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Practical 1 - Infrastructure as a Service using AWS

1] Cloud Computing Architecture :

Cloud computing architecture involves the components and systems that are necessary to deliver cloud services. It composes of both front-end & back-end platforms, both playing a crucial role in the overall functioning of cloud services.

- Components -

1. Front-end Platform :- Client devices such as laptops, tablets, smartphones etc that access cloud services and Web Browser i.e the interfaces through which users interact with cloud.
2. Back-end Platform :- Servers → High-performance computers that run the cloud applications & manage data.
   Storage → Systems for storing large amount of data including databases and file systems.
3. Cloud-based Delivery :- Service Models in which cloud services are delivered to users, categorized into IaaS, PaaS and SaaS.
   Application programming interfaces (API's) that allow different software components to communicate.
4. Network :- The internet or intranet that connects front-end & back-end platforms.

- It includes Service Models like -

IaaS (Infrastructure as a Service) → Provides virtualized computing resources over the internet.
PaaS (Platform as a Service) → Offers hardware and software tools over the internet.
SaaS (Software as a Service) → Delivers software applications over the internet.

Also includes cloud Deployment Models namely ① Public Cloud ② Private Cloud ③ Hybrid Cloud ④ Multi-Cloud.

2] IAAS [Infrastructure as a Service]:

IAAS is a form of cloud computing that provides virtualized computing resources over the internet.

- Key features -

1. Virtual Machines (VMs) → Users can create, configure & manage virtual machines with customizable specifications.
2. Storage Solutions → Block storage is suitable for frequently changing data like databases, Object storage handles large amounts of unstructured data and file storage provides a file system interface for shared access.
3. Networking → Virtual networks, firewalls, IP addresses etc to manage and secure network traffic.
4. Scalability → Dynamic scaling to meet varying workload demands ensuring optimal resource utilization & cost efficiency.

- Benefits -

1. Cost Savings → Reduces the need for investing in and maintaining physical hardware.
2. Flexibility → Users can quickly provision and de-provision resources as needed.
3. Security → Provides comprehensive security measures, including encryption, identity management etc.
4. Accessibility → Resources can be accessed & managed from anywhere with an internet connection.

- Use Cases -

① Development and Testing
② Hosting Websites and Applications
③ Big Data Analysis : Supports large scale data processing
④ High Performance Computing

- Eg of IaaS Providers -

① Amazon Web Services (AWS)
② Google Cloud Platform (GCP)

3] AWS [Amazon Web Services]:

AWS is a comprehensive & widely adopted cloud platform offered by Amazon. It provides a broad set of infrastructure services such as computing power, storage options and networking to help businesses scale and grow. AWS serves millions of customers including startups, large enterprises and public sector organizations, enabling them to lower costs, become more agile and innovate faster.

- Key Services -

1. Compute → Amazon EC2 (Elastic Compute Cloud) provides scalable virtual servers (instances) to run applications. AWS Lambda allows users to run code without provisioning or managing servers.
2. Storage → Amazon S3 provides scalable object storage for any type of data. Amazon EBS offers persistent block storage volumes for use with Amazon EC2 instances.
3. Database → Amazon RDS simplifies the setup, operation & scaling of relational databases in the cloud. It supports multiple database engines. Amazon DynamoDB is a fast & flexible NOSQL database service for any scale.
4. Networking → Amazon route 53 is a scalable & highly available domain name system (DNS) web service and can be used to route end-user requests to AWS services.

- Benefits -

1. Scalability and Flexibility → Users can quickly deploy applications globally across various availability zones & regions.
2. Cost-Effective → AWS's pay-as-you-go pricing model allows businesses to only pay for what they use, with no upfront costs or long-term commitments.
3. Innovation & Speed → AWS continually introduces new services & features, enabling businesses to innovate quickly.

4] EC2 [Elastic Compute Cloud]:

Amazon EC2 is a core service of AWS that provides scalable computing capacity in the cloud. It allows users to run virtual servers known as instances.

- Key features -

1. Scalability & Elasticity → Automically adjusts the number of EC2 instances based on demand. Users can set scaling policies to add or remove instances as needed.
2. Instance Types → General purpose, Compute Optimized, Memory Optimized, Storage Optimized and GPU instances.
3. Storage → Amazon EBS supports persistent block storage for EC2 instances. Amazon EFS has scalable file storage for use with EC2 instances.
4. Security → IAM roles manages permissions for EC2 instances to interact with other AWS services securely. Key Pairs secure SSH access to instances using public key cryptography.

- Use Cases -

1. Web Hosting: Deploy web servers that can scale automatically to handle traffic spikes.
2. Machine learning: Utilize GPU instances for training machine learning models.
3. High-Performance Computing.

- Benefits -

1. Flexibility → Wide range of instance types and configurations to match specific application needs.
2. Cost Efficiency → Multiple pricing options help optimize costs based on workload & usage patterns.
3. Global reach → Availability across multiple regions for high availability & low latency.
4. Integration → Seamlessly integrates with other AWS services like S3, RDS & Lambda for a comprehensive cloud solution.