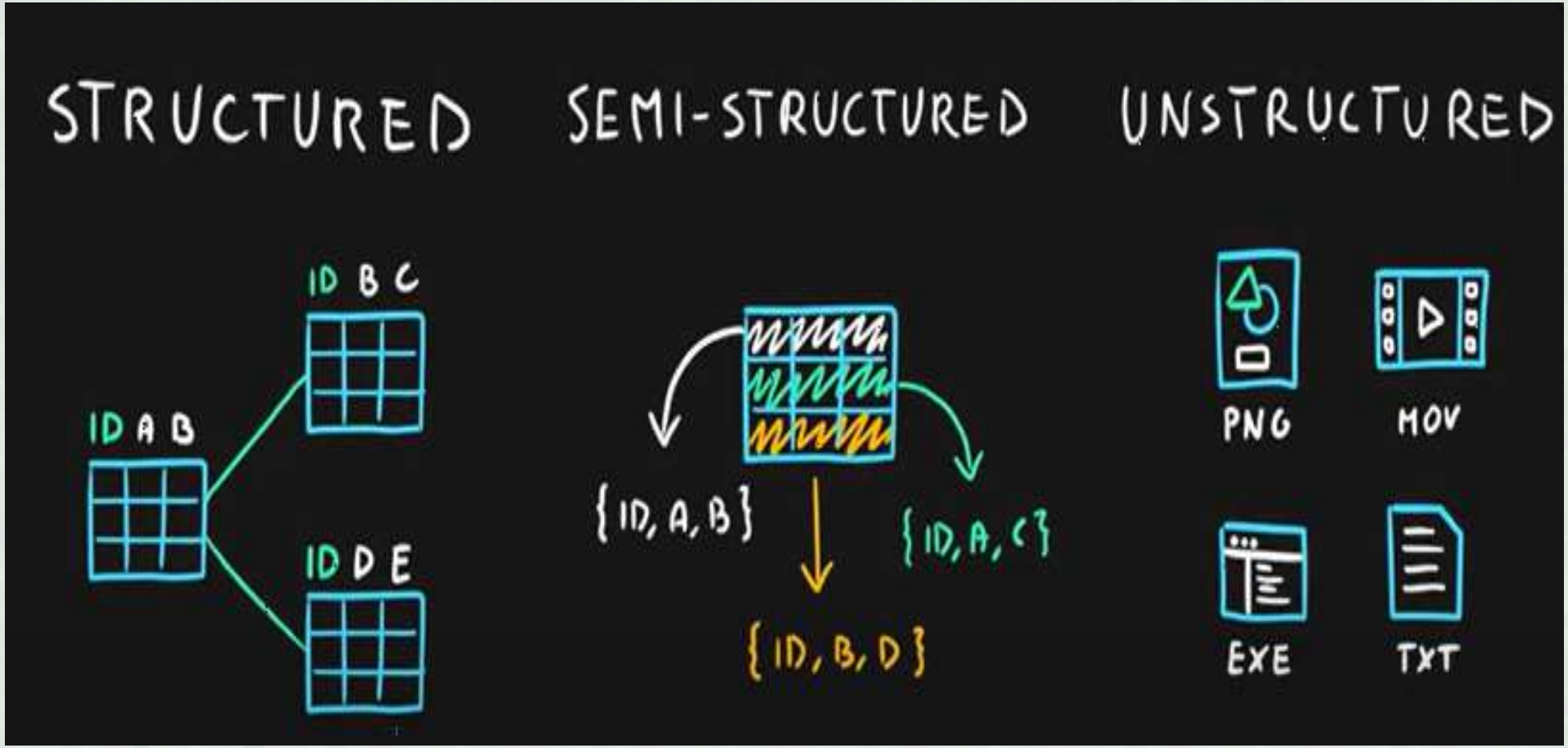
Azure PowerShell

Some common tasks you can perform with Azure PowerShell include:

- ✓ Creating and managing Azure virtual machines
- ✓ Managing Azure storage accounts and blobs
- ✓ Configuring Azure virtual networks and subnets
- ✓ Deploying and managing Azure resource groups
- ✓ Managing Azure Active Directory resources
- ✓ Configuring and managing Azure App Services
- ✓ Managing Azure SQL databases and other data services

Azure Storage Service

Types of Data



Azure Storage Service

- Azure Storage, managed by Microsoft, is one of the top cloud storage services that provide reliable and simplified storage services.
- Azure Storage offers storage services that are enormously scalable, accessible, and durable.
- The storage services include storage structures for data objects, disks for virtual machines, message storage for messaging and communication, file storage for cloud-based and on-site file systems, and NoSQL storage.

Azure Storage Account Types

- Azure Storage offers two kinds of storage services to its customers:
- Standard Storage
- Premium Storage.

Standard Storage Account

The standard plan includes –

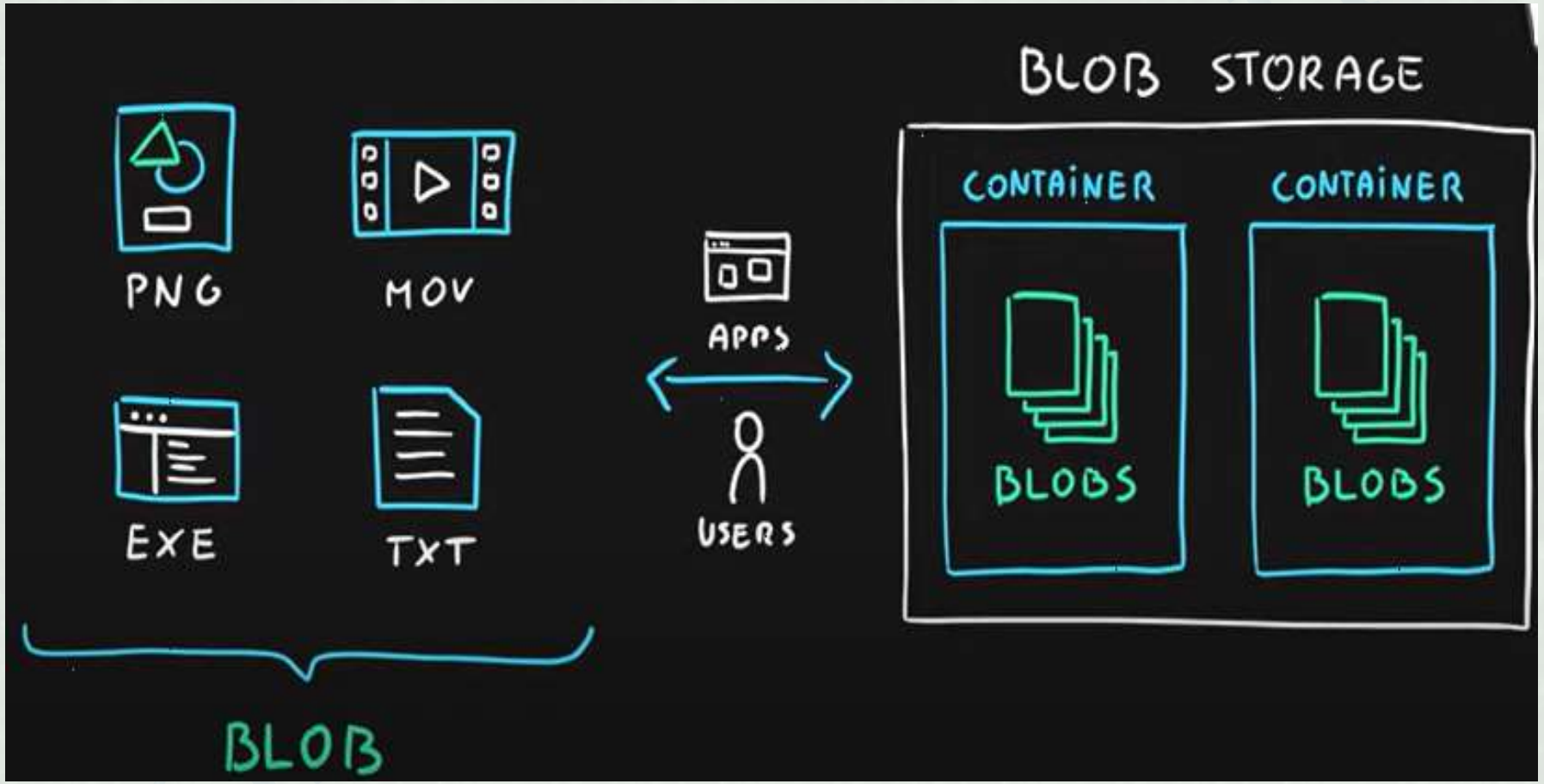
- **Blob**
- **Table**
- **File**
- **Queue storage.**

Let's have a look at each one in detail to understand the primary differences.

Blob Storage

- The first type of storage facility is Blob Storage.
- Blob Storage refers to storage for unstructured data.
- This type of data could include videos, images, audio files, raw data, logs, and documents.
- users can also store backup data.
- Similar to AWS S3, the data in Blob Storage is stored in a directory structure known as “Container”.
- The maximum size of the blob is 500 TB. Blob Storage consists of three kinds of blobs: block, append, and backup blobs.

Blob Storage



Lab -4

CREATE STORAGE ACCOUNT

Lab -5

CREATE A BLOB INSIDE STORAGE ACCOUNT AND UPLAOD A FILE

File Storage

- Azure File Storage is a storage service meant for legacy applications and data.
- It is an organized storage structure the enables file sharing across the cloud for on-premise environments. Azure VMs access Azure File storage to share their data.
- On the other hand, on-premise applications access the Azure File storage using REST API.

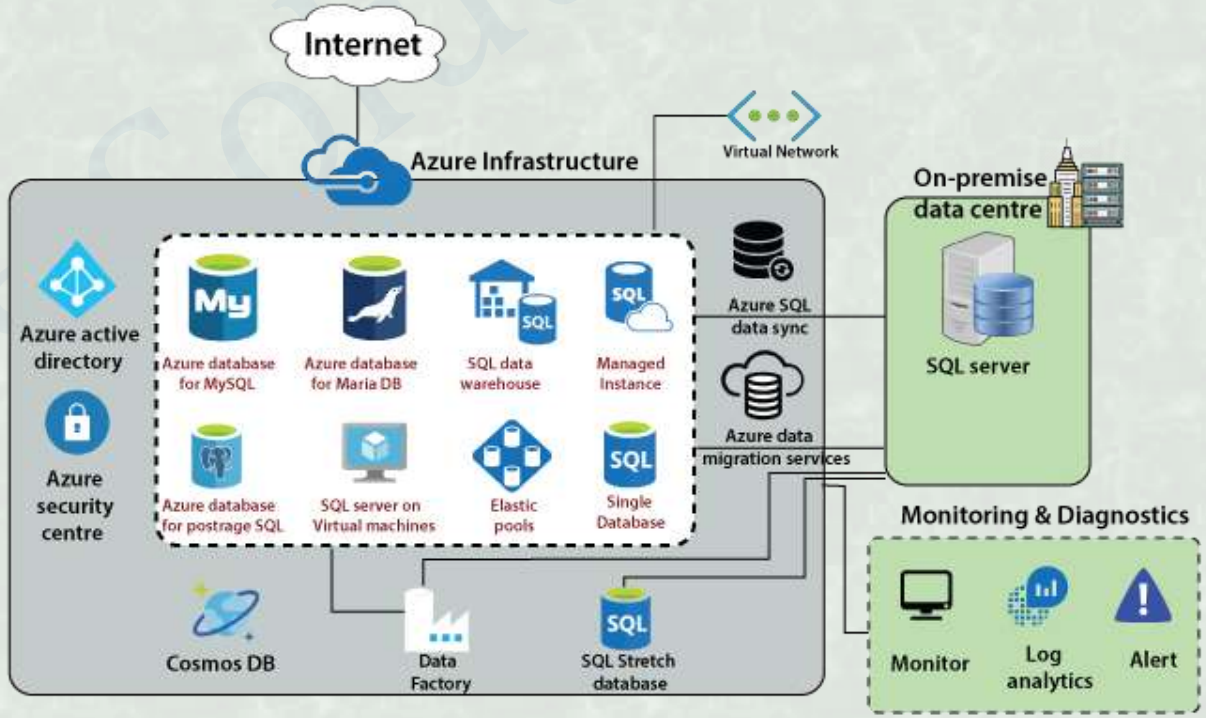
Table and Queue Storage

- **Table Storage:** Azure Tables, as the name implies, refers to the tabular data structure. This kind of structure is suitable for the data in key-value pairs. Azure Tables are easy to use and provide scalability to a massive level. Using the REST API, the data stored in the tables can be accessed easily.
- **Queue Storage:** The last type of storage service for Standard Account is Queue Storage. This service is mostly suitable for exchanging messages and facilitating communication between various Azure components. These components could be on Azure cloud or on-premise. The messages are communicated via HTTP or HTTPS protocol.

Azure RDS Services

Azure Database Services

- Azure SQL/NoSQL databases are one of the basic and fundamental building blocks offered by Microsoft Azure as part of its fully managed services.
- Azure provides various SQL/NoSQL servers and traditional SQL database tools to make database migration simple, guided and automated with a single click from the Azure portal. Users can simply deploy one or more databases to virtual machines or apps as part of Azure's shared elastic pools by using various database services.



Azure Database Services

- Microsoft Azure Database is a fully managed database platform that can be used as a platform as a service (Paas) to monitor and manage database functions such as backups, patches, and upgrades automatically.
- It reduces user intervention and allows customers to manage their data more easily on-premise or in virtual machines.
- Users may quickly migrate their SQL databases from various on-premises and machines to SQL without any difficult configuration and manage the moved instance thanks to Azure's global data centers.
- Microsoft's Azure infrastructure includes databases such as MySQL, PostgreSQL, and Elastic Pool.
- Azure also maintains SQL Server on virtual machines and SQL data warehouse in its managed platform on Azure as part of database services, as well as MariaDB and Cosmos DB

Azure SQL Database

- Microsoft Azure SQL Database is a relational database-as-a-service that is reliable and secure, and it gives high performance without having to worry about any infrastructure. It supports relational, JSON, XML, and spatial data structures.

Azure Cosmos Database

- It’s a NoSQL database that Azure uses to store structured, unstructured, and semi-structured data.
- The Azure Cosmos database is highly available (99.999%), dynamically scalable, and has very low latency for loading and retrieving data.
- The Cosmos database aids in the management of real-time data with massive changes that are controlled using big data technology.
- Users can enable the cosmos database service with a single button and save data across global areas, making it a globally distributed and multi-modal database.
- Because it is a NoSQL database, it does not require schema or index management because the database engine manages the schema automatically.
- As a result, there is no application downtime because Cosmos DB indexes the data automatically. It features built-in security, and by default, all data is encrypted.

Azure Cosmos Database

Cosmos DB has the following use cases:

- **IoT and Telematics**: Enables real-time data and processing bursts.
- **Retail and Marketing**: Data and event sources from catalogs are supported.
- **Gaming:** Low-latency needs, massive request bursts, and social graphs are all supported.
- **Web and Mobile Applications**: Supports sophisticated data types and flexible schema, which are required for social applications and personalization.

Azure Virtual Network

Azure Virtual Network

- The Azure Virtual Network is a logical representation of the network in the cloud. So, by creating an Azure Virtual Network, we can define our private IP address range on Azure, and also deploy different kinds of Azure resources. For Example - Azure virtual machine, App service environment, Integration service environment, etc.

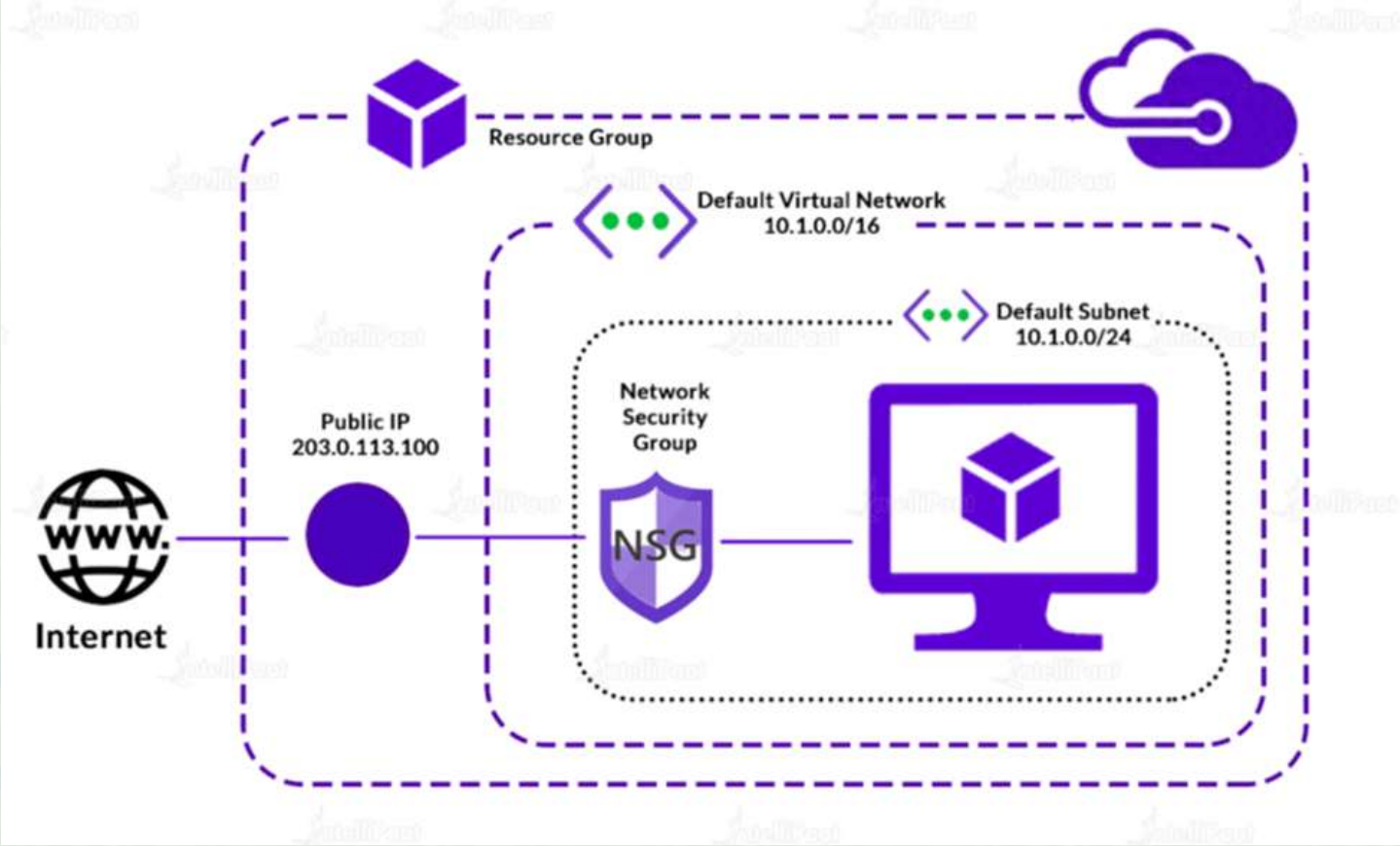
Azure Virtual Network Components

1. Subnets
2. IP addresses
3. Network Security Groups (NSG)
4. Firewall
5. Load balancing
6. Routing tables

Lab : Create a Virtual Network

Azure Network Security Group

A network security group contains security rules that allow or deny inbound network traffic to, or outbound network traffic from, several types of Azure resources. For each rule, you can specify source and destination, port, and protocol.



Azure Network Security Group

Some key features and capabilities of Azure Network Security Groups:

1.Traffic filtering:

2.Subnet and resource-level security

3.Prioritization of rules

4.Application security groups

5.Logging and monitoring

6.Integration with other Azure services

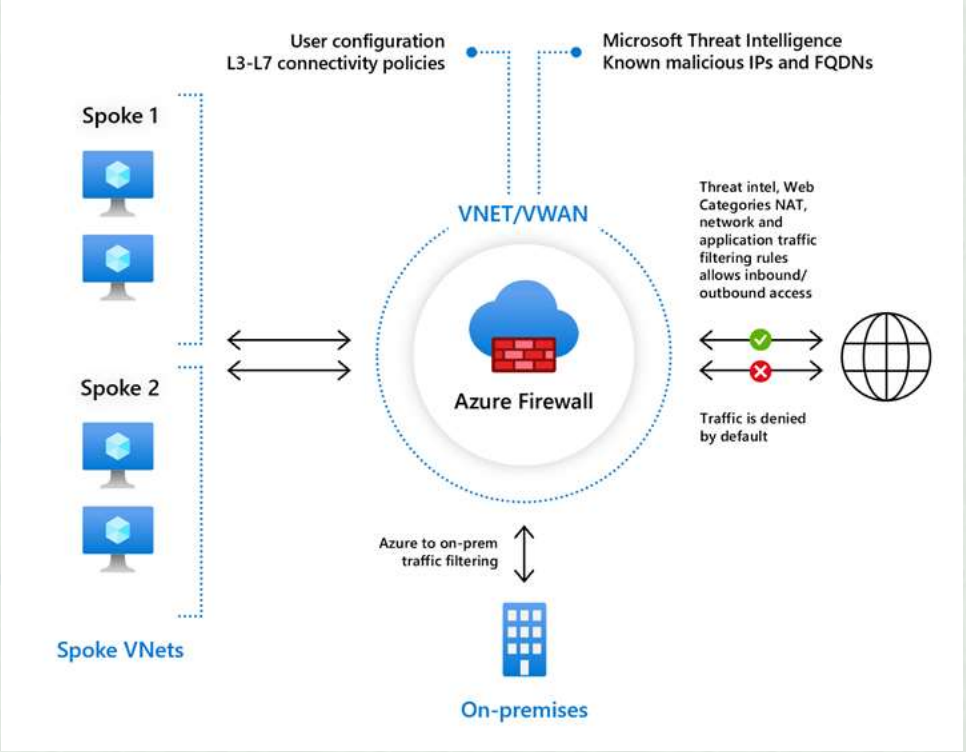
Azure Bastion

- Azure Bastion is a fully managed service that provides more secure and seamless Remote Desktop Protocol (RDP) and Secure Shell Protocol (SSH) access to virtual machines (VMs) without any exposure through public IP addresses.
- Secure and seamless RDP and SSH access to your virtual machines.
- No Public IP exposure on the VM.
- Help limit threats such as port scanning and other types of malware targeting your VMs.
- Uses a modern HTML5-based web client and standard SSL ports. This makes Firewall and other security rules very easy to manage.
- Fixed charge for the service. This is the charge billed hourly for deploying the service. E.g. in an East US location, this charge is around $0.19 per hour.

Azure Firewall

Azure Firewall is a cloud-based network security service provided by Microsoft Azure.

It acts as a barrier between your Azure virtual networks and the internet, allowing you to control and inspect network traffic that flows in and out of your virtual networks.



Azure Firewall

Azure Firewall operates at the network and application layers, providing advanced filtering and threat protection capabilities.

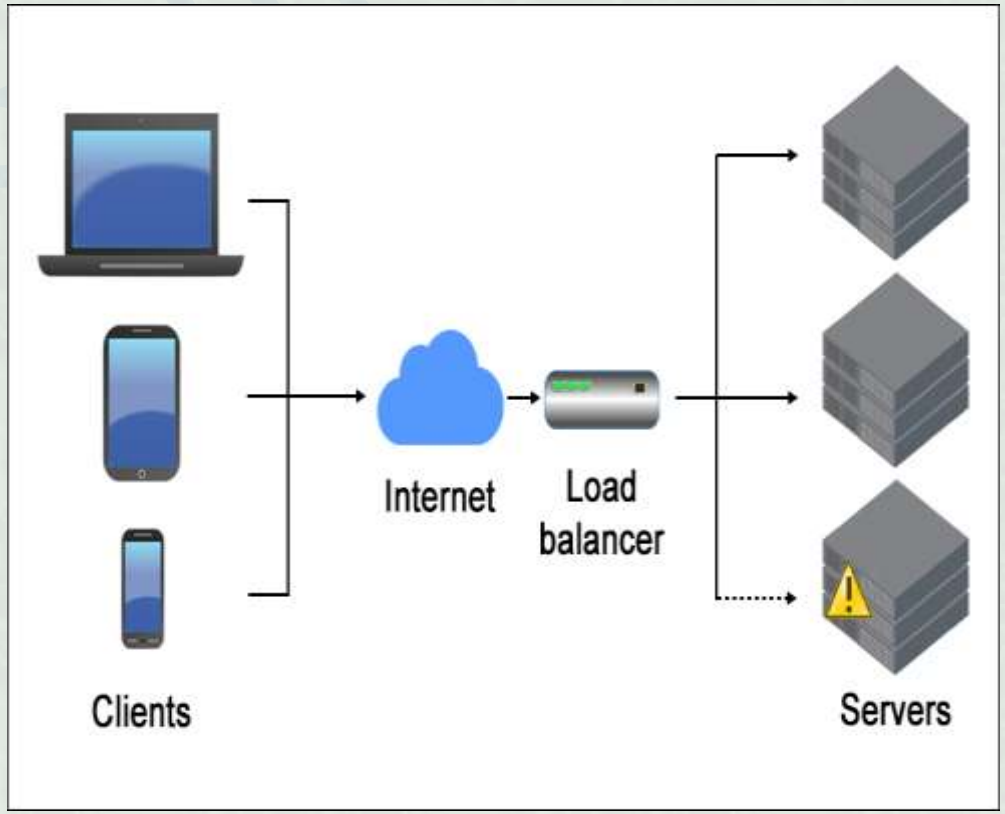
It offers the following features:

1. Network filtering
2. Application-level filtering
3. Threat intelligence-based filtering.
4. Outbound connectivity
5. High availability and scalability
6. Integration with Azure services

Azure Load Balancer

Azure load balancer

1. Azure load balancer allows you to distribute traffic to your backend virtual machines.
2. An Azure load balancer provides high availability for your application.
3. The Azure load balancer is a fully managed service itself.
4. A load balancer provides low latency and high throughput and scales up to millions of flows for all TCP and UDP applications.
5. Azure Load Balancer operates at layer 4 of the Open Systems Interconnection (OSI) model.



Azure load balancer

Key scenarios that you can accomplish using Azure Standard Load Balancer include:

1. Load balance internal and external traffic to Azure virtual machines.
2. Increase availability by distributing resources within and across zones.
3. Configure outbound connectivity for Azure virtual machines.
4. Use health probes to monitor load-balanced resources.
5. Employ port forwarding to access virtual machines in a virtual network by public IP address and port.
6. Enable support for load-balancing of IPv6.
7. Load balance services on multiple ports, multiple IP addresses, or both.
8. Move internal and external load balancer resources across Azure regions.
9. Load balance TCP and UDP flow on all ports simultaneously using HA ports.
10. Chain Standard Load Balancer and Gateway Load Balancer.

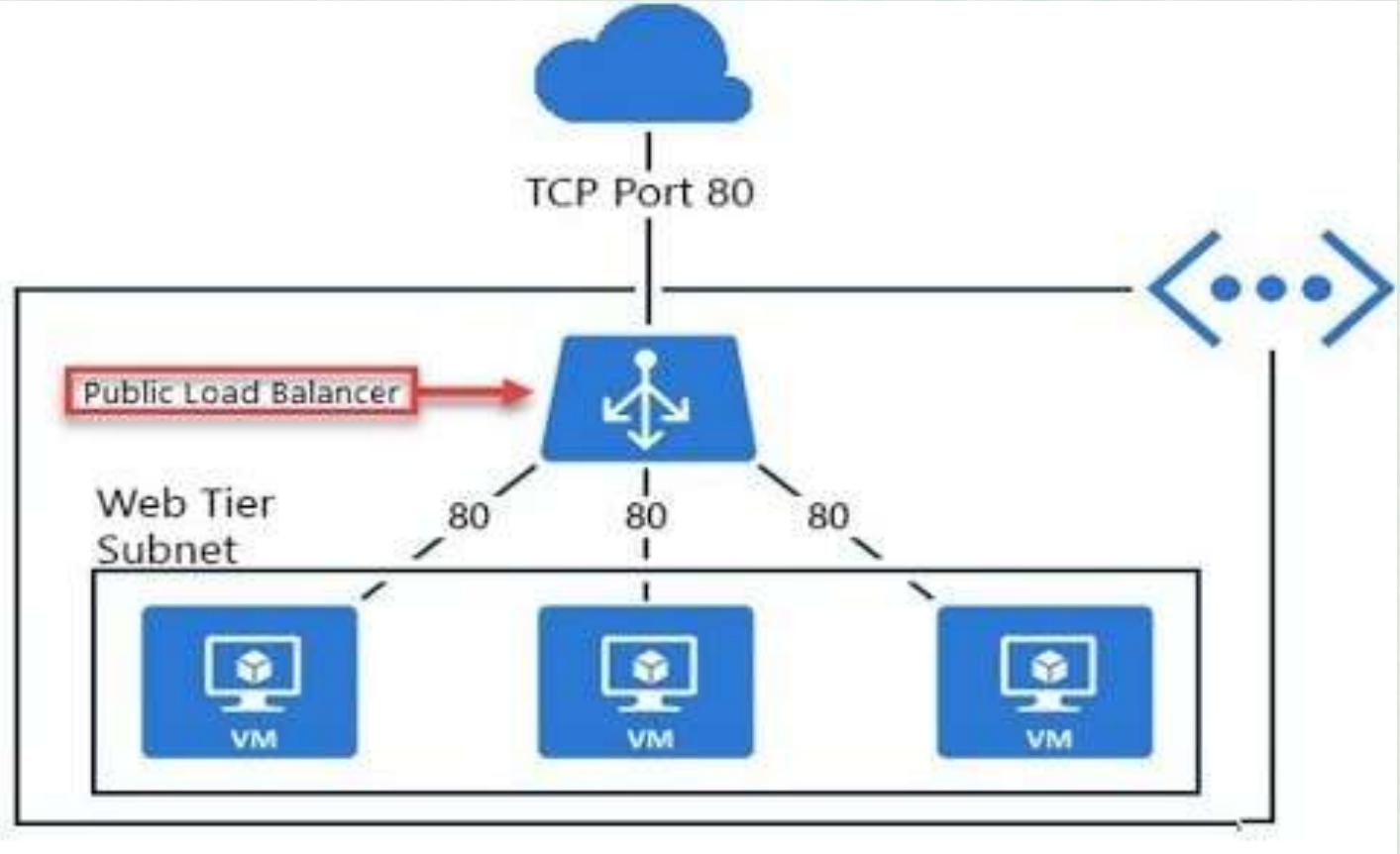
Types of Load Balancer

In Azure, you can create two types of the **load balancer**

1. Public load balancer
2. Internal/ private load balancer

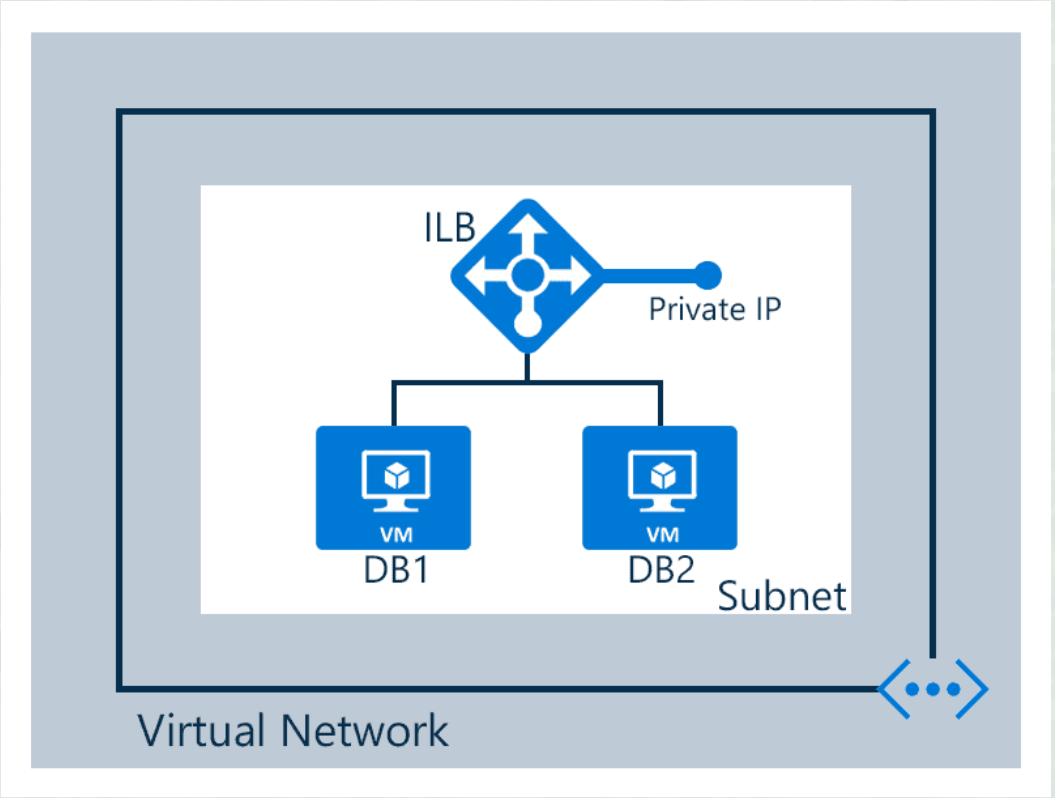
Public load balancer

A **public load balancer** can be used to load balance **internet traffic** to virtual machines. It can provide **outbound connections** for virtual machines (VMs) inside your virtual network.



Internal load balancer

An **internal (or private) load balancer** is used to balance traffic from **within a virtual network**.

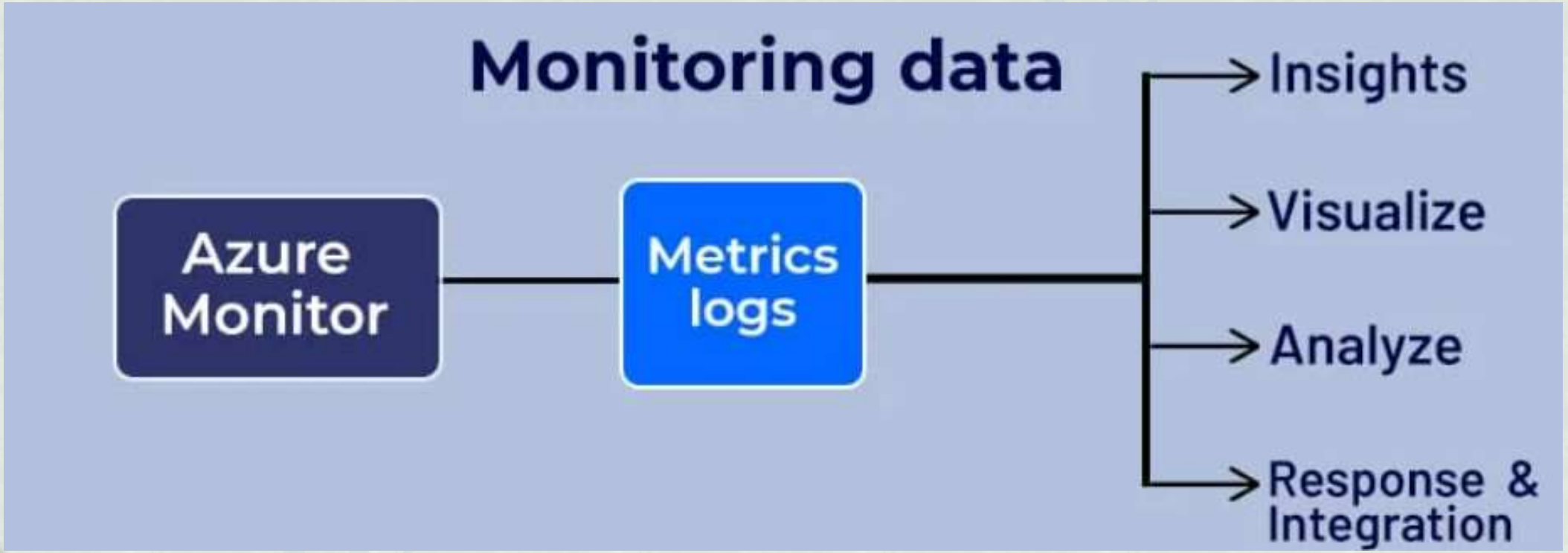


Azure Monitoring & Logging

Microsoft Azure Monitor

- Microsoft Azure Monitor is a tool that collects and analyzes data about the various Azure resources and the infrastructure on which these resources are run. Azure Monitor offers a one stop solution to store and analyze data about the working of various resources.

How Microsoft Azure Monitor Work



Lab : Azure Monitor

Serverless Computing

Serverless computing

- Serverless computing enables developers to build applications faster by eliminating the need for them to manage infrastructure.
- With serverless applications, the cloud service provider automatically provisions, scales, and manages the infrastructure required to run the code.

Top benefits of serverless computing

- **No infrastructure management** : Using fully managed services enables developers to avoid administrative tasks and focus on core business logic. With a serverless platform, you simply deploy your code, and it runs with high availability.

- **Dynamic scalability** : With serverless computing, the infrastructure dynamically scales up and down within seconds to match the demands of any workload.

- **Faster time to market** : Serverless applications reduce the operations dependencies on each development cycle, increasing development teams' agility to deliver more functionality in less time.

- **More efficient use of resources** : Shifting to serverless technologies helps organizations reduce TCO and reallocate resources to accelerate the pace of innovation.

App Service

- App Service is a Platform as a Service (PaaS) offering from Microsoft.
- Azure App Services provide a hosting service that developers can use to develop mobile or web apps.
- Azure Web Apps provides a platform to build an app in Azure without having to deploy, configure and maintain your own Azure VM's.
- You can build Web App using the ASP.NET, PHP, Node.js and Python.
- They also integrate common development environments like Visual Studio and GitHub.
- You need to pay for the Azure compute resources you use.

Azure Web Apps Features

- Multiple Languages and Frameworks
- Global Scale and Availability
- Easy Deployment
- Security and Compliance.
- Visual Studio Integration.
- API and Mobile Features.
- Serverless Code
- Managed Production Environment
- Application Templates

Datasets

Datasets represent data structures within the data stores, which simply point to or reference the data you want to use in your activities as inputs or outputs.

Linked services

Linked services are much like connection strings, which define the connection information that's needed for Data Factory to connect to external resources.

A linked service defines the connection to the data source, and a dataset represents the structure of the data. For example, an Azure Storage-linked service specifies a connection string to connect to the Azure Storage account.

Linked services

Linked services are used for two purposes in Data Factory:

- To represent a data store that includes, but isn't limited to, a SQL Server database, Oracle database, file share, or Azure blob storage account.

- To represent a compute resource that can host the execution of an activity. For example, the HDInsightHive activity runs on an HDInsight Hadoop cluster.

Azure Virtual Network

Azure Virtual Network

- *Azure virtual networks* enable Azure resources, such as VMs, web apps, and databases, to communicate with each other, with users on the internet, and with your on-premises client computers.

Azure virtual networks provide the following key networking capabilities:

- Isolation
- Internet communications
- Communicate between Azure resources
- Communicate with on-premises resources
- Connect virtual networks

- https://learn.microsoft.com/en-gb/training/modules/azure-networking-fundamentals/azure-virtual-network-fundamentals

Element of Azure Virtual Network

- Subnet
- Routing
- Network Security Group
- Address space
- Regions.
- Subscription

Why use an Azure Virtual network

- Azure virtual network enables Azure resources to securely communicate with each other, the internet, and on-premises networks. Key scenarios that you can accomplish with a virtual network include - communication of Azure resources with the internet, communication between Azure resources, communication with on-premises resources, filtering network traffic, routing network traffic, and integration with Azure services.

Communicate between Azure resources

- Through a virtual network
- Through a virtual network service endpoint
- Through VNet Peering

Virtual network peering

Azure supports the following types of peering:

- Virtual network peering: Connecting virtual networks within the same Azure region.
- Global virtual network peering: Connecting virtual networks across Azure regions.

Virtual Network service endpoints

- Virtual Network (VNet) service endpoint provides secure and direct connectivity to Azure services over an optimized route over the Azure backbone network. Endpoints allow you to secure your critical Azure service resources to only your virtual networks. Service Endpoints enables private IP addresses in the VNet to reach the endpoint of an Azure service without needing a public IP address on the VNet.

Lab
VNet Configuration

Azure Key Vault

- Azure Key Vault is a cloud service for securely storing and accessing secrets. A secret is anything that you want to tightly control access to, such as API keys, passwords, certificates, or cryptographic keys.

Configure, Validate, and Deploy ARM Templates

ARM Templates

- The ARM template is a JavaScript Object Notation (JSON) file that defines the infrastructure and configuration for your project.

```
"resources": [
 {
  "type": "Microsoft.Storage/storageAccounts",
  "apiVersion": "2019-04-01",
  "name": "mystorageaccount",
  "location": "westus",
  "sku": {
   "name": "Standard_LRS"
  },
  "kind": "StorageV2",
  "properties": {}
 }
]
```

Lab : Launching VM using ARM Templates