

Unit-1: Fundamentals of Cloud Computing

Service Models

Cloud computing refers to the delivery of computing services such as servers, storage, databases, networking, software, and more over the internet ("the cloud"). It enables organizations and individuals to access resources on-demand without needing to invest in physical infrastructure.

Cloud computing services are typically offered in three primary models:

- Infrastructure as a Service (IaaS)
- Platform as a Service (PaaS)
- Software as a Service (SaaS)

Each model plays a distinct role in supporting various applications and use cases.

Infrastructure as a Service (IaaS)

Definition

Infrastructure as a Service (IaaS) is a cloud computing service model that provides virtualized computing resources such as servers, storage, networks, and operating systems over the internet. It enables users to rent and manage IT infrastructure without owning or maintaining physical hardware.

Why is IaaS Required?

Cost Efficiency: Eliminates the need for upfront investment in physical hardware and ongoing maintenance costs.

Scalability: Resources can be scaled up or down based on demand, ensuring flexibility.

Accessibility: Provides global access to IT resources, enabling businesses to operate from anywhere.

Focus on Core Activities: Frees organizations from managing infrastructure, allowing them to concentrate on business innovation and growth.

Disaster Recovery: Ensures business continuity by offering reliable backup and recovery solutions.

Role of IaaS

Foundation for Cloud Solutions: Acts as the base layer for hosting applications, platforms, and other cloud services.

Dynamic Resource Allocation: Provides on-demand access to compute, storage, and network resources.

Support for Diverse Workloads: Handles various workloads such as development, testing, analytics, and data storage.

Facilitating Innovation: Offers a flexible environment for experimentation and development without worrying about hardware constraints.

Applications of IaaS

Hosting Websites and Applications: Provides the required infrastructure to host and scale web and mobile applications.

Development and Testing: Offers flexible environments to create, test, and deploy software applications.

Disaster Recovery and Backup: Ensures data safety by providing secure storage and quick recovery options.

E-commerce Platforms: Supports scalable and secure infrastructure for hosting online stores and handling large user traffic.

Real-Life Examples of IaaS Providers

Amazon Web Services (AWS EC2)

- Offers virtual servers and a wide range of infrastructure tools.
- Used by Netflix to stream content worldwide.

Microsoft Azure

- Provides virtual machines, storage, and advanced networking solutions.
- Used by Volkswagen for digital transformation and IoT projects.

Google Compute Engine

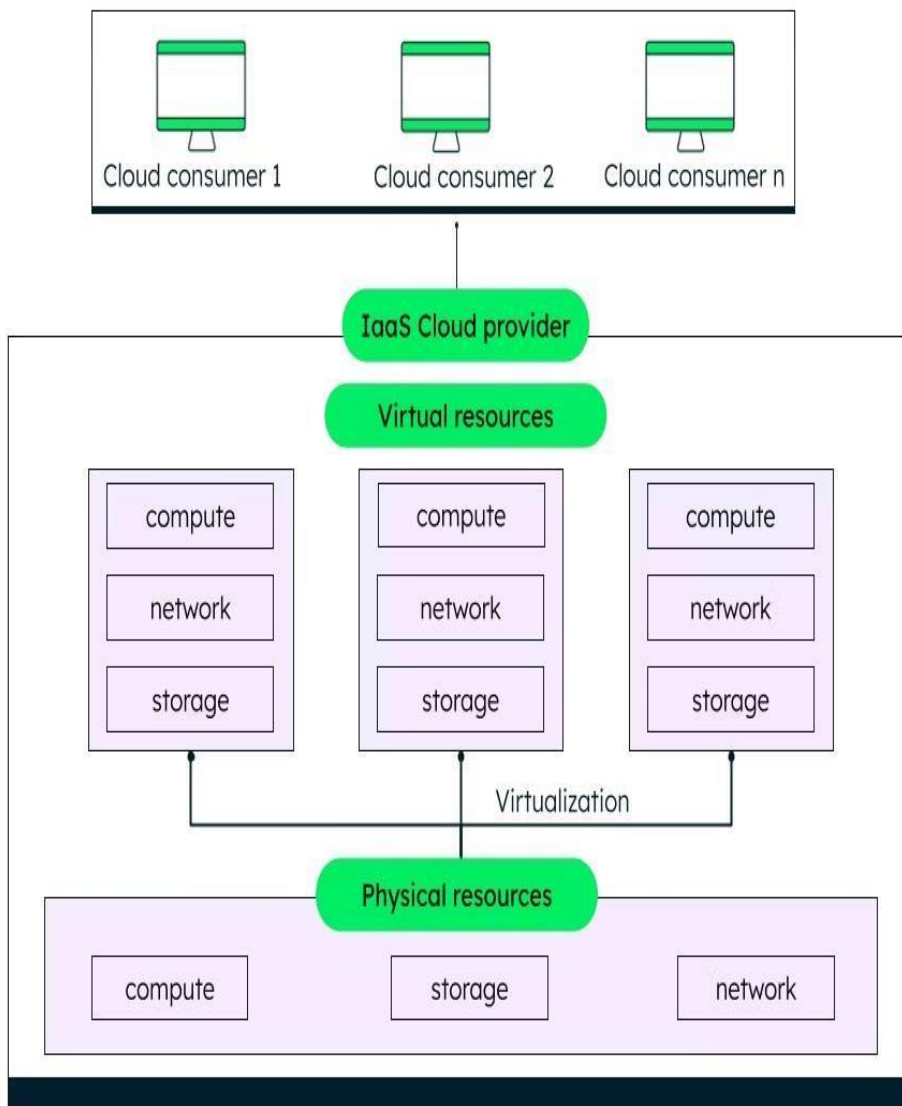
- Delivers scalable compute power for applications.
- Used by Snapchat for scalable photo and video sharing.

IBM Cloud

- Offers IaaS solutions for enterprises needing robust security and compliance.

Representation of IaaS

- Top Layer: Applications (Managed by the user)
- Middle Layer: Virtual machines, storage, and network (Provided by IaaS)
- Bottom Layer: Physical hardware and data centers (Managed by the provider)



Platform as a Service (PaaS)

Definition

Platform as a Service (PaaS) is a cloud computing service model that provides a ready-to-use platform with tools, libraries, and frameworks for developers to build, deploy, and manage applications. PaaS eliminates the need for managing the underlying infrastructure, such as servers, storage, and networking, allowing developers to focus solely on application development and innovation.

Why is PaaS Required?

Simplified Development Process: Provides pre-configured environments, reducing the complexity of setting up and managing development tools.

Accelerated Time-to-Market: Speeds up the application development and deployment cycle.

Cost Efficiency: Eliminates the need to purchase and maintain hardware and software.

Collaboration-Friendly: Enables distributed teams to work together seamlessly using centralized tools.

Flexibility: Supports multiple programming languages, frameworks, and technologies.

Role of PaaS

Streamlined Development: Offers tools, frameworks, and pre-built components to reduce development effort.

Scalability and Flexibility: Provides automatic scaling of applications based on demand.

Focus on Core Development: Frees developers from infrastructure management, enabling them to concentrate on building and improving applications.

Enhanced Productivity: Provides debugging, monitoring, and deployment tools to streamline the application lifecycle.

Applications of PaaS

Web Application Development: Simplifies the creation and deployment of scalable web applications.

Mobile Application Development: Supports frameworks for building feature-rich mobile apps.

API Development and Integration: Provides tools for creating and managing APIs.

Internet of Things (IoT): Facilitates the development of IoT applications with integrated connectivity tools.

Artificial Intelligence (AI) and Machine Learning (ML): Offers libraries and pre-built models for developing AI/ML applications.

Real-Life Examples of PaaS Providers

- **Google App Engine**
- **Microsoft Azure App Service**

PaaS Architecture

- **Top Layer:** User Interaction (UI, CLI, APIs).
- **Middle Layer:** Tools for application development, runtime environments, and management automation.
- **Bottom Layer:** Infrastructure (physical and virtual resources).

Software as a Service (SaaS)

Definition of SaaS:

Software as a Service (SaaS) is a cloud-based service model where software applications are delivered over the internet. Users can access these applications via a web browser without needing to install or maintain the software on their local devices. SaaS is typically offered on a subscription basis.

Why SaaS is Required?

Cost-Effectiveness: SaaS eliminates the need for expensive hardware, maintenance, and upgrades, reducing overall IT costs.

Scalability: Organizations can scale their SaaS solutions up or down based on their needs without significant investment in infrastructure.

Accessibility: Users can access SaaS applications from anywhere with an internet connection, promoting remote work and global collaboration.

Automatic Updates: SaaS providers handle software updates and maintenance, ensuring users always have access to the latest features and security enhancements.

Flexibility: SaaS solutions offer flexible payment models, such as pay-as-you-go or subscription-based pricing, allowing organizations to manage their budgets more effectively.

Role of SaaS:

Business Operations: SaaS applications support critical business functions such as Customer Relationship Management (CRM), Enterprise Resource Planning (ERP), and Human Resource Management (HRM).

Collaboration and Communication: Tools like email, video conferencing, and collaborative document editing facilitate team communication and project management.

Data Management: SaaS solutions provide robust data storage, analysis, and backup options, ensuring data integrity and availability.

Innovation and Agility: SaaS enables businesses to quickly adopt new technologies and innovations without the traditional delays associated with on-premises solutions.

Applications of SaaS:

Customer Relationship Management (CRM): Examples include Salesforce and HubSpot.

Enterprise Resource Planning (ERP): Examples include NetSuite and SAP Business ByDesign.

Communication Tools: Examples include Microsoft Teams, Zoom, and Slack.

Office Suites: Examples include Google Workspace and Microsoft 365.

E-commerce Platforms: Examples include Shopify and BigCommerce.

Representation of SaaS:



Users: Connect to SaaS applications via internet-enabled devices (PCs, tablets, smartphones).

Internet: Serves as the medium for accessing SaaS applications.

SaaS Provider: Hosts and manages the software applications on their cloud infrastructure.

Data Center: Contains the physical hardware and networking equipment required to run and support the SaaS applications.

Difference between IAAS, PAAS and SAAS

Basis Of	IAAS	PAAS	SAAS
Stands for	Infrastructure as a service.	Platform as a service.	Software as a service.
Uses	IAAS is used by network architects.	PAAS is used by developers.	SAAS is used by the end user.
Access	IAAS gives access to the resources like virtual machines and virtual storage.	PAAS gives access to run time environment to deployment and development tools for application.	SAAS gives access to the end user.
Model	It is a service model that provides virtualized computing resources over the internet.	It is a cloud computing model that delivers tools that are used for the development of applications.	It is a service model in cloud computing that hosts software to make it available to clients.
Technical understanding.	It requires technical knowledge.	Some knowledge is required for the basic setup.	There is no requirement about technicalities company handles everything.
Popularity	It is popular among developers and researchers.	It is popular among developers who focus on the development of apps and scripts.	It is popular among consumers and companies, such as file sharing, email, and networking.

Basis Of	IAAS	PAAS	SAAS
Percentage rise	It has around a 12% increment.	It has around 32% increment.	It has about a 27 % rise in the cloud computing model.
Usage	Used by the skilled developer to develop unique applications.	Used by mid-level developers to build applications.	Used among the users of entertainment.
Cloud services.	Amazon Web Services, sun, vCloud Express.	Facebook, and Google search engine.	MS Office web, Facebook and Google Apps.
Enterprise services.	AWS virtual private cloud.	Microsoft Azure.	IBM cloud analysis.
Outsourced cloud services.	Salesforce	Force.com, Gigaspaces.	AWS, Terremark
User Controls	Operating System, Runtime, Middleware, and Application data	Data of the application	Nothing