UNIT 6

**Q.1 ) What is cloud computing?** **What are the benefits of cloud computing? What are the types of cloud computing?**  
**Ans.:** Cloud computing is one of the most usable services in IT services where we can use this service for various operations. We can deliver the IT infrastructure such as servers, storage, database, networking, software, analytics and intelligence over the internet which is the cloud. It will make faster accessibility of the IT resources for the development and deployment of any kind of project. It helps to lower your operating costs and run infrastructure more efficiently and scale as your business needs change.  
**benefits of cloud computing**

* Cost
* Performance speed
* Productivity
* Reliability
* Security
* Global scale

**types of cloud computing**

* IaaS - Infrastructure as a service
* PaaS - Platform as a service
* SaaS - Software as a service
* Serverless computing

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Q2) **What is AWS cloud? List different services provided by it.**  
**AWS (Amazon Web Services)** is a **cloud computing platform** provided by **Amazon** that offers a wide range of **on-demand services** such as computing power, storage, networking, databases, and more. It enables individuals and businesses to **build, deploy, and manage applications** and infrastructure without owning physical servers.

AWS provides a **pay-as-you-go** model, which means users only pay for the resources they use, making it cost-efficient and scalable.  
**Different Services Provided by AWS:**  
1. **Compute Services:**  
**Amazon EC2 (Elastic Compute Cloud)** – Virtual servers to run applications.  
**AWS Lambda** – Serverless computing to run code without managing servers.

2. **Storage Services:**  
**Amazon S3 (Simple Storage Service)** – Scalable object storage for files and backups.  
**Amazon EBS (Elastic Block Store)** – Persistent block storage for EC2 instances

3. **Database Services:**  
**Amazon RDS (Relational Database Service)** – Managed SQL databases like MySQL, PostgreSQL.  
**Amazon DynamoDB** – NoSQL database for high-speed, low-latency apps.

4. **Networking Services:**  
**Amazon VPC (Virtual Private Cloud)** – Isolated cloud network for secure deployment.  
**Amazon CloudFront** – Content Delivery Network (CDN) for fast delivery

5. **Security & Identity Services:**  
**AWS IAM (Identity and Access Management)** – Controls access to AWS resources.  
**AWS KMS (Key Management Service)** – Manages encryption keys

6. **Machine Learning & Analytics:**  
**Amazon SageMaker** – Build, train, and deploy ML models.  
**Amazon Athena** – Query data directly from S3 using SQL.

**Features of AWS Cloud:  
1. On-Demand Self-Service**: Users can provision computing resources like servers, storage, and databases without human intervention. **2. Scalability and Elasticity:** AWS automatically scales up or down based on demand, ensuring efficient resource usage. **3. Pay-as-You-Go Pricing**: You pay only for what you use. No upfront costs or long-term commitments. **4. Global Infrastructure**: AWS has a global network of **Availability Zones and Regions**, offering low-latency and high availability. **5. Security and Compliance:** AWS offers strong security measures like **IAM, encryption, DDoS protection**, and meets compliance standards (e.g., HIPAA, GDPR, SOC). **6. Wide Range of Services**: Includes **compute, storage, databases, machine learning, networking, IoT, security, DevOps tools**, and more.

**Benefits of AWS Cloud:  
1. Cost Efficiency:** No need to invest in physical infrastructure. You pay for resources based on usage, reducing operational costs. **2. Speed and Agility:** New resources can be provisioned in minutes. Helps businesses experiment and innovate faster. **3. Flexibility**: Supports multiple operating systems, programming languages, architectures, and databases. **4. Reliability and High Availability**: Redundant data centers, automatic backups, and failover mechanisms ensure high uptime and disaster recovery. **5. Ecosystem and Integration**: AWS integrates well with third-party services and has a vast community, documentation, and marketplace. **6. Environmentally Friendly**: AWS runs on energy-efficient data centers and promotes sustainability.  
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Q3) **What is EC2 service?** **What are the EC2 types?**  
EC2 is a virtual machine with an operating system and hardware component that you want to use. AWS allows us to run various virtual computers and manage them with single hardware. EC2 is one of the most used primary services from the AWS ecosystem. EC2 enables on-demand, scalable computing capacity in the AWS cloud. An AWS EC2 instance eliminates the up-front investment for hardware, so there is no need to maintain any rented hardware. EC2 enables you to build and run applications faster. You can use EC2 in AWS to launch as many virtual servers as you need.  
**Amazon EC2 (Elastic Compute Cloud)** is a web service provided by **AWS** that offers **resizable compute capacity in the cloud**. It allows users to run **virtual servers (instances)** to host applications, websites, and other services without needing physical hardware.  
**Key Features:**  
Scalable computing capacity  
Various instance types for different workloads  
Pay-as-you-go pricing  
Supports Linux, Windows, and other OS

**Types of EC2 Instances:** Amazon EC2 provides different instance types optimized for various use cases:A screenshot of a computer

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Q4) **List steps to deploy website on EC2.**   
The steps to deploy a website on EC2 are:

* **Step 1:** Connect server with PuTTY
* **Step 2:** Update Ubuntu instance
* **Step 3:** Install Apache 2
* **Step 4:** Go back to your instances page and click on 'launch-wizard-1' under security groups
* **Step 5:** Go to Inbound and click on Edit inbound rules
* **Step 6:** Then, add an HTTP rule with Source as 'Anywhere-IPv4' and save the rule.
* **Step 7:** On your browser, use your public IP address, put it in the URL box and run
* **Step 8:** You can create your HTML page or upload your code with GitHub in the /var/www/html folder.

With these steps, you can deploy the website on the EC2 instance.  
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Q5) **What is PuTTY?** **connect EC2 instance with PuTTY**  
PuTTY is a free and open-source terminal emulator, serial console and network file transfer application. It supports several network protocols, including SCP, SSH, Telnet, rlogin, and raw socket connection. It can also connect to a serial port.     
**How to Connect an EC2 Instance Using PuTTY:**

**Step-by-step process:  
1. Launch your EC2 instance:** Go to the AWS Management Console → EC2 Dashboard → Launch an instance. **2. Download the .pem key file:** This is your private key provided during instance launch. **3. Convert .pem to .ppk using PuTTYgen:** Open PuTTYgen → Load the .pem file → Click **Save private key** to get a .ppk file. **4. Open PuTTY**In **Host Name**, type: ec2-user@<Public-IP> (replace <Public-IP> with your instance’s IP)Go to **Connection → SSH → Auth**Browse and select your **.ppk** private key file. **5. Connect**Click **Open**A terminal window opens; login as ec2-user (or ubuntu for Ubuntu OS)

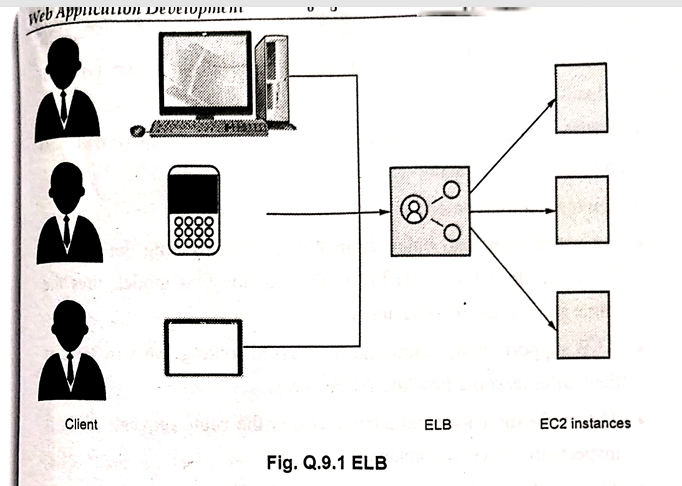
Thus now EC2 instance is connected.  
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**Q6)Concept of AWS Storage , AWS Storage ServiceS**  
Cloud storage is a cloud computing model that stores data on the Internet through a cloud computing provider that manages and operates data storage as a service.   
It is delivered on-demand and manages your own data storage infrastructure.  
It is cost-effective for storage buying.   
AWS storage services have different provisions for highly confidential data, frequently accessed data and not so frequently accessed data.

**AWS Storage Services**  
1. **Simple Storage Service (S3)**  
It is an object storage type and stores any type or size data.  
It is used for web applications, mobile applications, analytics, and backup services.  
It provides user management control for any specific requirement in the application to store the data.  
With S3, we can create, rename, delete folders with the help of a web-based file explorer.  
AWS provides 99.999999999% durability to deliver data to end-users.  
It provides 3 forms of encryption, including server-side encryption and client-side encryption.  
***Regarding S3 buckets:***S3 has two primary entities called buckets and objects.Objects are stored in buckets.Within this bucket, you can create multiple folders to differentiate the files.If you want to upload images, you may create a folder named images and store it in the logical address of the file with the prefix 'images'.You can create a maximum of 100 buckets per account.The bucket names should be unique.

**2. Amazon S3 Glacier**It is an object storage type.It is used for long-term data storage and especially for archival data.It also provides encryption on data for security.This service is used for a low retrieval rate of data in any application.It allows running queries and analytics on it directly.It provides 99% durability.

**3. Elastic Block Storage (EBS)**It is a block storage type.It is like hard drive storage.This storage is attached to the EC2 instance and used as block storage, where we can install any operating system.It is available in SSD or HDD format.EBS volumes are network file systems.These volumes get automatically replicated within availability zones for better availability and durability.We can dynamically increase or decrease the capacity of storage.

**4. Amazon EC2 Instance Storage**It is a block storage type.It is used as temporary storage for EC2 instances.The temporary storage of data that changes frequently like buffers, queue cache, etc.It uses SSD for high I/O performance.Durability provides with replication of storage.  
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q7) **What is elastic load balancer and explain its working. Explain in detail types of elastic load balancer.**

Every application needs good efficiency, performance and availability. The network traffic and load on a single server decrease the efficiency, performance, and availability of an application.  
Elastic Load Balancer or ELB is a service provided by AWS to distribute incoming traffic across multiple servers or clusters. The ELB increases the availability and fault tolerance of an application. AWS load balancer will distribute your workloads across multiple compute resources, such as a Virtual Machine or Virtual Server. With AWS management console, we can create load balancers.     


**Step-by-Step Working of ELB:  
1. Client Request Initiation:** A user (client) sends a request (like opening a website hosted on AWS). **2. DNS Resolution**: The request is first resolved to the **DNS name of the Load Balancer** (e.g., myapp-123456.elb.amazonaws.com). **3. Routing the Request**The ELB receives the request and **determines the best target** (EC2 instance, container, or IP) to forward it to.Routing decisions depend on load balancing algorithm (round-robin, least outstanding requests, etc.), health checks, and rules (like path/host in ALB). **4. Health Check**  
ELB regularly **performs health checks** on all registered targets. **Unhealthy targets** are automatically removed from routing.Traffic is only forwarded to **healthy instances**. **5. Forwarding the Request**  
ELB forwards the request to the selected **healthy target**.In ALB: It can route based on URLs (e.g., /login, /products).In NLB: It routes based on IP/Port. **6. Target Sends Response to Client**  
The selected target handles the request and **responds back to the client**, either directly or through the ELB (depending on the configuration).

There are different types of elastic load balancer:  
1. **Classic Load Balancer**  
It is a traditional load balancer that is used initially.  
The classic Load balancer in AWS is used on EC2-classic instances.  
This is the previous generation's load balancer and also it doesn't allow host-based or path-based routing.     
It ends up reducing efficiency and performance in certain situations.  
It is operated on connection level as well as request level.

2. **Network load balancer**  
Network load balancer in AWS takes routing decisions in the transport layer (TCP/SSL) of the OSI model.     
It is mainly used for load balancing TCP traffic.  
It can handle millions of requests per second.  
AWS network load balancer can be trusted in these types of situations.  
Widely used to load balancing the TCP traffic and it will also support elastic or static IP.

3. **Application load balancer**  
An application load balancer in AWS makes routing decisions at the application layer (HTTP/HTTPS) of the OSI model, thus the name application load balancer.     
ALB supports path-based and host-based routing.     
The application load balancer receives the route requests, then it inspects the received packets.  
Then it chooses the best target possible for the type of load and sends it to the target with the highest efficiency.     
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Q8) **What is AWS VPC? What are the different components of VPC?  
Ans.:** AWS provides security to the cloud and servers with its services. VPC or Virtual Private Cloud provides additional security levels on the AWS services that you are using. VPS gives you full control over routing traffic to and from your instances. AWS VPC is a private subsection of AWS in which you can place AWS resources such as EC2 instances and databases. It gives all the benefits of the traditional network that you have for your own data center. Resources and applications are accessed through IPv4 or IPv6 in your AWS VPC.     
A diagram of a network

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**There are two types of VPC:**

1. Default VPC
2. User defined VPC

**Components of VPC:  
1. Subnets:**Subdivisions of a VPC's IP address range.Two types: **Public Subnet** (connected to internet) and **Private Subnet** (internal only).

**2. Internet Gateway (IGW):** Allows instances in public subnets to access the internet. **3. NAT Gateway/Instance:** Lets instances in private subnets access the internet for updates, while still keeping them inaccessible from outside. **4. Route Tables:** Define the rules for routing traffic within the VPC and to the internet. **5.Security Groups:** Virtual firewalls that control inbound and outbound traffic at the instance level. **6. Network ACLs (Access Control Lists):** Stateless filters that control traffic at the subnet level. **7. DHCP Option Sets:** Provide configuration for domain name servers, domain names, etc. **8. VPC Peering:** Allows connection between two VPCs for internal traffic flow.  
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Q9) **What is elastic beanstalk and enlist the advantages of using it?**

**Ans.:** Elastic Beanstalk is a compute service for web applications. It is a pre-configured EC2 server where environment configuration is already done. EC2 is infrastructure-as-a-service whereas Elastic Beanstalk is platform-as-a-service. It makes it easier for developers to deploy and manage applications on AWS. In EC2 we have to create a deployment environment for application deployment like for PHP, Python, Node.JS, etc. but in Elastic Beanstalk, it provides a configured server. It cost pay-per-use of resources so there is no additional cost for you.

**Advantages of Using Elastic Beanstalk:  
1. Easy Deployment:** Just upload code and Elastic Beanstalk handles the rest (infrastructure, monitoring, etc.). **2. Auto-scaling:** Automatically adjusts the number of instances to match the traffic load. **3. Built-in Monitoring:** Integrates with **CloudWatch** to monitor application health and metrics. **4. Cost-effective:** You only pay for the AWS resources used (EC2, S3, etc.), not for the platform itself. **5. Customizable Environment:** You can retain full control over AWS resources and configurations if needed. **6. Supports Multiple Environments:** Easily manage **development, staging, and production** environments separately.  
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**q10) Deploying a website or web application on AWS involves several steps.**   
**1. Create an AWS Account:** If you don’t have an AWS account, you'll need to create one at [AWS](https://aws.amazon.com/).

**2. Set Up an EC2 Instance**Launch EC2 Instance:  
Connect to EC2 Instance:

**3. Set Up Web Server (Apache/Nginx)  
Install a Web Server**:For Apache, use sudo apt-get install apache2 (for Ubuntu) or sudo yum install httpd (for Amazon Linux).For Nginx, use sudo apt-get install nginx or sudo yum install nginx. **Start and Enable Web Server**: Start the web server and ensure it runs on startup:Apache: sudo systemctl start apache2 and sudo systemctl enable apache2.Nginx: sudo systemctl start nginx and sudo systemctl enable nginx.

**4. Upload Website Files  
Transfer Files**:You can use SCP, SFTP, or a file manager like WinSCP to upload your website files (HTML, CSS, JavaScript, etc.) to the EC2 instance.The files typically go in /var/www/html for Apache or /usr/share/nginx/html for Nginx.

**5. Set Up a Domain Name (Optional)  
Get a Domain**: If you have a domain, you can use Route 53 (AWS's DNS service) to manage domain names and route traffic to your EC2 instance.Create a hosted zone in Route 53 and add an A record pointing to your EC2 instance’s public IP.

**6. Security Group Configuration  
Open Necessary Ports**:Configure your EC2 security group to allow HTTP (port 80) and HTTPS (port 443) traffic.You can modify the security group by going to the EC2 dashboard, selecting your instance, and editing its inbound rules.

**7. Set Up a Database (If Required)  
RDS (Relational Database Service)**: If your application requires a relational database (e.g., MySQL, PostgreSQL), you can create an RDS instance. **Configure Database**: Once the RDS instance is set up, connect your EC2 instance to it using the appropriate database connection string.

**8. Configure SSL (Optional)**If you need HTTPS, you can use AWS Certificate Manager (ACM) to get an SSL certificate for your domain.You can install SSL on your server and configure Apache or Nginx to handle HTTPS traffic.

**9. Scale the Application (Optional)**For higher availability, use **Elastic Load Balancer (ELB)** to distribute traffic across multiple EC2 instances.You can also set up **Auto Scaling** to automatically add or remove EC2 instances based on traffic demand.

**10. Monitor and Maintain  
CloudWatch**: Use AWS CloudWatch to monitor your application’s performance and set up alerts for resource usage. **Backups**: Implement regular backups, either through manual snapshots of your EC2 instance or automated backups of your RDS database.