

# Cloud Computing Fundamentals(MS Azure focused)

- The Azure Fundamentals Learning Path:  
<https://docs.microsoft.com/en-us/learn/paths/azure-fundamentals/>
- Azure Docs: <https://docs.microsoft.com/en-us/azure/>

# CORE AZURE SERVICES

- COMPUTE SERVICE,
- NETWORKING SERVICE,
- STORAGE SERVICE,
- DATABASE SERVICE

# Azure Compute Services

Services for hosting and running application workload

- Azure Virtual Machines: Linux and Windows
- Virtual Machine Scale Sets
- App Services (Web apps, API apps, WebJobs, Mobile apps)
- Azure Container Service
- Azure Kubernetes Service (AKS)

# Azure Compute Services

## Virtual machine (VM)

- An emulation of a computer - just like your desktop or laptop you're using now.
- Each VM includes an operating system and hardware that appears to the user like a physical computer running Windows or Linux.
- You can install whatever software you need to do the tasks you want to run in the cloud.

## Containers

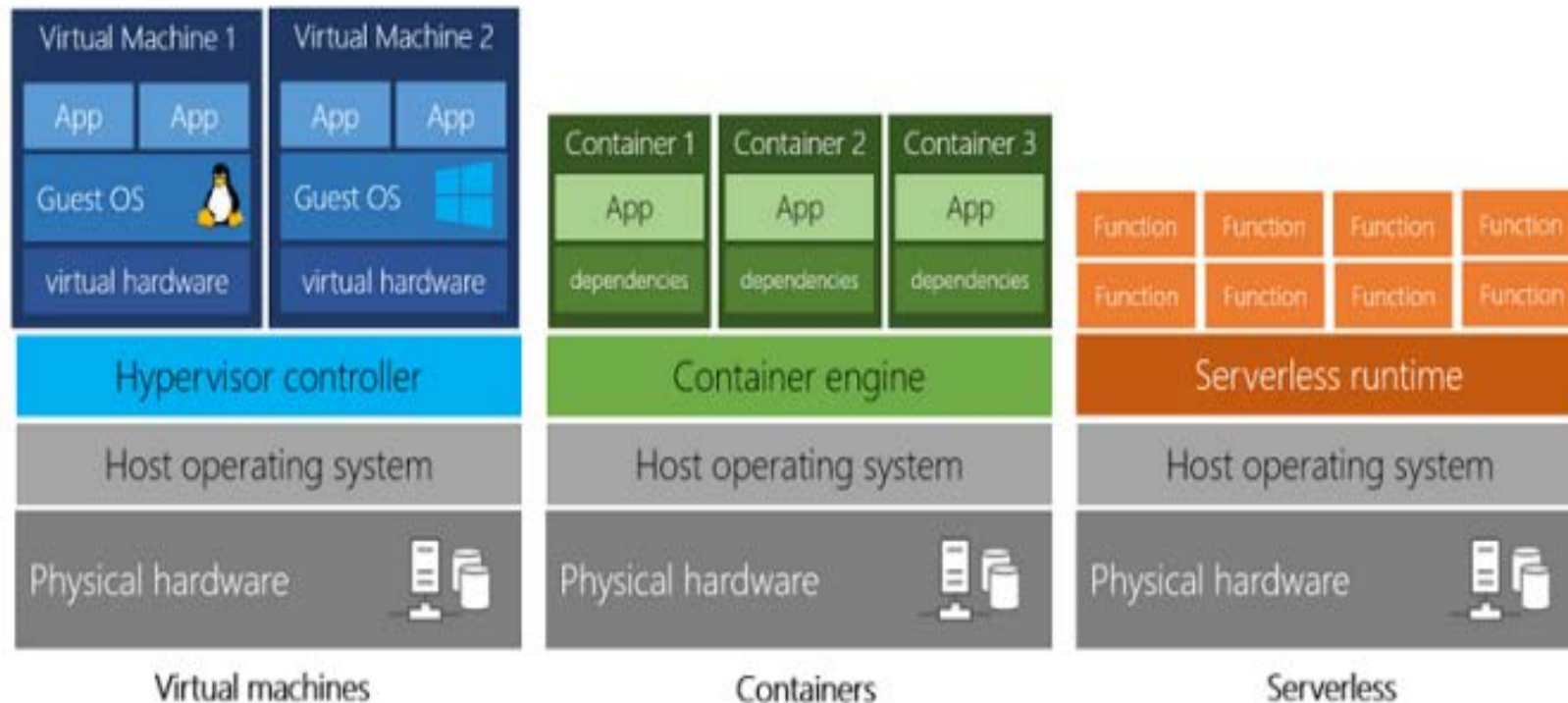
- Similar to VMs except they don't require a guest operating system.
- The application and all its dependencies is packaged into a "container" and then a standard runtime environment is used to execute the app.

## Serverless computing

- Run application code without creating, configuring, or maintaining a server.
- The core idea is that your application is broken into separate functions that run when triggered by some action.
- This is ideal for automated tasks - for example, you can build a serverless process that automatically sends an email confirmation after a customer makes an online purchase.

# Azure Compute Services

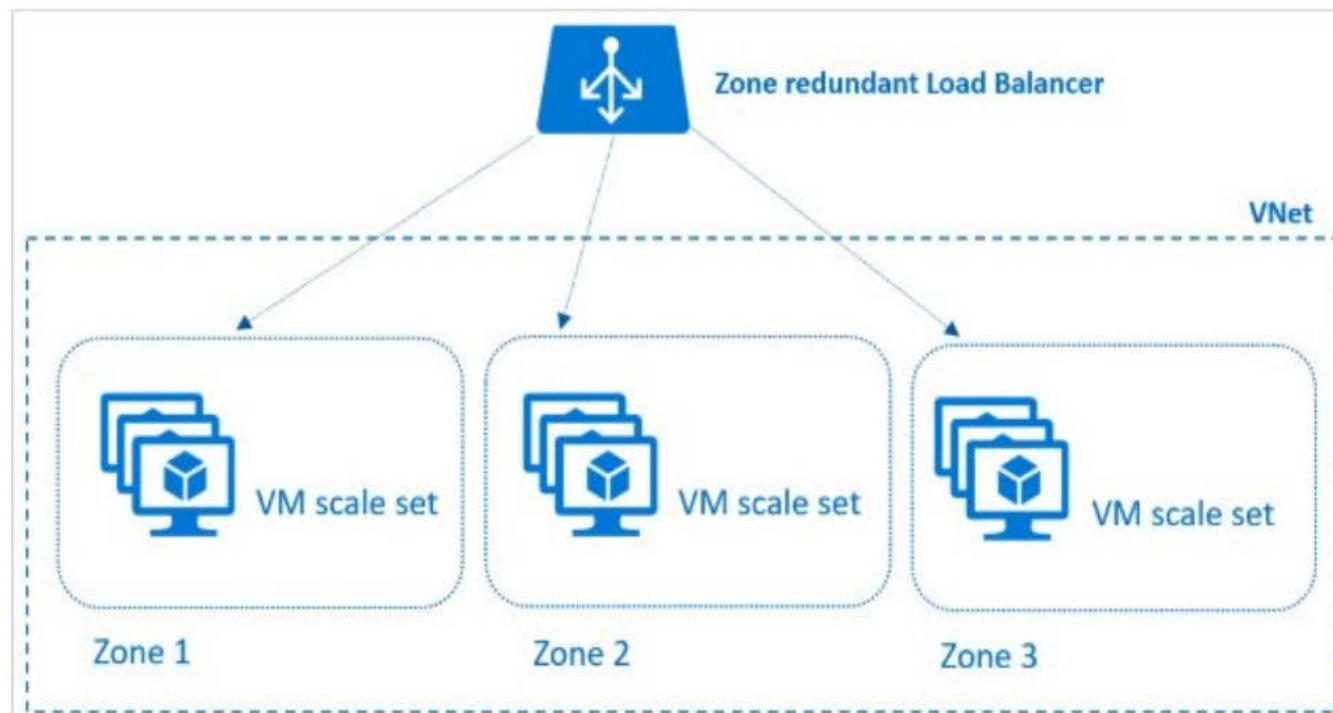
## VM, Container & Serverless



# Azure Compute Services

## Virtual machine scale sets

- Create and manage a group of identical, load-balanced VMs.
- Centrally manage, configure, and update a large number of VMs in minutes to provide highly available applications.
- The number of VM instances can automatically increase or decrease in response to demand or a defined schedule.
- VM inside a scale set can be deployed into fault domains or Availability zones.
- Scale set must be set to VM orchestration mode, and the same region and resource group. Integrated with Azure Autoscale and Azure Load Balancer



# Azure Compute Services

## Azure Container Instances

- Containers are becoming the preferred way to package, deploy, and manage cloud applications.
- Azure Container Instances offers the fastest and simplest way to run a container in Azure, without having to manage any virtual machines and without having to adopt a higher-level service.
- Azure Container Instances is a great solution for any scenario that can operate in isolated containers, including simple applications, task automation, and build jobs.

## Benefits of containers

- Increased portability
- Less Overhead
- More consistent operation
- Container Isolation and Resource Sharing
- Greater efficiency
- Improved Developer Productivity

## Azure Kubernetes Service (AKS) :

- The task of automating, managing, and interacting with a large number of containers is known as orchestration.
- Azure Kubernetes Service is a complete orchestration service for containers with distributed architectures and large volumes of containers.

# Azure Compute Services

## Serverless computing

- **Azure Functions**

- ✓ Process events with serverless code.
- ✓ Functions are commonly used when you need to perform work in response to an event timer, or message from another Azure service and when that work can be completed quickly.
- ✓ When you're concerned only about the code running your service, and not the underlying platform or infrastructure, using Azure Functions is ideal.
- ✓ Functions scale automatically based on demand, so they're a solid choice when demand is variable.

- **Azure Logic Apps :**

- ✓ Logic apps are similar to functions. Both enable you to trigger logic based on an event.
- ✓ Where **functions execute code**, **logic apps execute workflows** that are designed to automate business scenarios and are built from predefined logic blocks.
- ✓ Every Azure logic app workflow starts with a trigger, which fires when a specific event happens or when newly available data meets specific criteria.
- ✓ Many triggers include basic scheduling capabilities, so developers can specify how regularly their workloads will run. Each time the trigger fires, the Logic Apps engine creates a logic app instance that runs the actions in the workflow.



# Azure Compute Services

## Azure App Service

- Build and host web apps, background jobs, mobile backends, and RESTful APIs in the programming language of your choice without managing infrastructure.
- Auto-scaling and high availability, supports both Windows and Linux, and enables automated deployments from GitHub, Azure DevOps, or any Git repo to support a continuous deployment model.

(Web Apps, API Apps, WebJobs, Mobile Apps)

# Azure Networking Services

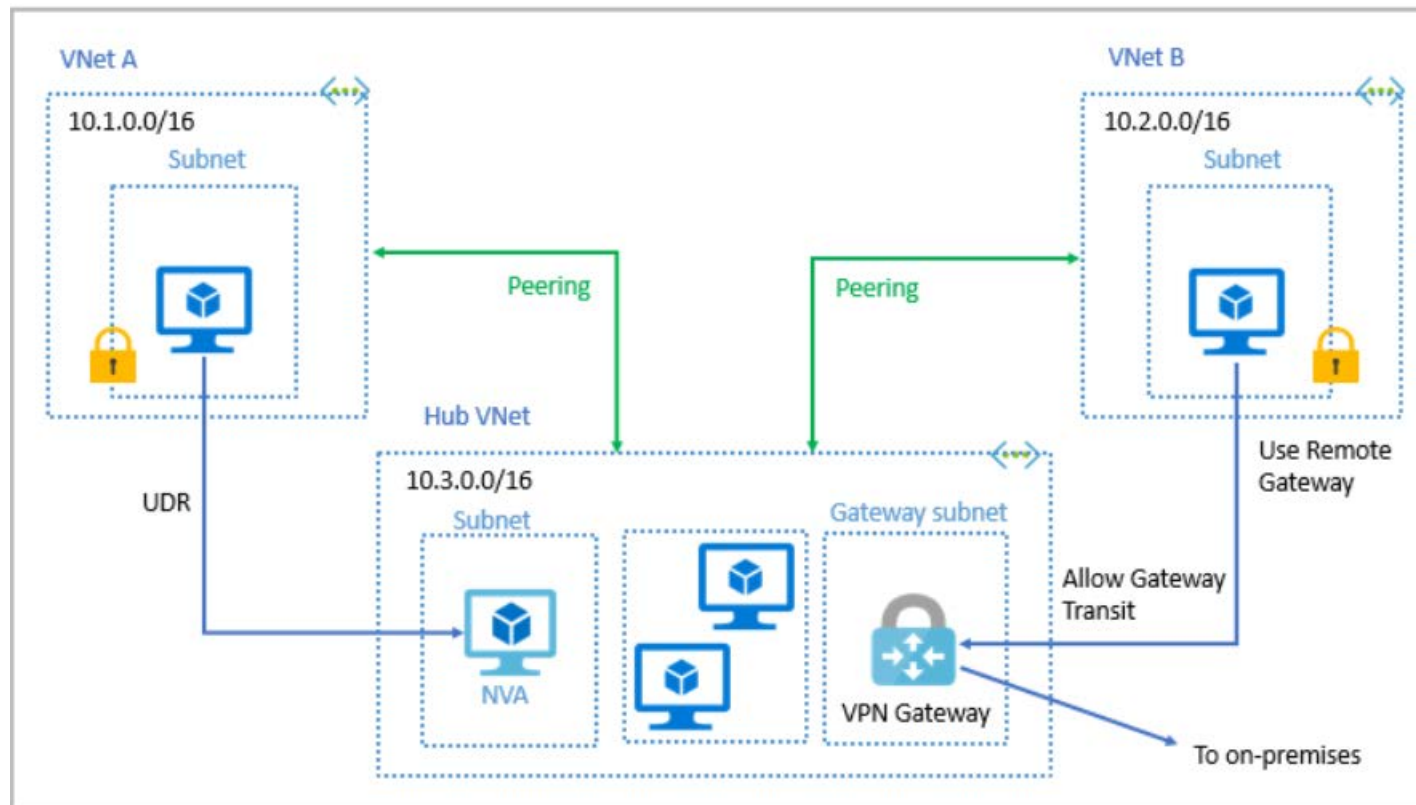
Services for networking both within Azure and between Azure and on-premises datacenters.

- Azure Virtual Network
- Azure Load Balancer
- VPN Gateway
- ExpressRoute Gateway
- Application Gateway
- Azure Content Delivery Network

# Azure Networking Services

## Virtual Network

- Azure Virtual Network (VNet) is the fundamental building block for your private network in Azure.
- An Azure Virtual Network (VNet) is a representation of your own network in the cloud.
- It is a logical isolation of the Azure cloud dedicated to your subscription.
- You can use Vnets to provision and manage virtual private networks (VPNs)



# Azure Networking Services

## Load Balancer

- You can scale your applications and create high availability for your services.
- A layer 4 load balancer that distributes incoming traffic among healthy virtual machine instances. Load balancers use a hash-based distribution algorithm.
- We can configure the load balancer to:
  - ✓ Load balance incoming traffic across your virtual machines.
  - ✓ Forward traffic to and from a specific virtual machine using NAT rules.

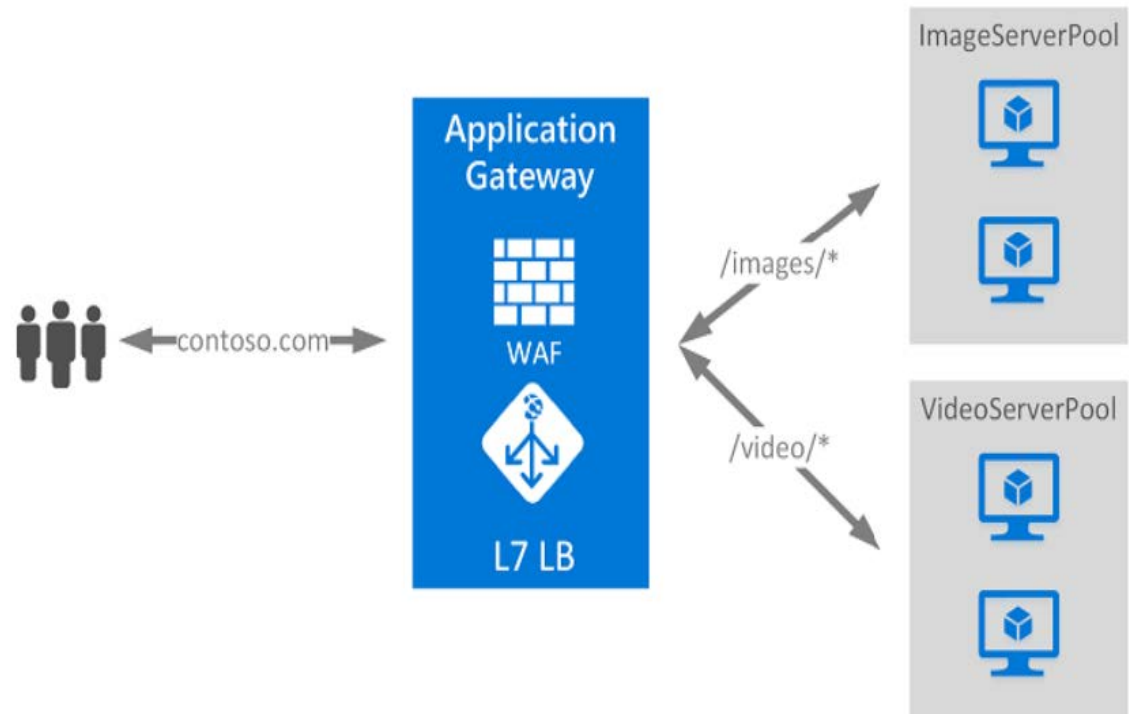
## VPN Gateway

- A VPN gateway is a specific type of virtual network gateway that is used to send encrypted traffic between an Azure virtual network and an on-premises location over the public Internet.
- You can also use a VPN gateway to send encrypted traffic between Azure virtual networks over the Microsoft network.
- Each virtual network can have only one VPN gateway.

# Azure Networking Services

## Application Gateway

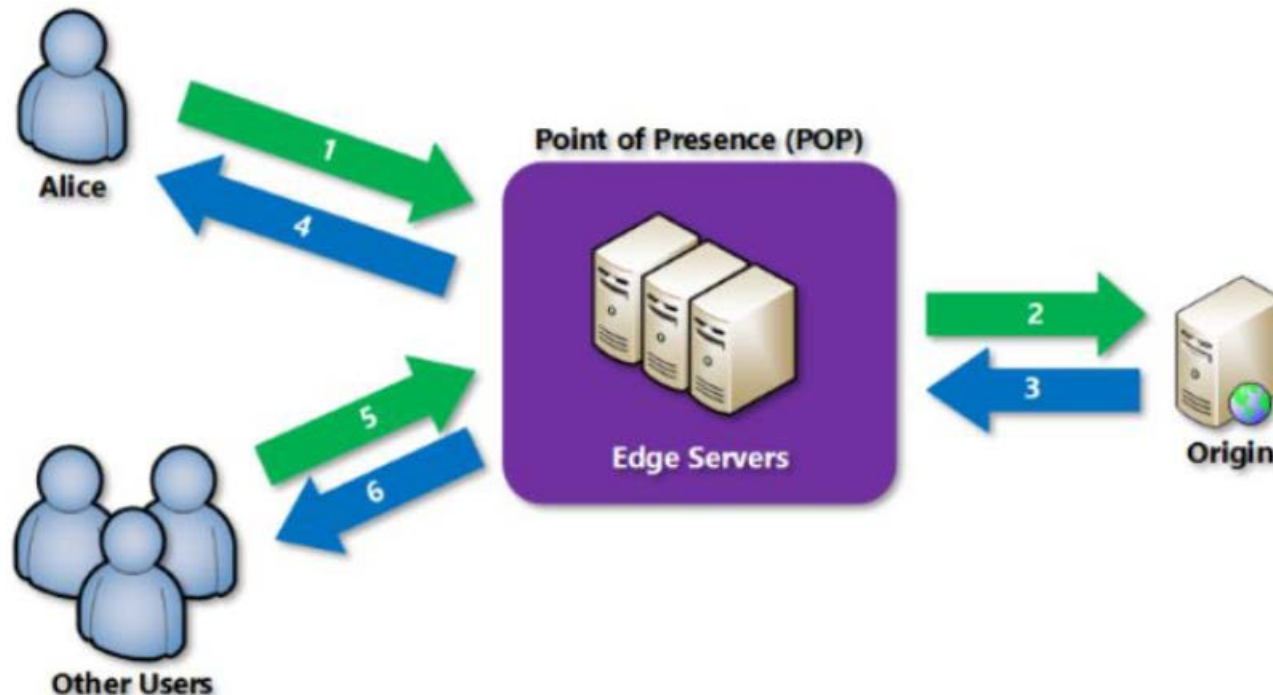
- Azure Application Gateway is a web traffic load balancer that enables you to manage traffic to your web applications.
- you can make routing decisions based on additional attributes of an HTTP request, such as URI path or host headers.



# Azure Networking Services

## Content Delivery Network(CDN)

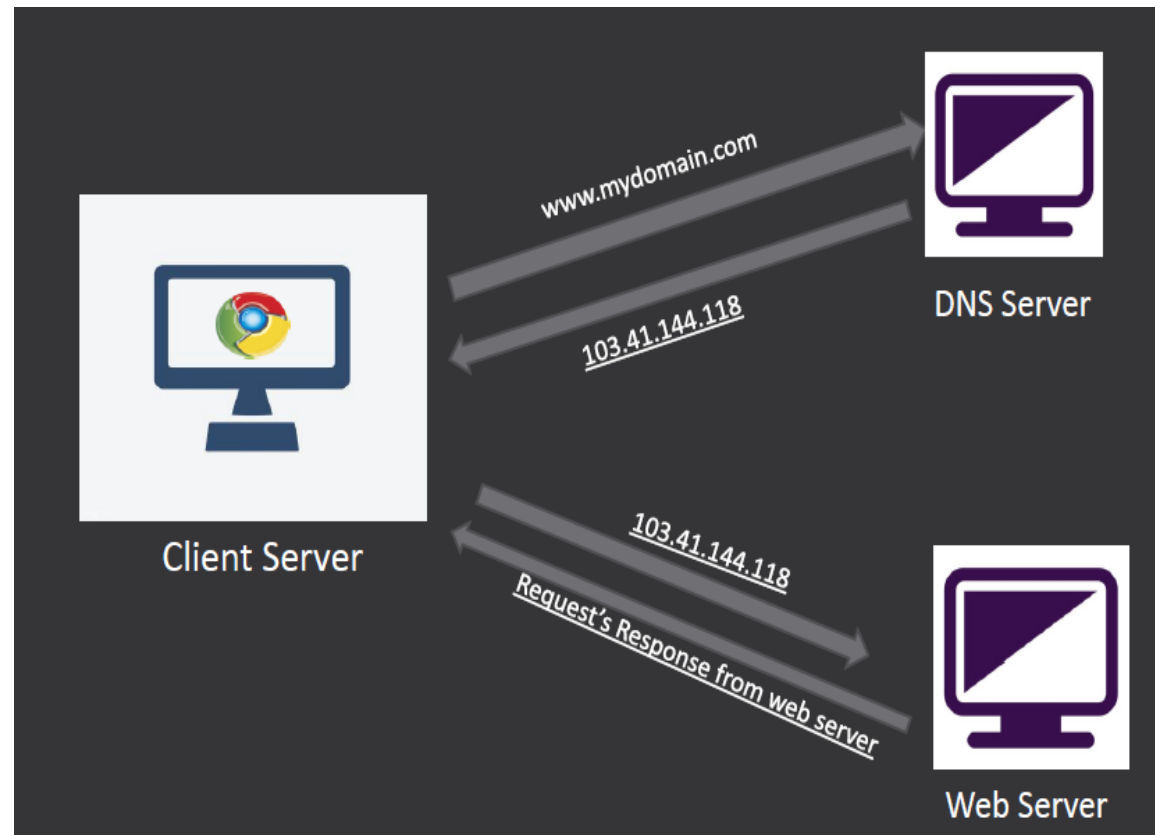
- A content delivery network(CDN) is a **distributed network of servers that can efficiently deliver web content to users.**
- CDNs store **cached content on edge servers in point-of presence(POP) locations** that are close to end users, to minimize latency.



# Azure Networking Services

## DNS

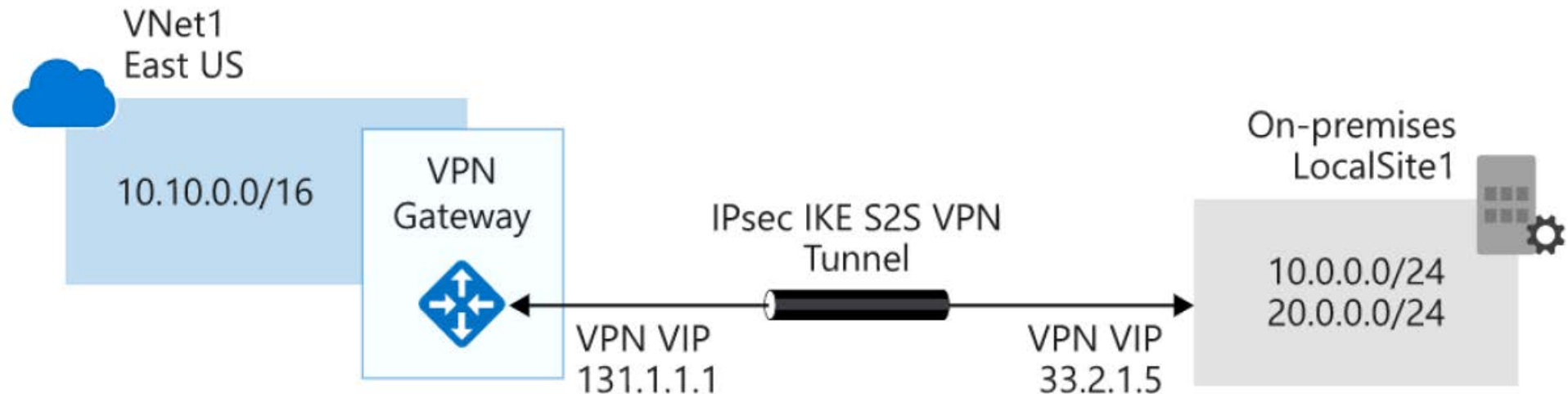
- Azure DNS is a hosting service for DNS domains that **provides name resolution** by using Microsoft Azure infrastructure.
- By hosting your domains in Azure, you can manage your DNS records by using the same credentials, APIs, tools, and billing as your other Azure services.



# Azure Networking Services

## VPN Gateway

- VPN Gateway sends **encrypted traffic between an Azure virtual network and an on-premises location over the public Internet**. You can also use VPN Gateway to **send encrypted traffic between Azure virtual networks over the Microsoft network**.

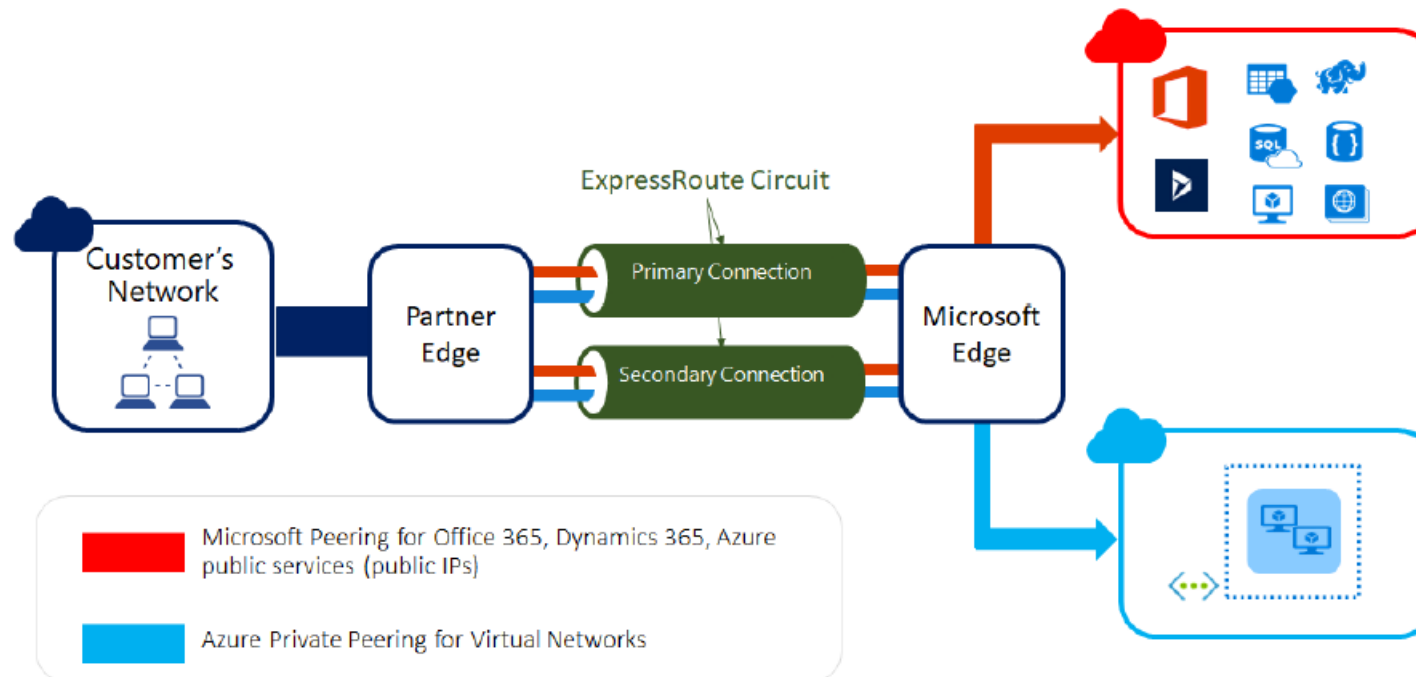




# Azure Networking Services

## Azure ExpressRoute Gateway

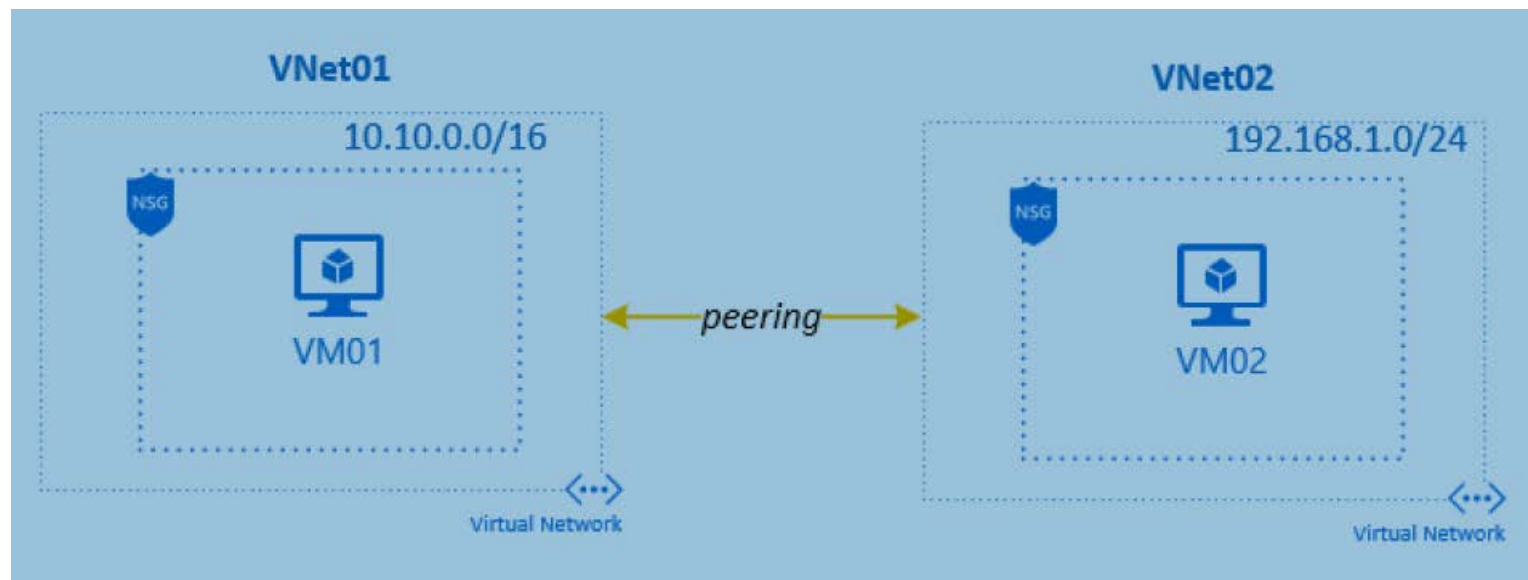
- ExpressRoute lets you extend your **on-premises networks into the Microsoft cloud over a private connection** with the help of a connectivity provider. With ExpressRoute, you can establish connections to Microsoft cloud services, such as Microsoft Azure and Microsoft 365.



# Azure Networking Services

## Virtual Network Peering

- Virtual network peering enables you to **seamlessly connect two or more Virtual Networks in Azure**. The virtual networks appear as one for connectivity purposes. The traffic is routed through Microsoft's private network only.



# Azure Storage Services

- Azure Storage is Microsoft's cloud storage solution for modern data storage scenarios.
- Azure Storage offers a massively scalable object store for data objects, a file system service for the cloud, a messaging store for reliable messaging, and a NoSQL store.
- Azure Storage includes these data services:
  - ✓ **Blobs:** A massively scalable object store for text and binary data.
  - ✓ **Files:** Managed file shares for cloud or on-premises deployments.
  - ✓ **Tables:** A NoSQL store for schemaless storage of structured data.
  - ✓ **Queues:** A messaging store for reliable messaging between application components.

# Azure Storage Services

## Blob Storage

- Azure Blob Storage is a service for storing large amounts of **unstructured** object data, such as text or binary data.
- No restrictions on the kinds of data it can hold
- You can use Blob Storage to expose data publicly to the world, or to store application data privately.

## File Storage

- Azure Files offers fully managed file shares in the cloud that are accessible via the industry standard Server Message Block (SMB) protocol.
- Azure file shares can be mounted concurrently by any number of cloud or on-premises VMs of Windows, Linux, and macOS at time.
- Typical usage scenarios would be to share files anywhere in the world, diagnostic data, or application data sharing.

# Azure Storage Services

## **Table storage**

- Is a service that stores structured NoSQL data in the cloud, providing a key/attribute store with a schemaless design.
- Azure tables are ideal for storing structured, nonrelational data.

## **Azure Queue storage**

- Is a service for storing large numbers of messages that can be accessed from anywhere in the world.
- Azure Queue Storage can be used to help build flexible applications and separate functions for better durability across large workloads.

# Azure Storage Services

## Storage Tiers

- Azure storage offers different access tiers, which allow you to store blob object data in the most cost-effective manner.
- The available access tiers include:
  - ✓ **Hot storage tier:** optimized for storing data that is accessed frequently.
  - ✓ **Cool storage tier:** optimized for data that is infrequently accessed and stored for at least 30 days.
  - ✓ **Archive storage tier:** for data that is rarely accessed and stored for at least 180 days with flexible latency requirements.

# Azure Storage Services

## Redundancy

- **Locally Redundant Storage (LRS)**

- ✓ Azure Storage provides high availability by ensuring that three copies of all data are made synchronously before a write is deemed successful.
- ✓ These copies are stored in a single facility in a single region.
- ✓ The replicas reside in separate fault domains and upgrade domains.

- **Geo-Redundant Storage (GRS)**

- ✓ GRS makes three synchronous LRS copies of the data in the primary region for high availability, and then it asynchronously makes three LRS replicas in a paired region for disaster recovery.
- ✓ Each Azure region has a defined paired region within the same geopolitical boundary for GRS.

# Azure Storage Services

## Redundancy

- **Read-Access Geo-Redundant Storage (RA-GRS)**

- ✓ This is GRS plus the ability to read the data in the secondary region, which makes it suitable for customer disaster recovery.
- ✓ If there is a problem with the primary region, you can change your application to have read-only access to the paired region.

- **Zone Redundant Storage (ZRS)**

- ✓ This is a new option that applies only to block blobs.
- ✓ It replicates your data across two to three facilities, either within a single region or across two regions.
- ✓ This provides higher durability than LRS, but ZRS accounts do not have metrics or logging capability.



## Type of Data

- **Structured Data**

- ✓ Structured data is data that adheres to a schema, so all of the data has the same fields or properties. (Example: A database table)

- **Semi-structured Data**

- ✓ Semi-structured data doesn't fit neatly into tables, rows, and columns. Instead, semi-structured data uses *tags* or *keys* that organize and provide a hierarchy for the data. (Example: JSON file, XML file )

- **Unstructured Data**

- ✓ Unstructured data encompasses data that has no designated structure to it
- ✓ This lack of structure also means that there are no restrictions on the kinds of data it can hold. (Example: email, video file, pdf )

### Jason Example

```
{
  "student": [
    {
      "id": "01",
      "name": "Tom",
      "lastname": "Price"
    },
    {
      "id": "02",
      "name": "Nick",
      "lastname": "Thameson"
    }
  ]
}
```

# Azure Database Services

Products available for Databases

- Azure SQL Database
- Azure Database for MySQL, Azure Database for PostgreSQL
- Cosmos DB
- Azure Database Migration service

# Azure Database Services

## 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

## 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 Database Services

## 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

# Big Data & Analytics-1

## What is Big Data?

- **Big Data** is a field of technology that helps with the **extraction, processing** and **analysis** of information that is **too large or complex** to be dealt with by traditional software.
- The three V's rule
  - ✓ Big data typically has one of the following characteristics
  - ✓ **Velocity** - how fast the data is coming in or how fast we are processing it
    - ✓ Batch
    - ✓ Periodic
    - ✓ Near Real Time
    - ✓ Real Time
  - ✓ **Volume** - how much data we are processing
    - ✓ Megabytes
    - ✓ Gigabyte
    - ✓ Terabytes
    - ✓ Petabytes
  - ✓ **Variety** - how structured/complex the data is
    - ✓ Tables
    - ✓ Databases
    - ✓ Photo, Audio
    - ✓ Video, Social Media

# Big Data & Analytics-2

## Azure Synapse Analytics

- Big data analytics platform (PaaS)
- Multiple components
  - ✓ Spark
  - ✓ Synapse SQL
    - ✓ SQL pools (dedicated – pay for provisioned performance)
    - ✓ SQL on-demand (ad-hoc – pay for TB processed)
  - ✓ Synapse Pipelines (Data Factory – ETL)
  - ✓ Studio (unified experience)

## Azure HDInsight

- Flexible multi-purpose big data platform (PaaS)
- Multiple technologies supported (Hadoop, Spark, Kafka, HBase, Hive, Storm, Machine Learning)

## Azure Databricks

- Big data collaboration platform (PaaS)
- Unified workspace for notebook, cluster, data, access management and collaboration
- Based on Apache Spark
- Integrates very well with common Azure data services

# Azure Marketplace

## Azure Marketplace

- Think of it like an **“Azure Shop”** where you purchase services and solutions for the Azure platform
- Each product is a template which contains one or multiple services
- Products are delivered **by first and third-party vendors**
- Solutions can leverage all **service categories like IaaS, PaaS and SaaS**