

Module 02: Azure Compute Services

1.Virtual Machine, App Services, Functions, ACI,AKS

A. Virtual Machines

- Infrastructure as a Service (**IaaS**)
- **Total control over** the **operating system and the software**
- Supports marketplace and custom images
- Best suited for
 - Custom software requiring custom system configuration
 - **Lift-and-shift scenarios**
- Can run any application/scenario
 - web apps & web services,
 - databases,
 - desktop applications,
 - jumpboxes,
 - gateways, etc.

Virtual machines

FIS (fisglobal.onmicrosoft.com)

+ Create

Switch to classic

Reservations

Manage view

Refresh

Export to CSV

Open query

Assign tags

Start

Restart

Stop

Delete

Services

Maintenance

Filter for any field...

Subscription equals FIS Global - CIO - Dev - North America 2

Type equals all

Resource group equals all

Location equals all

Add filter

Showing 1 to 7 of 7 records.

No grouping

List view

<input type="checkbox"/>	Name ↑↓	Subscription ↑↓	Resource group ↑↓	Location ↑↓	Status ↑↓	Operating system ↑↓	Size ↑↓	Public IP address ↑↓	Disks ↑↓	
<input type="checkbox"/>	vwmazapac1host	FIS Global - CIO - Dev - Nort...	FIS-ASSET-FINANCE-NA2	East US 2	Stopped (deallocated)	Windows	Standard_D16s_v3	-	2	...
<input type="checkbox"/>	vwmazcnh64bckup	FIS Global - CIO - Dev - Nort...	FIS-ASSET-FINANCE-NA2	East US 2	Stopped (deallocated)	Windows	Standard_D16ds_v4	-	2	...
<input type="checkbox"/>	vwmazcxoptapp	FIS Global - CIO - Dev - Nort...	FIS-ASSET-FINANCE-NA2	East US 2	Stopped (deallocated)	Windows	Standard_F4s_v2	-	1	...
<input type="checkbox"/>	vwmazemea1host	FIS Global - CIO - Dev - Nort...	FIS-ASSET-FINANCE-NA2	East US 2	Stopped (deallocated)	Windows	Standard_D16s_v3	-	2	...
<input type="checkbox"/>	vwmazemea2tb1st	FIS Global - CIO - Dev - Nort...	FIS-ASSET-FINANCE-NA2	East US 2	Stopped (deallocated)	Windows	Standard_D16ds_v4	-	2	...
<input type="checkbox"/>	vwmazna001host	FIS Global - CIO - Dev - Nort...	FIS-ASSET-FINANCE-NA2	East US 2	Stopped (deallocated)	Windows	Standard_D16s_v3	-	2	...
<input type="checkbox"/>	vwmaznvstrdp	FIS Global - CIO - Dev - Nort...	FIS-ASSET-FINANCE-NA2	East US 2	Running	Windows	Standard_D4s_v3	-	2	...

Virtual machines

FIS (fisglobal.onmicrosoft.com)

+ Create

Switch to classic

...

Filter for any field...

Name ↑↓

vwmazapac1host

vwmazcnh64bckup

vwmazcxoptapp

vwmazemea1host

vwmazemea2tb1st

vwmazna001host

vwmaznvstrdp

Overview

Activity log

Access control (IAM)

Tags

Diagnose and solve problems

Connect

Networking

Settings

Disks

Extensions + applications

Operating system

Configuration

SQL Server configuration

Advisor recommendations

Properties

Locks

Availability + scale

vwmazemea1host

Virtual machine

Search

Connect

Start

Restart

Stop

Hibernate

Capture

Delete

Refresh

Open in mobile

Feedback

CLI / PS

Advisor (1 of 1): Right-size or shutdown underutilized virtual machines →

Essentials

Resource group (move) : FIS-ASSET-FINANCE-NA2

Status : Stopped (deallocated)

Location : East US 2

Subscription (move) : FIS Global - CIO - Dev - North America 2

Subscription ID : 89e05d73-8862-4007-a700-0f895fc0f7ea

Operating system : Windows

Size : Standard D16s v3 (16 vcpus, 64 GiB memory)

Public IP address : -

Virtual network/subnet : SDL-INFRASTRUCTURE-EAST2-VNET-NA2/SDL-LEVERAGED-SNET

DNS name : -

Health state : -

Time created : 4/16/2024, 6:19 PM UTC

Tags (edit) : BUC : 4001.515310.9839..0000.0000.3121 RBU : Ambit Asset Finance (AAF) REQUESTOR : Timothy Specht RSV : NA SNOW : SCTASK24007393938

JSON View

Properties

Monitoring

Capabilities (7)

Recommendations (1)

Tutorials

Virtual machine

Computer name : vwmazemea1host

Operating system : Windows

VM generation : V1

VM architecture : x64

Hibernation : Disabled

Host group : -

Networking

Public IP address : -

Public IP address (IPv6) : -

Private IP address : 10.7.149.26

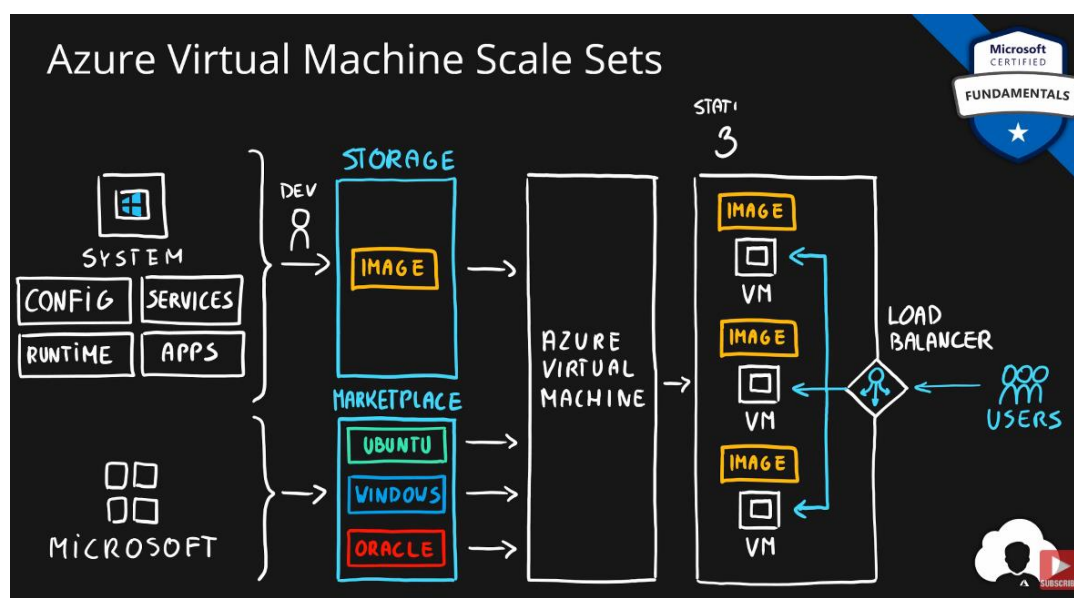
Private IP address (IPv6) : -

Virtual network/subnet : SDL-INFRASTRUCTURE-EAST2-VNET-NA2/SDL-LEVERAGED-SNET

DNS name : -

B. Virtual Machine Scale Sets

- Infrastructure as a Service (**IaaS**)
- Set of identical virtual machines
- **Built-in auto scaling features**
- Designed for manual and auto-scaled workloads like web services,* batch processing, etc.



C. Azure Kubernetes Service (AKS)

- Open-source container orchestration platform
- Platform as a Service
- Highly scalable and customizable
- Designed for high scale container deployments (anything really!)

D. App Service

- Designed as enterprise grade web application service
- Platform as a Service
- Supports multiple programming languages and containers

E. Containers

- Use host's operating system
- Emulate operating system (VMs emulate hardware)
- Lightweight (no O/S)
 - Development Effort
 - Maintenance
 - Compute & storage requirements
- Respond quicker to demand changes
- Designed for almost any scenario

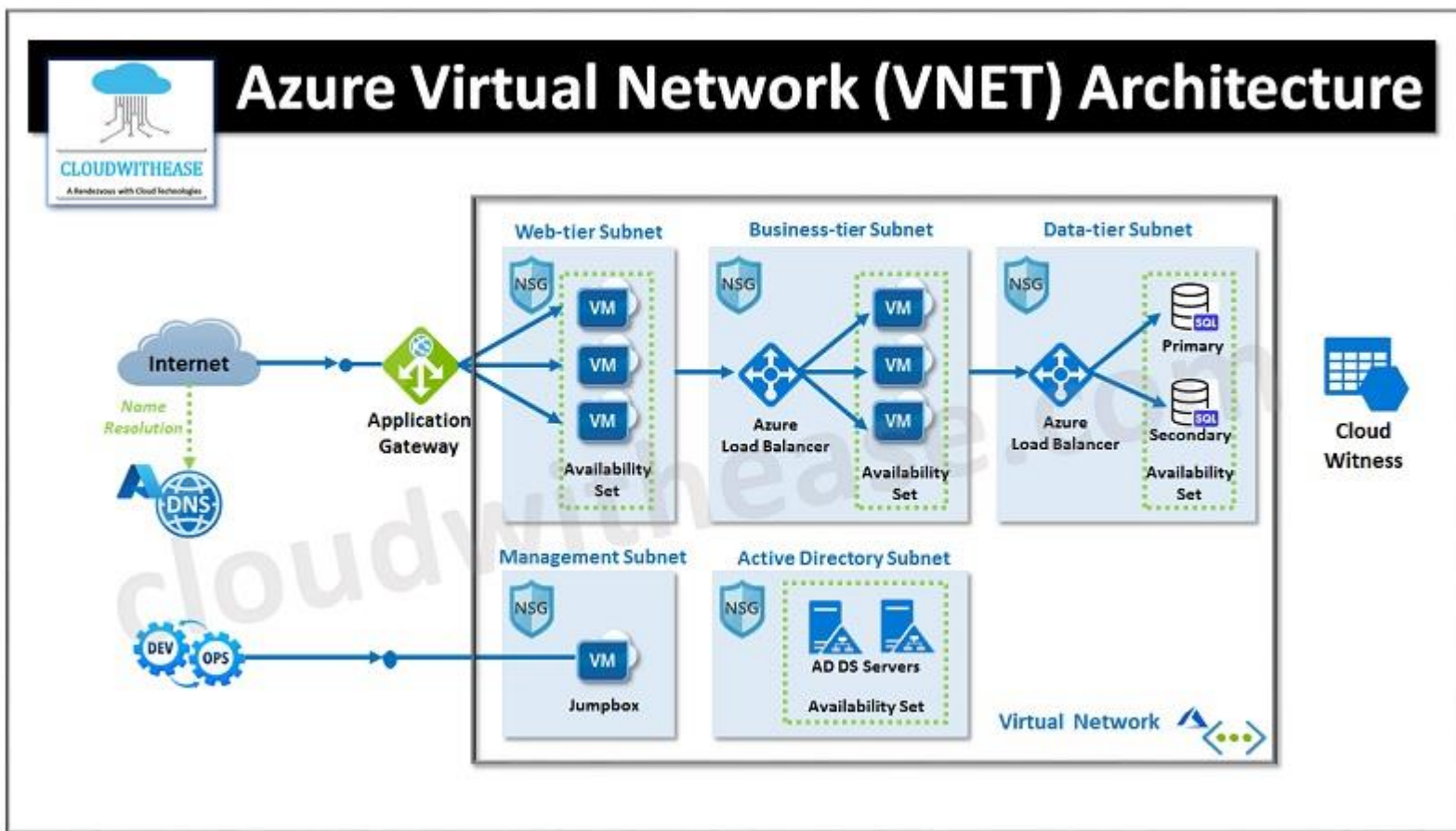
Summary:

- **Virtual Machines (IaaS)** - Custom software, custom requirements, very specialized, high degree of control
- **VM Scale Sets (IaaS)** - Auto-scaled workloads for VMs
- **Container Instances (PaaS)** - Simple container hosting, easy to start
- **Kubernetes Service (PaaS)** - Highly scalable and customizable * container hosting platform
- **App Services (PaaS)** - Web applications, a lot of enterprise web * hosting features, easy to start
- **Functions (PaaS) (Function as a Service) (Serverless)** - micro/nano-services, excellent consumption-based pricing, easy to start

2. Azure Networking Services

A. Azure Virtual Network

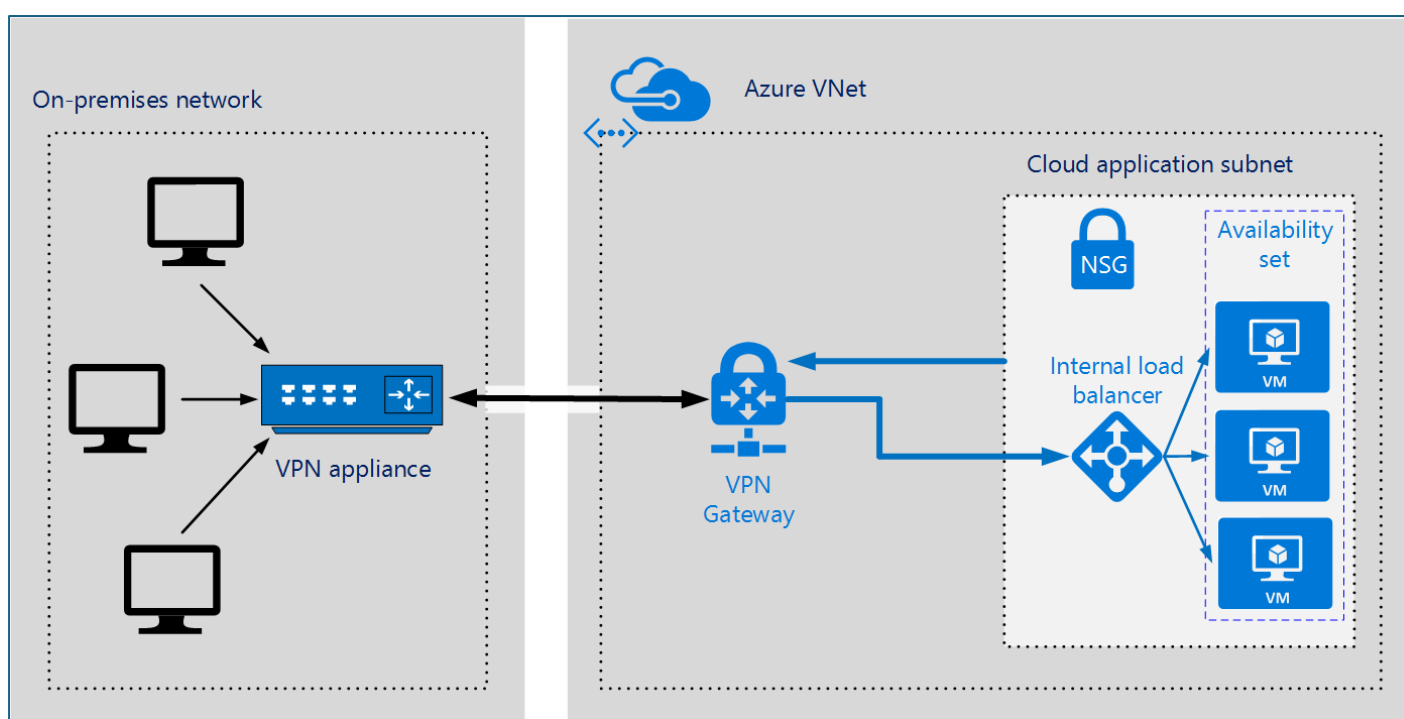
- Emulation of physical networking infrastructure
- Designed for isolation, segmentation, communication, filtering, routing between resources (internet and on-premises)
- Scoped to a single region
- VNet Peering or VPN Gateway allow cross VNet communication
- Segmented into one or more subnets
- Subnets are discrete sections used for
 - effective address allocation and
 - network filtering via Network Security Groups (NSG) or Application Security Groups (ASG)



<https://cloudwithease.com/azure-virtual-network-vnet/>

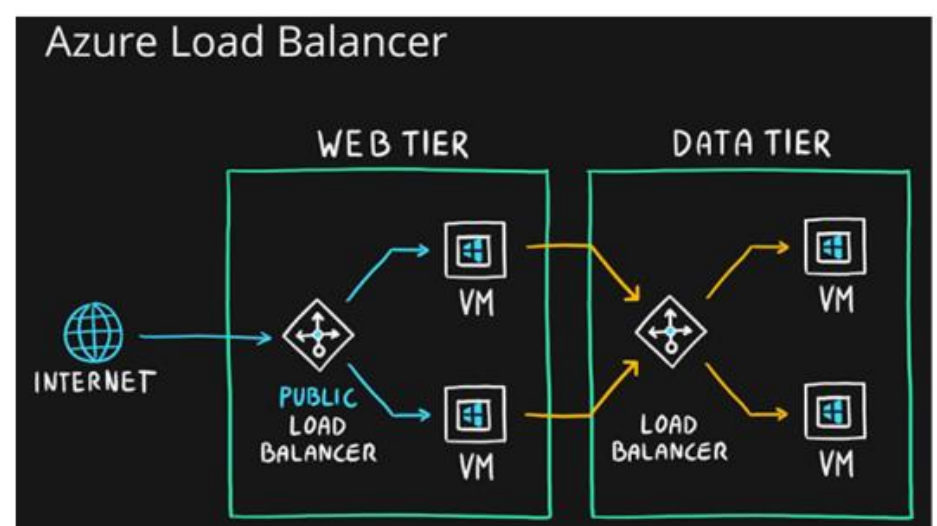
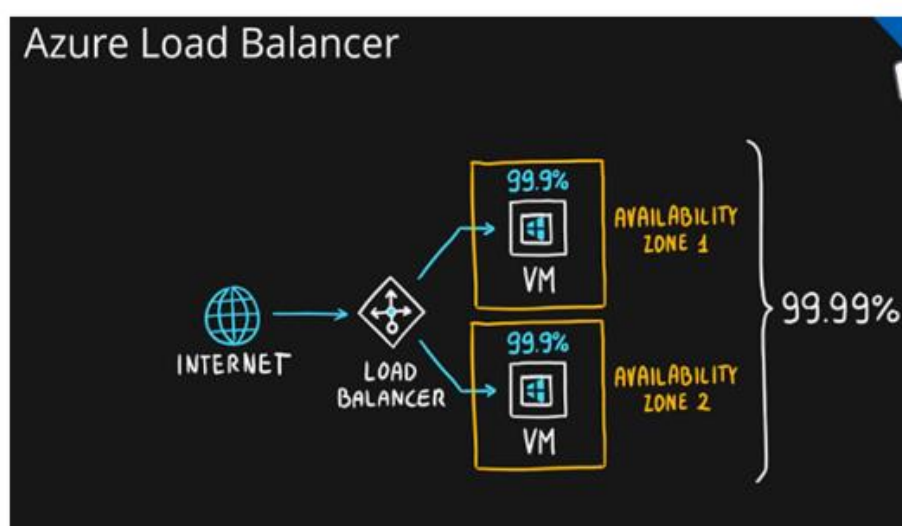
B. VPN Gateway

- Specific type of virtual network gateway for on-premises to azure traffic over the public internet



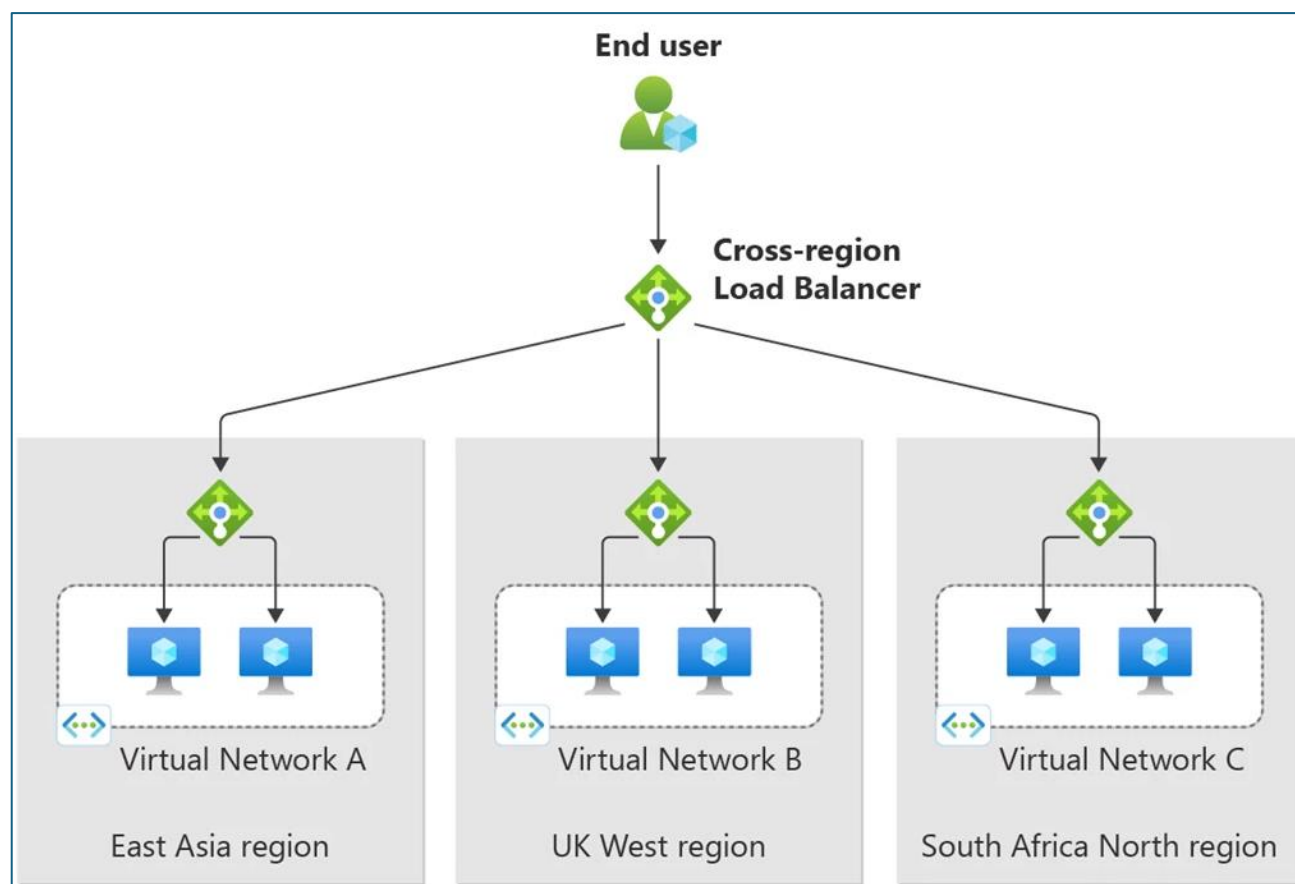
<https://www.oakridgeit.com/blog1>

C. Azure Load Balancer



- Even traffic distribution
- Supports both inbound and outbound scenarios
- High-availability scenarios
- Both TCP (transmission control protocol) and UDP (user datagram protocol) applications

- Internal and External traffic
- Port Forwarding
- High scale with up to millions of flows



D. Application Gateway

- Web traffic load balancer
- Web application firewall
- Redirection
- Session affinity
- URL Routing
- SSL termination

E. Content Delivery Network

- Define content
- Minimize latency
- POP (points of presence) with many locations

3. Azure Storage Services

A. Storage Account

- Group of services which include
 - **blob storage**,
 - **queue storage**,
 - **table storage**, and
 - **file storage**
- Used to store
 - files,
 - messages, and
 - semi-structured data
- Highly scalable (up to petabytes of data)
- Highly durable (99.999999999% - 11 nines, up to 16 nines)
- Cheapest per GB storage

B. Blob Storage

- **BLOB** – **binary large object** – file
- Designed for storage of files of any kind

- Three storage tiers
 - **Hot** – frequently accessed data
 - **Cool** – infrequently accessed data (lower availability, high durability)
 - **Archive** – rarely (if-ever) accessed data

Azure Blob Storage

Storage for data as binary large objects (BLOBs)

Block blobs

- Large, discrete, binary objects that change infrequently
- Blobs can be up to 4.7 TB, composed of blocks of up to 100 MB
 - A blob can contain up to 50,000 blocks

Page blobs

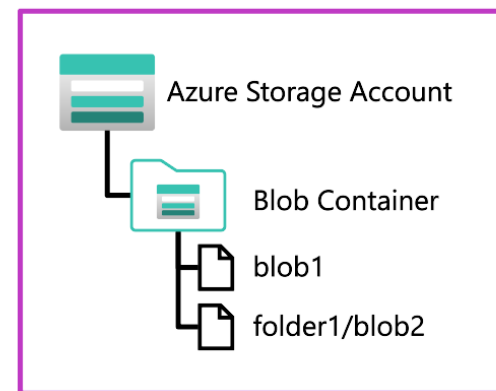
- Used as virtual disk storage for VMs
- Blobs can be up to 8 TB, composed of fixed sized-512 byte pages

Append blobs

- Block blobs that are used to optimize append operations
- Maximum size just over 195 GB – each block can be up to 4 MB

Per-blob storage tiers

- Hot – Highest cost, lowest latency
- Cool – Lower cost, higher latency
- Archive – Lowest cost, highest latency



Blobs can be organized in virtual directories, but each path is considered a single blob in a flat namespace – folder level operations are not supported

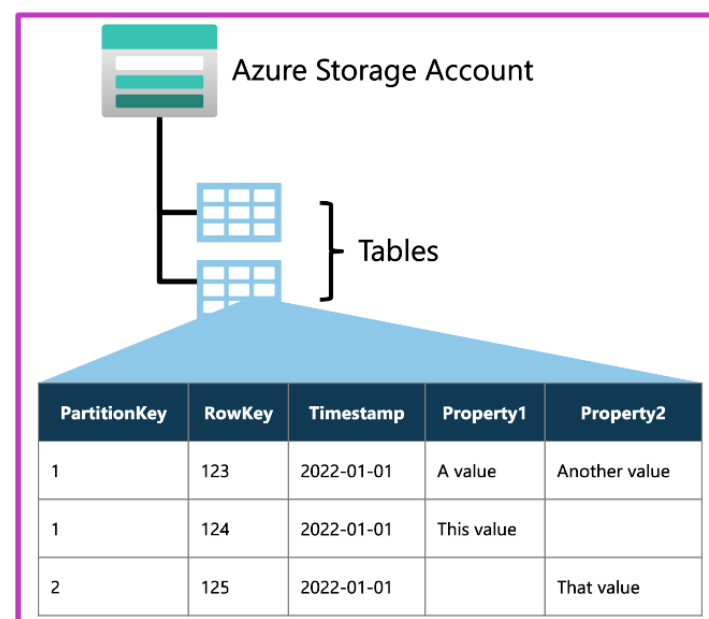
C. Table Storage

- Storage for **semi-structured data** (NoSQL)
 - **No need for foreign joins**, foreign keys, relationships or strict schema
 - Designed for fast access
- Many programming interfaces and SDKs

Azure Table Storage

Key-Value storage for application data

- Tables consist of **key and value columns**
 - **Partition and row keys**
 - Custom property columns for data values
 - A *Timestamp* column is added automatically to log data changes
- Rows are grouped into partitions to improve performance
- Property columns are assigned a data type, and can contain any value of that type
- **Rows do not need to include the same property columns**



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D. Queue Storage

- Storage for **small pieces of data** (messages)
- Designed for **scalable asynchronous processing**

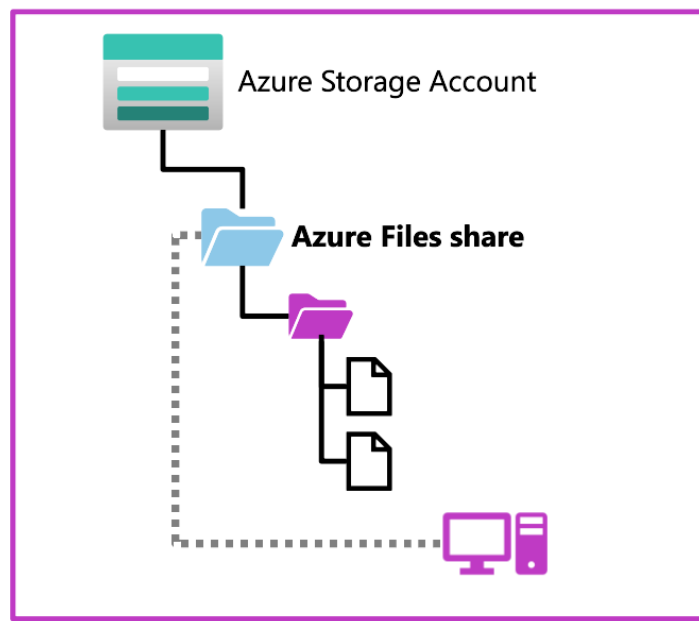
E. File Storage

- **Storage for files** accessed **via shared drive protocols**
- Designed to extend on-premise file shares or **implement lift-and-shift scenarios**

Azure Files

Files shares in the cloud that can be accessed from anywhere with an internet connection

- Support for common file sharing protocols:
 - Server Message Block (SMB)
 - Network File System (NFS) – *requires premium tier*
- Data is replicated for redundancy and encrypted at rest



F. Disk Storage

- Disk emulation in the cloud
- Persistent storage for Virtual Machines
- Different
 - sizes,
 - types (SSD, HDD)
 - performance tiers
- Disk can be unmanaged or managed

❖ Summary

- **Azure Storage Account** - Highly **scalable and highly durable storage service** consisting group of smaller services (blob, file, queue and table storage services)
- **Azure Blob Storage** - **General purpose (blob) file storage**, fits any scenario
- Azure File Storage - **File share service** in the cloud, lift-and-shift scenarios
- **Azure Queue Storage** - Service **for storing small messages for asynchronous processing**
- **Azure Table Storage** - **Scalable NoSQL storage** service for semi-structured data
- **Azure Disk Storage** - Disk **emulation service** in the cloud

4. Azure Database Services

A. Data Types

- ❖ **Structured** - Data that can be represented using tables with **very strict schema**. Each row must follow defined schema. Some tables have defined relationships between them. Typically used in **relational databases**.
- ❖ **Semi-structured** - Data that can be represented using tables but **without strict defined schema**. Rows must only **have unique key identifier**.
- ❖ **Unstructured** - Any files in **any format**. Like **binary files**, **application files**, **images**, **movies**, etc.

What is data?

Values used to record information – Often representing *entities* that have one or more *attributes*

Structured

Customer				
ID	FirstName	LastName	Email	Address
1	Joe	Jones	joe@litware.com	1 Main St.
2	Samir	Nadoy	samir@northwind.com	123 Elm Pl.

Product		
ID	Name	Price
123	Hammer	2.99
162	Screwdriver	3.49
201	Wrench	4.25

Semi-structured

```
{
  "firstName": "Joe",
  "lastName": "Jones",
  "address": {
    "streetAddress": "1 Main St.",
    "city": "New York",
    "state": "NY",
    "postalCode": "10099"
  },
  "contact": {
    {
      "type": "home",
      "number": "555 123-4567"
    },
    {
      "type": "email",
      "address": "joe@litware.com"
    }
  ]
}
```

Unstructured

Dear Joe,

Thank you for ordering your hardware supplies from our online store (order number 1000) on 1/1/2022.

Your order has been shipped and should arrive in 3-5 business days.

Contoso Hardware

Our products are of the highest quality and used by professionals. We have amazing screwdrivers, that are really useful for tightening and loosening screws.

We also have wrenches (or, if you prefer, spanners)...

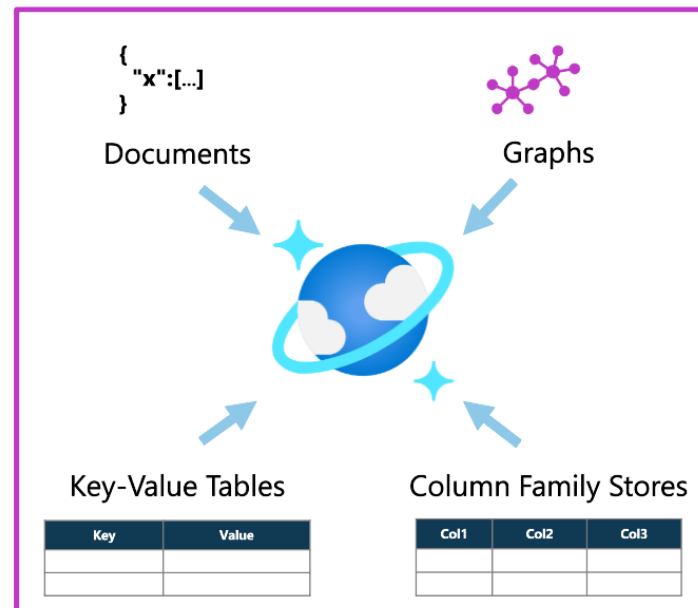
B. Cosmos DB

- Globally distributed **NoSQL** (semi-structured data) Database service
- **Schema-less**
- **Multiple APIs** (SQL, MongoDB, Cassandra, Gremlin, Table Storage)
- Designed for
 - **Highly responsive** (real time) applications with super low latency responses <10ms
 - **Multi-regional applications**

What is Azure Cosmos DB?

A multi-model, global-scale **NoSQL** database management system

- Support for multiple storage APIs
- Real time access with fast read and write performance
- Enable *multi-region writes* to replicate data globally; enabling users in specified regions to work with a local replica



Azure Cosmos DB APIs

Azure Cosmos DB for NoSQL

- Native API for Cosmos DB

```
SELECT *
FROM customers c
WHERE c.id =
"joe@litware.com"
```

```
{
  "id": "joe@litware.com",
  "name": "Joe Jones",
  "address": {
    "street": "1 Main St.",
    "city": "Seattle"
  }
}
```

Azure Cosmos DB for MongoDB

- Compatibility with MongoDB

```
db.products.find({
  id: 123})
```

```
{
  "id": 123,
  "name": "Hammer",
  "price": 2.99
}
```

Azure Cosmos DB for PostgreSQL

- Compatibility with PostgreSQL

id	name	dept	manager
1	Sue Smith	Hardware	Joe Jones
2	Ben Chan	Hardware	Sue Smith

Azure Cosmos DB for Table

- Key-value storage API
- Compatible with Azure Table Storage

PartitionKey	RowKey	Name
1	123	Joe Jones
1	124	Samir Nadoy

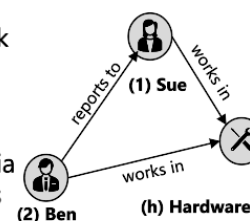
Azure Cosmos DB for Apache Cassandra

- Compatibility with Apache Cassandra

id	name	dept	manager
1	Sue Smith	Hardware	
2	Ben Chan	Hardware	Sue Smith

Azure Cosmos DB for Apache Gremlin

- Used to work with graph data
- vertices are connected via relationships (edges)



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C. SQL Database

- **Relational database** service in the cloud (**PaaS**) (DBaaS - Database as a Service)
- **Structured data service** defined using **schema and relationships**
- **Rich Query Capabilities** (SQL)
- **High-performance**, reliable, fully managed and secure database for building – applications

Azure SQL

SQL Family of SQL Server based cloud database services

SQL Server on Azure VMs

- Guaranteed compatibility to SQL Server on premises
- Customer manages everything – OS upgrades, software upgrades, backups, replication
- Pay for the server VM running costs and software licensing, not per database
- Great for hybrid cloud or migrating complex on-premises database configurations

IaaS

Azure SQL Managed Instance

- Near 100% compatibility with SQL Server on-premises
- Automatic backups, software patching, database monitoring, and other maintenance tasks
- Use a single instance with multiple databases, or multiple instances in a pool with shared resources
- Great for migrating most on-premises databases to the cloud

Azure SQL Database

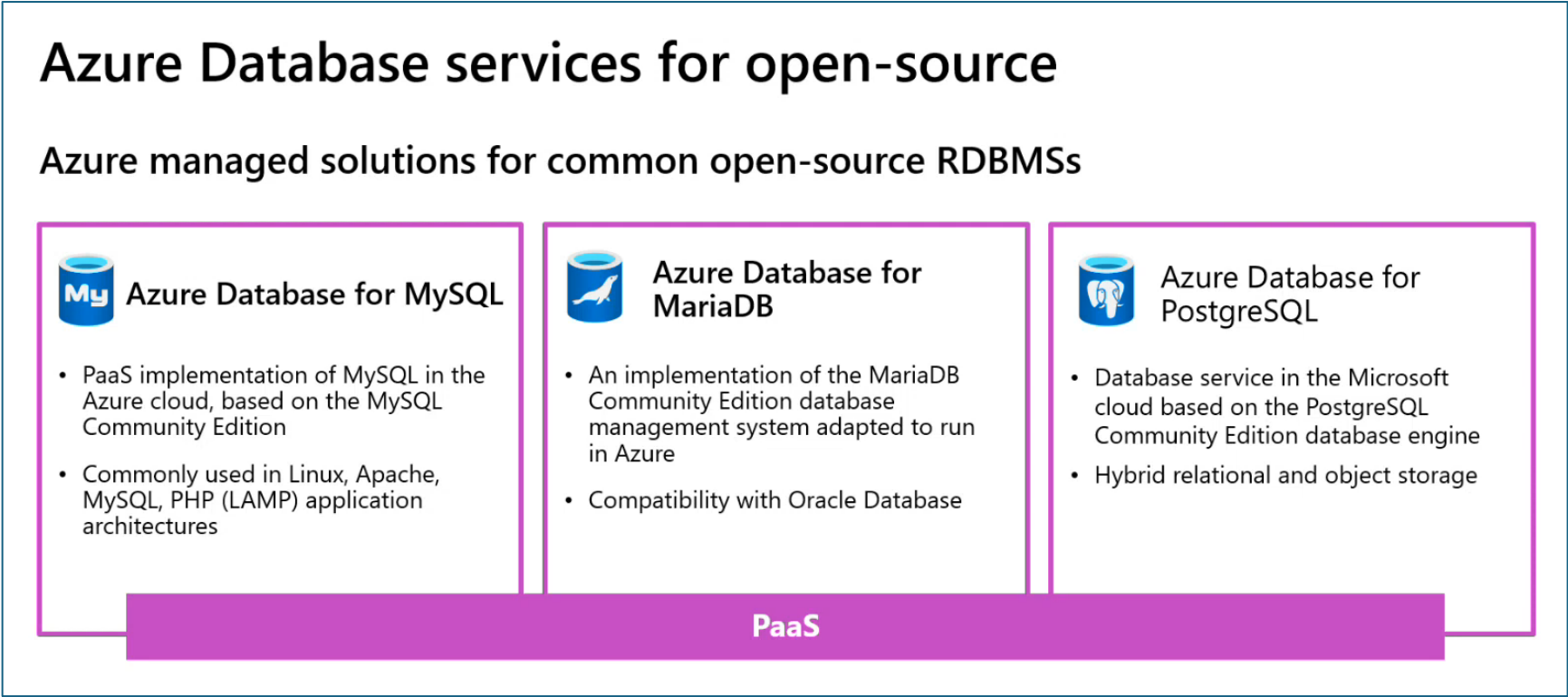
- Core database functionality compatibility with SQL Server
- Automatic backups, software patching, database monitoring, and other maintenance tasks
- *Single database* or *elastic pool* to dynamically share resources across multiple databases
- Great for new, cloud-based applications

PaaS

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D. Azure SQL product family

- Azure **SQL Database** – Reliable relational database based on SQL Server
- Azure **Database for MySQL** – Azure SQL version for [MySQL database engine](#)
- Azure **Database for PostgreSQL** – Azure SQL version for [PostgreSQL database engine](#)
- Azure **SQL Managed Instance** – Fully fledged SQL [Server managed by cloud provider](#)
- Azure **SQL on VM** – Fully fledged SQL Server on [IaaS](#)
- Azure **SQL DW (Synapse)** – [Massively Parallel Processing \(MPP\)](#) version of SQL Server



5. Azure Market Place:

Azure Marketplace [allows customers to find, try, purchase, and provision applications and services from hundreds of leading service providers](#), which are all certified to run on Azure.

- Open-source [container platforms](#).
- Solutions can [leverage all service categories](#) like IaaS, PaaS and SaaS
- [Virtual machine](#) and database images.
- [Application build](#) and deployment software.
- Developer tools.
- And much more, with 10,000+ listings!

