UNIT V – DEPLOYMENT AND CLOUD BASICS [9 hours]

How Software is Deployed in Real Life ,Cloud Platforms Overview (AWS/GCP/Azure), Hosting a Web App on Cloud (AWS EC2/Heroku), Docker Compose Basics, Introduction to Monitoring Tools (like Grafana)

DEPLOYING SOFTWARE IN REAL LIFE

Introduction

Software deployment is the process of making a developed software application available for users or customers. After developers complete coding and testing, the software must be transferred from the development environment to the production environment, where real users can access and use it.

In real-world projects, deployment is an important stage of the Software Development Life Cycle (SDLC). Modern organizations use DevOps practices to automate deployment so that software can be delivered faster, more reliably, and with fewer errors. Deployment ensures that the software runs properly on servers, cloud platforms, or user devices.

Stages of Real-Life Software Deployment

1. Development

The development stage is where the actual software is created. Developers write the application code using programming languages such as Java, Python, JavaScript, or C#. The code is organized into modules or components that perform specific tasks in the application.

In real-world projects, the source code is stored in version control systems like Git. Version control helps developers track changes, manage different versions of the software, and collaborate with team members. The code is often hosted on platforms such as GitHub, which allows teams to share code, review updates, and maintain project history.

2. Build Process

After the software code is written, it must be converted into a form that can be executed on a system. This process is called the build process.

For example:

Java programs are compiled into .class files or packaged into .jar files.

Web applications are bundled into deployable packages.

Build automation tools such as Maven and Gradle are commonly used in real projects. These tools automatically compile the code, manage required libraries (dependencies), and create deployable packages. The build process ensures that the software is correctly compiled and ready for testing or deployment.

3. Testing

Testing is an essential step before deploying software to real users. The goal of testing is to identify and fix bugs, ensure the software works as expected, and verify that it meets user requirements.

Different types of testing are performed:

Unit Testing:

Individual components or modules of the software are tested separately to ensure they function correctly.

Integration Testing:

Different modules are combined and tested together to verify that they interact properly.

System Testing:

The entire system is tested to ensure that all components work together correctly.

User Acceptance Testing (UAT):

The software is tested by real users or stakeholders to ensure that it meets their needs and expectations.

Automation tools such as JUnit and Selenium help automate testing, making it faster and more reliable.

4. Continuous Integration and Continuous Deployment (CI/CD)

Modern software development uses CI/CD pipelines to automate the process of building, testing, and deploying applications.

Continuous Integration (CI):

Developers frequently integrate their code into a shared repository. Whenever new code is added, the system automatically builds and tests the application.

Continuous Deployment (CD):

After successful testing, the updated software is automatically deployed to production or staging environments.

Tools such as Jenkins help automate these processes. Automation reduces manual work, speeds up deployment, and ensures that new features are delivered quickly.

5. Containerization

In real-world environments, software must run consistently on different systems. However, different machines may have different configurations, operating systems, or libraries. To solve this problem, developers use containerization technologies such as Docker. A container packages the application together with all required dependencies, libraries, and configuration files.

This ensures that the software behaves the same way on a developer's computer, testing server, and production server. Containerization improves portability, reliability, and scalability of applications.

6. Deployment to Servers or Cloud

Once the software is packaged and tested, it is deployed to servers where users can access it. Deployment may occur on:

- Physical servers
- Virtual machines
- Cloud platforms

Many modern companies prefer cloud services such as:

- Amazon Web Services
- Microsoft Azure
- Google Cloud

These cloud platforms provide powerful infrastructure, storage, networking, and computing resources. Cloud deployment allows applications to scale easily and support millions of users across the world.

7. Monitoring and Maintenance

After deployment, the software must be continuously monitored to ensure it runs smoothly. Monitoring tools collect data about system performance, resource usage, and errors.

Tools such as Grafana and Prometheus help track important metrics such as:

- Application performance
- System errors
- CPU and memory usage
- Network activity

If any issue occurs, developers can quickly identify the problem and fix it. Regular maintenance includes releasing updates, security patches, and new features.

Deployment Strategies Used in Real Life

Blue-Green Deployment

In Blue-Green deployment, two identical environments are maintained. One environment runs the current version of the application, while the other hosts the new version. After testing the new version, user traffic is switched to the new environment. This method reduces downtime and allows quick rollback if problems occur.

Rolling Deployment

Rolling deployment gradually updates servers with the new version of the software. Instead of updating all servers at once, the update is applied to a few servers at

a time. This ensures that the application remains available while updates are being applied.

Canary Deployment

In Canary deployment, the new version of the application is released to a small group of users first. If the new version performs well without issues, it is gradually released to all users. This approach reduces the risk of deploying faulty updates to the entire user base.

Example of Real-Life Deployment

Consider an online shopping application. Developers write the code and store it in GitHub. Jenkins automatically builds the application and performs testing using automated tools. The application is then packaged into a Docker container. The container is deployed on cloud servers such as AWS. Monitoring tools track system performance and detect errors. Users can then access the application through their web browsers or mobile devices.

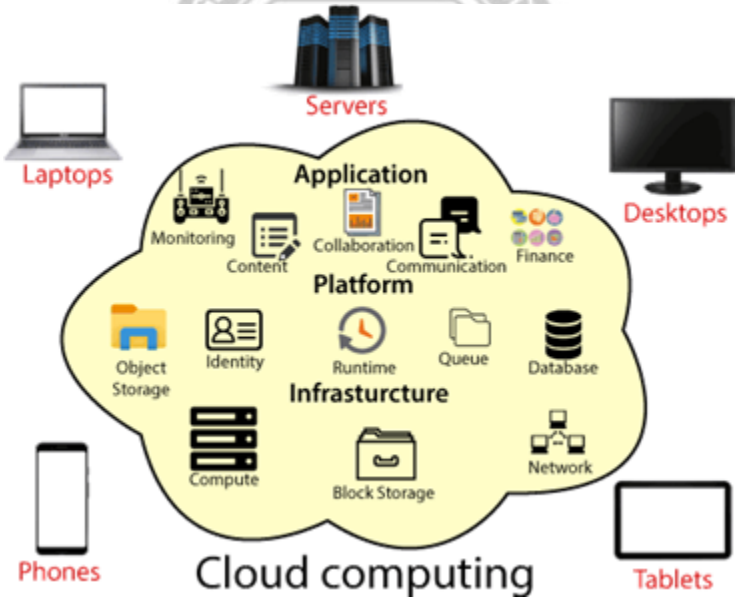
Advantages of Modern Deployment

1. **Faster Software Delivery:**
   Automation allows organizations to release updates and new features quickly.
2. **Reduced Human Errors:**
   Automated pipelines reduce mistakes that can occur during manual deployment.
3. **Improved Software Quality:**
   Continuous testing ensures that errors are detected early.
4. **Continuous Updates and Improvements:**
   Applications can be updated regularly without interrupting users.
5. **Better System Reliability:**
   Modern deployment strategies and monitoring tools ensure stable and reliable systems.

INTRODUCTION TO CLOUD COMPUTING

Cloud Computing is the delivery of computing services such as servers, storage, databases, networking, software, analytics, intelligence, and more, over the Cloud (Internet).

Cloud Computing, a cloud vendor is responsible for the hardware purchase and maintenance. They also provide a wide variety of software and platform as a service. We can take any required services on rent. The cloud computing services will be charged based on usage.



Types of Cloud Computing

1. **Public Cloud:** The cloud resources that are owned and operated by a third-party cloud service provider are termed as public clouds. It delivers computing resources such as servers, software, and storage over the internet.

Example:

- **Amazon Web Services (AWS)** – Offers services like EC2, S3, Lambda, RDS.
- **Microsoft Azure** – Provides virtual machines, Azure Functions, SQL databases, etc.

- **Google Cloud Platform (GCP)** – Includes Compute Engine, BigQuery, Cloud Storage.
- **IBM Cloud** – Offers AI, compute, and Kubernetes services.
- **Oracle Cloud Infrastructure (OCI)** – Known for databases, compute, and analytics services.
- **Alibaba Cloud** – Popular in Asia; provides ECS, Object Storage, and AI services.
- **DigitalOcean** – Simplified cloud for developers; droplets, Kubernetes, storage.
- **Linode (now Akamai Cloud)** – Developer-friendly, cost-effective VMs and networking.
- **Salesforce Cloud** – For CRM and customer relationship services.
- **Heroku** – A platform-as-a-service (PaaS) for app hosting.

2. **Private Cloud:** The cloud computing resources that are exclusively used inside a single business or organization are termed as a private cloud. A private cloud may physically be located on the company's on-site datacentre or hosted by a third- party service provider.

Examples:

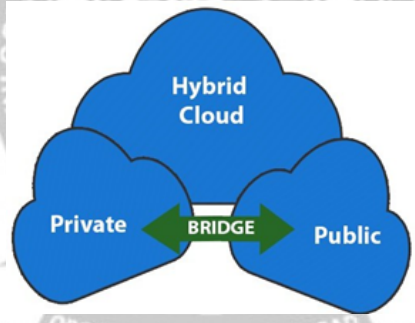
- **VMware vSphere / vCloud Suite** - Used to build and manage private cloud infrastructure with virtualization.
- **Microsoft Azure Stack** - Brings Azure services into your own data center for private cloud deployment.
- **OpenStack** - Open-source platform to build private and hybrid clouds.
- **Red Hat OpenShift** - Enterprise Kubernetes platform often used in private cloud setups.
- **HPE Helion** - Hewlett Packard Enterprise's private cloud platform based on OpenStack.
- **Oracle Private Cloud Appliance** - Offers Oracle-engineered systems for private cloud environments.
- **Dell EMC Cloud for Microsoft Azure Stack** - Combines Dell hardware with Azure Stack software for private cloud use.
- **IBM Cloud Private** - Container-based platform for developing and managing private cloud apps.
- **Nutanix Enterprise Cloud** - Hyperconverged infrastructure that supports private cloud deployment.
- **Cisco Unified Computing System (UCS)** - Enables private cloud infrastructure with advanced computing and networking.

3. **Hybrid Cloud:** It is the combination of public and private clouds, which is bounded

together by technology that allows data applications to be shared between them. Hybrid cloud provides flexibility and more deployment options to the business.

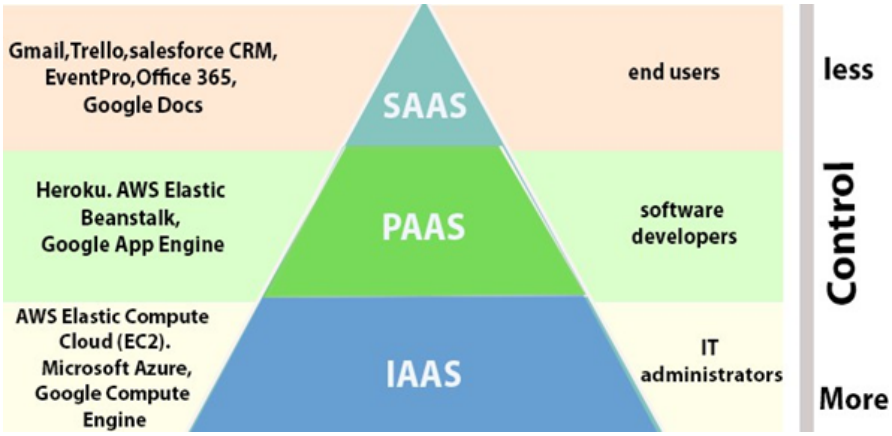
Examples:

- **Microsoft Azure Arc / Azure Stack** - Extends Azure services to on-premises, enabling hybrid deployment.
- **Amazon Web Services (AWS) Outposts** - Brings AWS infrastructure to on-premises for hybrid workloads.
- **Google Anthos** - Manages applications across on-prem, Google Cloud, and other clouds. IBM Hybrid Cloud - Combines Red Hat OpenShift with IBM Cloud and on-prem systems.
- **VMware Cloud Foundation** - Integrates with AWS, Azure, or private data centers for hybrid cloud operations.
- **Oracle Cloud Infrastructure (OCI) Hybrid Cloud** - Oracle Cloud + on-prem data centers using Oracle Cloud@Customer.
- **Dell Technologies Cloud** - Offers consistent infrastructure and operations across public and private clouds.



Types of Cloud Services

- **Infrastructure as a Service (IaaS)**: It provides you all the hardware components you require such as computing power, storage, network, etc.
- **Platform as a Service (PaaS)**: It provides you a platform that you can use to develop applications, software, and other projects.
- **Software as a Service (SaaS)**: It provides you with complete software to use like Gmail, google drive, etc.



Introduction To AWS

AWS (Amazon Web Services) is a comprehensive, evolving cloud computing platform provided by Amazon that includes a mixture of infrastructure- as-a-service (IaaS), platform-as-a-service (PaaS) and packaged-software-as-a- service (SaaS) offerings. AWS services can offer organization tools such as compute power, database storage and content delivery services.

Some of the services that are commonly used by Amazon Web Services:

1. **Amazon EC2 (Elastic Compute Cloud):- Amazon EC2** is a Infrastructure-as-a-Service that allows users to **run virtual servers** (called instances) in the cloud. It's one of the core services in AWS and is widely used for hosting websites, applications, and backend systems. EC2 can be resettable due to the user's necessity, as long as a secured computing capacity is available in the cloud. For example, in situations whereby web traffic changes, this facility can increase its atmosphere, behind the scenes, to three occurrences when necessary and then contract to a single resource when weight is reduced.
2. **Amazon Elastic Beanstalk :- Amazon Elastic Beanstalk** is a **Platform as a Service (PaaS)** offering from AWS that lets us quickly **deploy and manage applications** without worrying about the underlying infrastructure (like EC2, load balancers, or networking). It consists of several programming languages; such a service enables scale and organizes web apps. Just upload the required code, and the Elastic Beanstalk would automatically handle the setting from the capacity provision to load balancing and auto-scaling to app health checking.
3. **Amazon Lightsail :-** It is a **simplified cloud platform** offered by AWS, designed to make it easy and affordable to launch and manage **virtual private servers (VPS)** — especially for beginners, small businesses, or developers who want an easy start.Easy to present and manage, Amazon Lightsail is essentially a confidential server and contains all required to launch a project without delay on a computer-generated

machine, such as tools for transferring data, SSD-based storage, static IP, and DNS management.

4. **Amazon Lambda :- AWS Lambda** is a **serverless computing service** provided by Amazon Web Services (AWS). It **runs the code without provisioning or managing servers**. The function is written and uploaded, and Lambda takes care of everything else — like scaling, execution, and resource management. It automatically scales little requests for a day to so many for a second. Organizations pay for the time used for computing and no charges while code isn't running.

Amazon Web Services Storage Services

With the quantity of data organizations collect, storing the data seems to be high in demand. AWS, therefore, helps bring numerous solutions listed below:

- **Amazon S3 (Simple Storage Service)** – Amazon S3 is a cloud storage service offered by AWS that allows to store and retrieve any amount of data, anytime, from anywhere on the web. It's designed for high durability, availability, and scalability. With S3, data can be stored and retrieved including IoT sensors, mobile apps, websites, and others. There's flexibility in data management, security, and durability for internet storage.
- **Amazon Glacier** – It's a service for cloud storage meant for storing data for future use, including long-term backups, highly secure options, data archiving (e.g., old media, legal documents, medical records) and low-cost Glacier.
- **Amazon Elastic Block Store (EBS) -** EBS offers block store volumes for cases of EC2. It is a dependable storage volume attached to whichever running instance in a similar accessibility zone.
- **Amazon Elastic File System (EFS)**: - Amazon EFS is a serverless, scalable, fully managed file storage service that can be mounted by multiple Amazon EC2 instances at the same time, just like a shared network file system (NFS). It's scalable and straightforward. Users can create and manage file systems without needing to worry about application scaling. The system automatically increases or decreases storage capacity as files are added or deleted — no manual resizing is needed..

Amazon Web Services Databases

Amazon Web Services offers databases in dual primary flavors:

- **Amazon RDS** – Easing the process of setting up, operating, and scaling a relational database in the cloud, Amazon RDS provides cost-efficient and resizable capacity while automating time-consuming administrative tasks such as database hardware setup, repairing, and backups. The enhanced service is for memory performance and output/input processes. Amazon RDS gives you the freedom to use your relational database of choice including the most popular open source and commercial agents and

amazon relational database built for the cloud, Amazon Aurora, which offers the performance and availability of traditional commercial databases and fraction of the cost.

- **Amazon Redshift:** is a data warehousing service allowing users to examine data with SQL and other intelligence business instruments. It can be used in running multifaceted queries compared to terabytes of organized data and obtain results in seconds.

Services of AWS

Since its existence, AWS has developed into a vital technological cloud computing. Below are some essential services offered by AWS:

1. **Amazon S3:** It is a tool used for backing up the internet and less costly for storage options in the category of object-storage. The central part of this option is that data stored can be retrieved from virtually anywhere they are needed.
2. **AWS Data Transfer Products:** These services help you import/export large data sets, stream real-time data, or transfer files across networks efficiently, securely, and at scale. As the term suggests, they are collecting data, transferring data products, and migration that aids the collection of data seamlessly. They can also allow the monitoring and analysis of data in actual time.
3. **Amazon EC2 (Elastic Compute Cloud): Amazon EC2** is a **web service** from AWS that provides **resizable compute capacity** (virtual servers) in the cloud. It allows you to run applications on virtual machines (called **instances**) without needing to buy physical hardware.
4. **Amazon SNS (Simple Notification Services):** It is a tool for delivering notification messages to a significant number of subscribers via SMS or email. Alarms can be sent, including service notifications and other messages proposed to call attention to important information.
5. **Amazon KMS (Key Management System):** It is a security instrument using 256-bit encryption for data. Also safeguarding it from cybercrime/attacks and hackers.
6. **Amazon Lambda Telegram Channel:** It's for code running depending on a particular event and manages reliant resources. You do not need either provisioning servers or operating, and how much is paid depending on the length of time, it takes in executing your code. It's cost-effective, unlike services that their charges are according to hourly rates.
7. **Route 53: Amazon Route 53** is a **highly available and scalable Domain Name System (DNS) web service** from AWS. It doesn't need to keep a separate DNS account. The aim is to provide a cost-effective and reliable method to route users for businesses to internet apps.

Advantages of AWS

- AWS provides a user-friendly programming model, architecture, database as well as operating system that has been already known to employers.
- AWS is a very cost-effective service. There is no such thing as long-term commitments for anything you would like to purchase.
- It offers billing and management for the centralized sector, hybrid computing, and fast installation or removal of your application in any location with few clicks.
- There is no need to pay extra money on running data servers by AWS.
- AWS offers a total ownership cost at very reasonable rates in comparison to other private cloud servers.

Disadvantages of AWS

- AWS has supportive paid packages for intensive or immediate response. Thus, users might need to pay extra money for that.
- There might be some cloud computing problems in AWS especially when you move to a cloud Server such as backup protection, downtime, and some limited control.
- From region to region, AWS sets some default limitations on resources such as volumes, images, or snapshots.
- If there is a sudden change in your hardware system, the application on the cloud might not offer great performance

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GOOGLE CLOUD PLATFORM (GCP)

GCP is a public cloud vendor — like competitors Amazon Web Services (AWS) and Microsoft Azure. With GCP and other cloud vendors, customers are able to access computer resources housed in Google's data centers around the world for free or on a pay-per-use basis.

GCP offers a suite of computing services to do everything from GCP cost management to data management to delivering web and video over the web to AI and machine learning tools.

Google Cloud vs Google Cloud Platform

Google Cloud includes a combination of services available over the internet that can help organizations go digital. Google Cloud Platform (which provides public

cloud infrastructure for hosting web-based applications and is the focus of this blog post) is a part of Google Cloud.

Some other services that are a part of Google Cloud include:

- Google Workspace, formerly known as G Suite and Google Apps. This product provides identity management for organizations, Gmail, and collaboration tools.
- Enterprise versions of Android and Chrome OS. These phone and laptop operating

systems are ways for users to connect to web-based applications.

- Application programming interfaces (APIs) for machine learning and enterprise mapping services. These provide software-to-software communication. E.g.) Google Cloud Vision API, Google Cloud speech-to-text API, Google Cloud text-to-speech API, Google Cloud Natural language API, Cloud video Intelligence, Audio ML APIs, Tensorflow, BigQueryML etc.,

What are Google Cloud Platform services?

Each GCP region offers a category of services. Some services are limited to specific regions. Major services of Google Cloud Platform include:

- Computing and hosting
- Storage and database
- Networking
- Big Data
- Machine learning

Google Cloud Platform Advantages:

1. **Good documentation:** We are talking about many pages in total, including a reasonably detailed API Reference guide.
2. **Different storage classes for every necessity:** Regional (frequent use), Nearline (infrequent use), and Coldline (long-term storage).
3. **High durability:** This suggests that data survives even within the event of the simultaneous loss of two disks.
4. **Many regions available to store your data:** North America, South America, Europe, Asia, and Australia.

Google Cloud Platform Disadvantages

1. The support fee is sort of hefty: Around 150 USD per month for the foremost basic service (Silver class).
2. Downloading data from Google Cloud Storage is expensive. 0, 12 USD per GB.
3. Google Cloud Platform web interface is somewhat confusing. Sometimes I am lost while browsing around the menus.
4. Prices in both Microsoft Azure (around 0.018 USD per GB/month) or Backblaze B2 (about 0.005 USD per GB/month) are less than Google Cloud Storage.
5. It has a high pricing schema, almost like AWS S3, so it's easy to urge unexpected costs (e.g. number of requests, transfers, etc.).

Cloud Storage in Google Cloud Platform

Google Cloud Platform provides a number of cloud storage choices, each with special features and applications. The types are listed below.

1. Google Cloud Persistent Disk(Block Storage)

2. Google Cloud Filestore(Network File storage)
3. Google Cloud Storage (Object Storage).
4. Google Cloud Storage for Firebase
5. Google Cloud Storage Transfer Service

Google Cloud Persistent Disks (Block Storage)

A type of block storage called Google Cloud Persistent Disks offers dependable and quick storage for your virtual machine instances on the Google Cloud Platform.

- We can back up our storage using persistent discs, which allow us to attach discs of various sorts and sizes, such as SSDs or HDDs, to the necessary virtual machines. This block storage will boost throughput and decrease latency.
- Because of its high durability and support for snapshots, persistent discs enable us to take a disc backup when necessary without losing any data.
- Once the disk is attached to the VMs then also we can change the size of the disk which makes them more flexible. It can be done without losing the data.
- Persistent Disks are more secure: we can encrypt the data by using a Google key or customer-managed keys and also we can restrict the access of the disk to specific users, groups, or resources by using IAM roles.

Google Cloud Filestore (Network File Storage)

A controlled network file storage service offered by Google Cloud Platform is Google Cloud File Store. It enables reliable performance and high availability for storing and sharing files. We can create files with the aid of file storage that can be mounted onto the necessary path and accessed from an instance operating on the GCP or on-premises. Automatic snapshots will be taken in the file storage, and since our storage is automatically backed up, we can prevent data loss.

File storage is available in two types:

1. **Standard tier:** It provides a throughput of 800 MB/s per share, which will result in minimal latency and good performance.
2. **Premium tier:** The premium tier's throughput is 1.2 GB/s per share, enables SSD storage and can be particularly beneficial for applications that require high IOPs and low latency.

Google Cloud Storage (Object Storage)

Object storage is scalable, durable, and secure. Once we store our data in object storage it can be accessed from anywhere means the object storage is region independent.

1. Object storage is very different from Block storage and file storage in that we store the data in the form of objects. It is more suited for static data like videos, photos, etc.
2. We can save our data in accordance with our needs; for example, if we frequently use it, we will keep it in Standard storage, while less frequently accessed data can be kept

in Coldline and Archive for long-term data access.

3. Object storage offers us data encryption, data replication, and lifecycle management which make it more reliable and we can integrate the object storage with multiple GCP services like Google Cloud Functions, BigQuery, and AI Platform, enabling you to build powerful applications.

Features of GCP

- **Object Lifecycle Management:** Define conditions that trigger data deletion or transition to a cheaper storage class.
- **Object Versioning:** Continue to store old copies of objects when they are deleted or overwritten.
- **Retention policies:** Define minimum retention periods that objects must be stored for before they're deleted.
- **The object holds:** Place a hold on an object to prevent its deletion
- **Customer-managed encryption keys:** Encrypt object data with encryption keys stored by the Cloud Key Management Service and managed by you.
- **Customer-supplied encryption keys:** Encrypt object data with encryption keys created and managed by you.
- **Uniform bucket-level access:** Uniformly control access to your Cloud Storage resources by disabling object ACLs.
- **Requester Pays:** Require access to your data to include a project ID to bill for network charges, operation charges, and retrieval fees.
- **Bucket Lock:** Bucket Lock allows you to configure a data retention policy for a Cloud Storage bucket that governs how long objects in the bucket must be retained.

INTRODUCTION TO AZURE

What is Azure?

Azure is Microsoft's cloud platform, just like Google has its Google Cloud and Amazon has its Amazon Web Service. Generally, it is a platform through which we can use Microsoft's resources. For example, to set up a huge server, we will require huge investment, effort, physical space, and so on. In such situations, Microsoft Azure comes to our rescue. It will provide us with virtual machines, fast processing of data, analytical and monitoring tools, and so on to make our work simpler. The pricing of Azure is also simpler and cost-effective. Popularly termed as "Pay As You Go", which means how much you use, pay only for that.

How Microsoft Azure Works?

- It is a private and public cloud platform that helps developers and IT professionals to build deploy and manage the application. It uses the technology known as

virtualization.

- Virtualization separates the tight coupling between the hardware and the operating system using an abstraction layer called a hypervisor.
- Hypervisor emulates all the functions of a computer in the virtual machine, it can run multiple virtual machines at the same time and each virtual machine can run any operating system such as Windows or Linux.
- Azure takes this virtualization technique and repeats it on a massive scale in Datacenter owned by Microsoft. Each data center has many racks filled with servers and each server includes the hypervisor to run multiple virtual machines.
- The network switch provides connectivity to all those servers.
- One server in each rack runs a special piece of software called fabric controller. Each fabric controller is connected to another special piece of software known as the Orchestrator. Each Orchestrator is responsible for managing the work like responding to user requests.

Microsoft Azure Services

Following are some of the services Microsoft Azure offers:

1. **Compute:** Includes Virtual Machines, Virtual Machine Scale Sets, Functions for serverless computing, Batch for containerized batch workloads, Service Fabric for microservices and container orchestration, and Cloud Services for building cloud-based apps and APIs.
2. **Networking:** With Azure, you can use a variety of networking tools, like the Virtual Network, which can connect to on-premise data centers; Load Balancer; Application Gateway; VPN Gateway; Azure DNS for domain hosting, Content Delivery Network, Traffic Manager, ExpressRoute dedicated private network fiber connections; and Network Watcher monitoring and diagnostics
3. **Storage:** Includes Blob, Queue, File, and Disk Storage, as well as a Data Lake Store, Backup, and Site Recovery, among others.
4. **Web + Mobile**: Creating Web + Mobile applications is very easy as it includes several services for building and deploying applications.
5. **Containers:** Azure has a property that includes Container Service, which supports Kubernetes, DC/OS or Docker Swarm, and Container Registry, as well as tools for microservices.
6. **Databases:** Azure also included several SQL-based databases and related tools.
7. **Data + Analytics:** Azure has some big data tools like HDInsight for Hadoop Spark, R Server, HBase, and Storm clusters
8. **AI + Cognitive Services:** With Azure developing applications with artificial intelligence capabilities, like the Computer Vision API, Face API, Bing Web Search,

Video Indexer, and Language Understanding Intelligent.

9. **Internet of Things:** Includes IoT Hub and IoT Edge services that can be combined with a variety of machine learning, analytics, and communications services.
10. **Security + Identity:** Includes Security Center, Azure Active Directory, Key Vault, and Multi-Factor Authentication Services.

Creation And Connection of User and Virtual Machine:

Follow the below steps to create and connect a user to a virtual machine:

Step 1: The user makes a request using Orchestrators Web API for creating the virtual machine.

Step 2: The web API can be called by many tools including the UI of the Azure portal.

Step 3: The orchestrator package everything that is needed, it picks the best server rack and sends the package and request to the fabric controller.

Step 4: Once the fabric controller has created the virtual machine the user can connect to it.

Advantages of Azure:

Following are some advantages of using Microsoft Azure:

1. **High Availability:** It refers to the quality of computing infrastructure which allows it to continue functioning, even when some of its components fail.
2. **Data Security:** Azure provides many of the things to secure data over the cloud-like Microsoft Defender for Cloud, Key Vault, Azure Information Protection, and many more.
3. **Scalability:** Azure provides 2 types of scalability i.e. Vertical and Horizontal scaling to tackle the load by changing the capacity of resources or by adding the resources.
4. **Cost-Effective:** Azure provides different pricing models that can help to save costs.
5. **Learning-Curve:** Azure provides various programming languages such as C#, Visual Basics etc., and tools such as Visual Studio, Azure ML Studio, Azure Dev tools etc., for learning.
6. **Hybrid-Capabilities**: Azure provides a hybrid working model. It allows the organization or enterprise to avail services from public cloud as well as from on-premise network.

Disadvantages of Azure:

Following are the key disadvantages of using Microsoft Azure:

1. **Requires Platform Expertise:** A common mistake, on-premise servers compute power does not translate equivocally in the cloud but can potentially cost businesses.
2. **Requires Management:** As Azure provides many of the platforms so it needs to be expertly managed and maintained which includes patching and server monitoring.
3. **Complexity:** For maintaining the SaaS application for large enterprises, it is a bit

complex in nature to ensure the smoothness of application all the time.