Azure is a cloud computing platform and service offered by Microsoft that provides a wide range of cloud services, including computing, storage, networking, databases, analytics, artificial intelligence (AI), machine learning (ML), Internet of Things (IoT), security, and more. Azure enables organizations to build, deploy, and manage applications and services quickly and efficiently, leveraging Microsoft's global network of datacenters.

Microsoft Azure was officially launched on February 1, 2010, under the name Windows Azure. At the time of its launch, Azure offered a relatively small number of services compared to its current offerings. While the exact number of services available at the initial launch may vary depending on how services are counted and categorized, Azure primarily focused on core infrastructure services such as virtual machines, storage, and networking.

**IAM (Identity and Access Management) in Azure :**

**\*\*What is IAM?\*\***

IAM stands for Identity and Access Management. In Azure, IAM refers to the process of managing who can access Azure resources and what they can do with those resources. It's like managing keys to different rooms in a building - you decide who gets access to which rooms and what they're allowed to do inside.

**\*\*Key Concepts:\*\***

1. \***\*Users:\***\* Users are individuals who need access to Azure resources. Each user has a unique identity, typically associated with their email address or username.

2. \***\*Groups:**\*\* Groups are collections of users. Instead of managing permissions for each user individually, you can assign permissions to groups and add users to those groups. This makes it easier to manage permissions at scale.

3. \***\*Roles:**\*\* Roles define what users or groups can do within Azure. Azure provides built-in roles with predefined sets of permissions, such as Owner, Contributor, and Reader. You can also create custom roles with specific permissions tailored to your needs.

4. \***\*Permissions:\***\* Permissions specify what actions users or groups are allowed to perform on Azure resources. Actions include read, write, delete, and manage. Each role has a set of permissions associated with it.

\*\***How IAM Works:**\*\*

1. **\*\*Authentication:\***\* Users must authenticate themselves to access Azure resources. This typically involves providing a username and password, but Azure also supports other authentication methods like multi-factor authentication (MFA) and Azure Active Directory (Azure AD) integration.

2. **\*\*Authorization:**\*\* Once authenticated, Azure checks whether the user has the necessary permissions to access the requested resource. This involves checking the user's assigned roles and permissions.

**3. \*\*Role-Based Access Control (RBAC)**:\*\* RBAC is a key feature of Azure IAM. It allows you to assign roles to users or groups at the subscription, resource group, or individual resource level. Users inherit permissions from the roles assigned to them.

\*\***Example:\***\*

Let's say you have an Azure subscription with virtual machines (VMs) running your company's web applications. You want your developers to be able to deploy and manage these VMs, but you don't want them to accidentally delete important resources.

- You create a "VM Contributor" role in Azure, which allows users to manage VMs but not delete them.

- You assign this role to a group called "Developers" in Azure IAM.

- You add individual developers to the "Developers" group.

- Now, any developer in the group can deploy and manage VMs within the subscription, but they cannot delete them.

In summary, IAM in Azure helps you control who has access to your resources and what they can do with them, ensuring security and compliance in your Azure environment.

**Services:**

* **Computation:**

1. **Azure Virtual Machines** (VMs) are on-demand, scalable computing resources provided by Microsoft Azure, a cloud computing service. Azure VMs enable you to run a wide range of operating systems, including Windows and various Linux distributions, on Microsoft's cloud infrastructure.

**Scenario:** You're a small business owner who wants to host a website for your online store.

**Solution:** You can use Azure VMs to set up a virtual server with the necessary web server software (e.g., Apache, Nginx) and database (e.g., MySQL, PostgreSQL). Choose a VM size that fits your website's traffic and resource requirements. Azure VMs provide flexibility and control over your website's configuration and scalability.

1. **Azure App Service** is a platform-as-a-service (PaaS) offering from Microsoft Azure that enables developers to build, deploy, and scale web applications and APIs quickly and easily.

**Scenario:** Suppose you're a startup developing a new web application. You want to focus on coding and rapidly deploy updates without managing infrastructure.

**Solution:** Azure App Service provides a perfect solution. You can deploy your web application to an App Service plan, which automatically handles scaling, load balancing, and deployment. This allows your team to focus on development and quickly iterate on features without worrying about server management

1. **Containers** are a form of lightweight, portable, and isolated execution environments for applications and their dependencies. They package an application and its runtime environment, including libraries and dependencies, into a single unit called a container image.
2. **Azure Kubernetes Service** (AKS) is a managed Kubernetes service offered by Microsoft Azure. Kubernetes is an open-source container orchestration platform that automates the deployment, scaling, and management of containerized applications. AKS abstracts away the complexity of managing Kubernetes clusters, allowing developers and DevOps teams to focus on building and deploying applications without worrying about the underlying infrastructure.

**Scenario:** You're building a microservices-based application and need a platform to orchestrate and manage containers at scale.

**Solution:** Use Azure Kubernetes Service (AKS) to deploy and manage your containerized microservices with Kubernetes. Break down your application into smaller, independent services and package each service into a container. AKS automates tasks like scaling, load balancing, and container orchestration, making it easy to deploy and manage complex applications.

**Networking:**

**Virtual Network:**

computing infrastructure, enabling users to create isolated and secure network environments within a cloud provider's data centers. Virtual networks can be divided into multiple subnets, each with its own CIDR block.

**Scenario:** You're migrating your on-premises infrastructure to Azure and need to establish a secure network environment.

**Solution:** Create a Virtual Network (VNet) in Azure to logically isolate your cloud resources and control traffic flow. Define subnets within the VNet to segment resources based on their functionality or security requirements. Configure network security groups (NSGs) to control inbound and outbound traffic to and from resources within the VNet.

1. **Load balancing** is a critical component of modern network architectures, helping to distribute incoming network traffic across multiple servers or resources to ensure optimal utilization, high availability, and reliability. In Azure, there are several load balancing options available to meet different needs.

1)**Azure Load Balancer**:Azure Load Balancer is a Layer 4 (TCP/UDP) load balancer that distributes incoming traffic across multiple virtual machines (VMs), virtual machine scale sets, or Azure Kubernetes Service (AKS) nodes.

It provides high availability by distributing traffic across healthy instances within the backend pool and automatically removing unhealthy instances from rotation.

Azure Load Balancer supports inbound and outbound scenarios and can be used for load balancing internet-facing or internal traffic.

Azure Application Gateway:

**2)Azure Application Gateway** is a Layer 7 (HTTP/HTTPS) load balancer that provides advanced application delivery and security features.

Application Gateway is ideal for load balancing web applications and APIs, offering more granular control over traffic routing and application-level features

* **Scenario:** You're deploying a highly available web application in Azure and need to distribute incoming traffic across multiple instances for scalability and fault tolerance.
* **Solution:** Use Azure Load Balancer or Azure Application Gateway to distribute incoming traffic across multiple backend instances. Load Balancer operates at the transport layer (Layer 4) and is suitable for distributing TCP and UDP traffic, while Application Gateway operates at the application layer (Layer 7) and provides additional features such as SSL termination and URL-based routing.

1. **Azure VPN Gateway** is a service in Microsoft Azure that provides secure, encrypted connectivity between your on-premises network and Azure Virtual Networks (VNets). It allows you to establish a virtual private network (VPN) tunnel over the public internet, enabling secure communication between your on-premises infrastructure, remote users, and Azure resources.
2. **VPN peering**, also known as VNet-to-VNet VPN, is a feature in Azure that allows you to securely connect multiple Azure Virtual Networks (VNets) using VPN gateways. With VPN peering, you can establish direct, encrypted communication between VNets in the same or different Azure regions.
3. **ExpressRoute** provides a private connection to Azure that does not traverse the public internet, ensuring data privacy and security.

It establishes a dedicated connection between your on-premises network and Azure data centers through a secure private network connection provided by a connectivity provider.

**IOT:-**

1. **Azure IoT Hub** is a fully managed service provided by Microsoft Azure that enables bi-directional communication between Internet of Things (IoT) devices and the cloud. It acts as a central message hub for connecting, monitoring, and managing IoT devices securely at scale.

**Scenario:** Smart Home System with Azure IoT Hub Imagine you're making a smart home system where you can control things like lights, thermostats, and door locks from your phone.Azure IoT Hub is like the brains behind your smart home system, helping your devices talk to each other, letting you control them from anywhere, and making sure everything runs smoothly and securely.

1. **Azure IoT Central** is an Internet of Things (IoT) SaaS (Software as a Service) solution provided by Microsoft Azure. It simplifies the development, deployment, and management of IoT applications and solutions, enabling organizations to connect, monitor, and manage IoT devices and assets at scale without requiring extensive expertise in cloud or IoT technologies.

**Database:-**

1. **Sql database:** Azure SQL Database is a fully managed relational database service provided by Microsoft Azure. it enables organizations to build, scale, and manage relational databases without the complexity of managing underlying infrastructure.
2. **Cosmos db:** Azure Cosmos DB is a globally distributed, multi-model database service provided by Microsoft Azure. It is a fully managed NoSQL database service designed to provide high availability.Azure Cosmos DB supports multiple data models, including document, key-value, column-family, and graph models.
3. **Azure migration** : Azure migration refers to the process of moving applications, data, and workloads from on-premises environments or other cloud platforms to Microsoft Azure. This migration enables organizations to take advantage of Azure's scalability, reliability, and wide range of services for hosting their applications and managing their IT infrastructure.

**Storage:**

1. **Table storage:** Azure Table Storage is a NoSQL key-value store service provided by Microsoft Azure. It offers a scalable and cost-effective solution for storing semi-structured data, such as key-value pairs or entities with flexible schema, in the cloud.
2. **Data lake storage:** Azure Data Lake Storage is a scalable and secure cloud-based data lake solution provided by Microsoft Azure. It is designed to store large volumes of structured, semi-structured, and unstructured data in its native format, enabling organizations to ingest, store, and analyze diverse data types with high throughput and low latency.
3. **Blob storage :** Azure Blob Storage is a scalable object storage service provided by Microsoft Azure. It is designed to store and manage large amounts of unstructured data, such as text or binary data, including documents, images, videos, logs, backups, and other types of files

**Analytics:**

1. **Azure synapse analytics** : Azure Synapse Analytics, formerly known as Azure SQL Data Warehouse, is a cloud-based analytics service provided by Microsoft Azure. It enables organizations to analyze and process large volumes of data from various sources, gain insights, and build data-driven solutions at scale.
2. **Azure Data Lake Storage** is a scalable and secure cloud-based storage solution provided by Microsoft Azure. It is designed to store and analyze large volumes of structured, semi-structured, and unstructured data in its native format, enabling organizations to run big data analytics and machine learning workloads at scale.
3. **Azure HDInsight** is a fully managed cloud service provided by Microsoft Azure for running open-source Apache Hadoop, Spark, HBase, and other big data analytics frameworks. It enables organizations to process, analyze, and derive insights from large volumes of data using distributed computing technologies.