

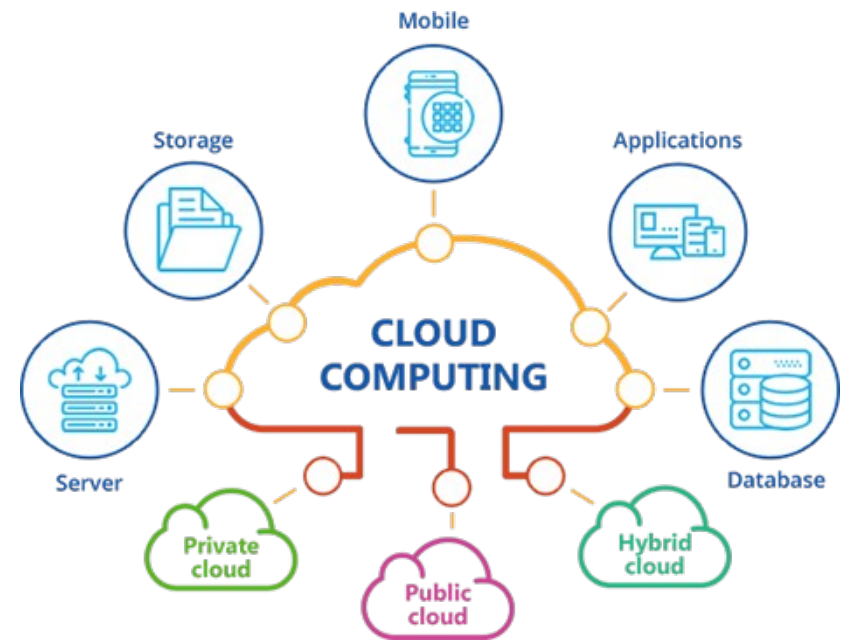


# BCA Programme Sem-V

**210301503**

**INTRODUCTION TO CLOUD COMPUTING**

# Cloud Computing



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# Types of Cloud Services

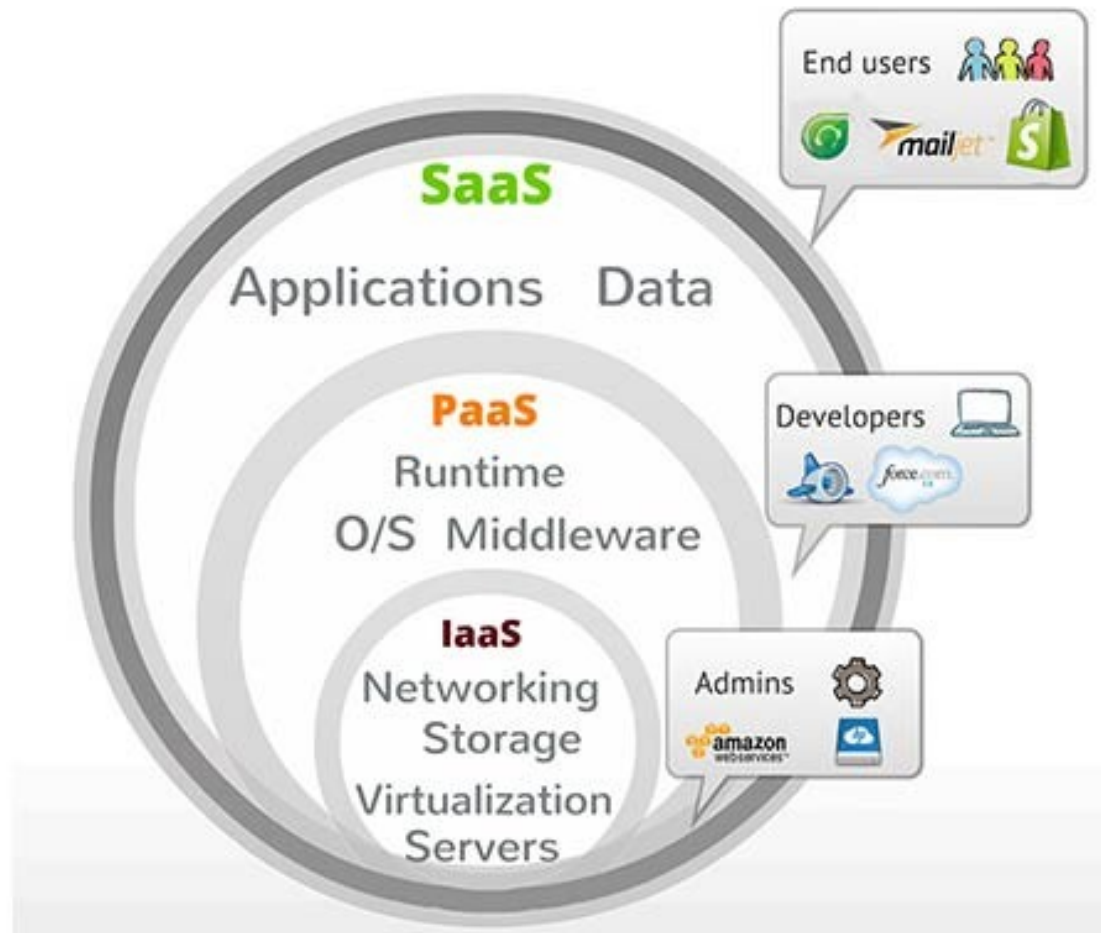
**Cloud models come in three types:**

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

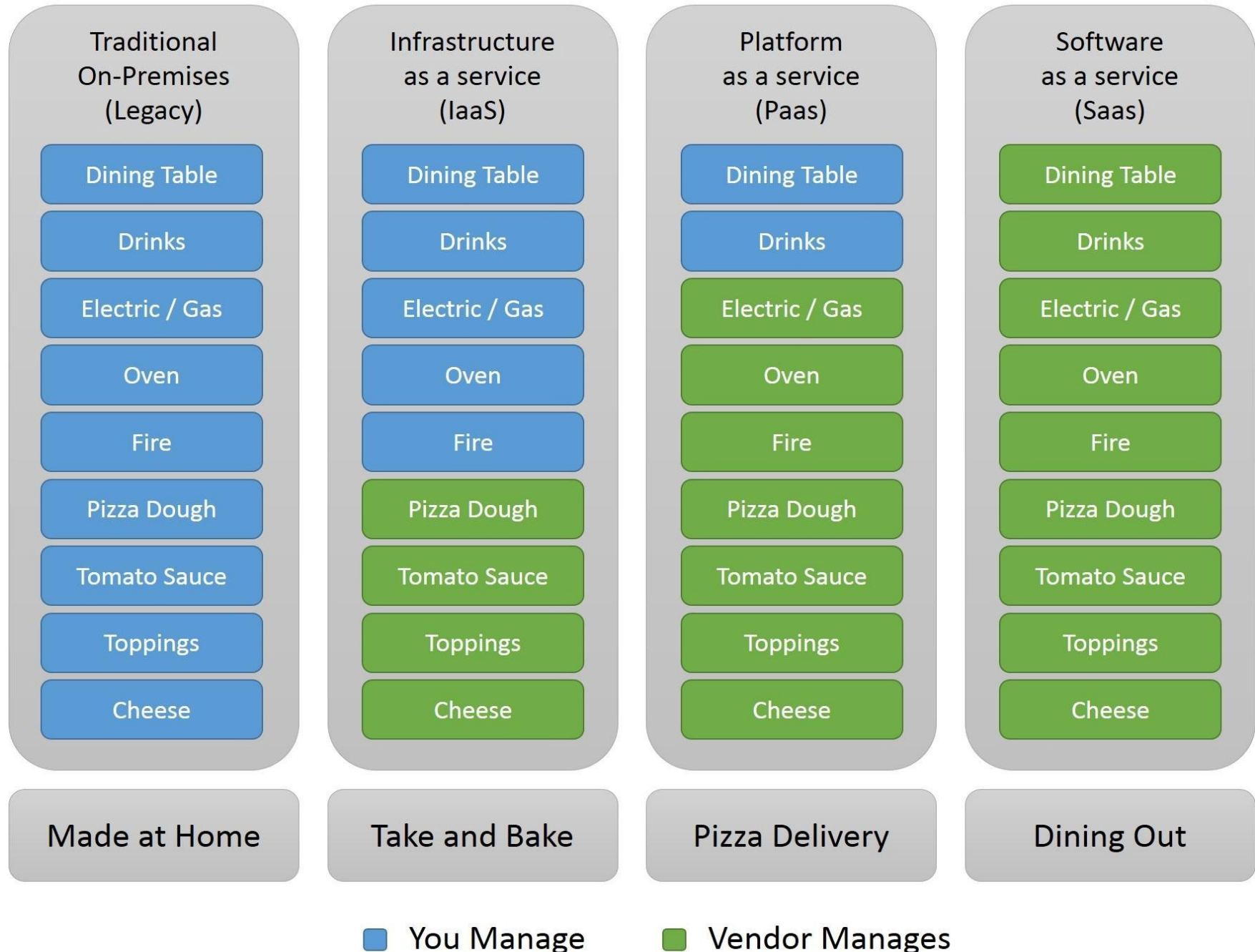
Each of the cloud models has their own set of benefits that could serve the needs of various businesses.

Choosing between them requires an understanding of these cloud models, evaluating your requirements and finding out how the chosen model can deliver your intended set of workflows.

# Types of Cloud Services



# Pizza as a Service



# Pizza as a Service Analogy

## 1. Traditional On-Premises (Made at Home)

You Manage Everything (Blue boxes): From the dining table to making the pizza (dough, sauce, cheese, etc.)

Just like in IT, you manage the full stack: hardware, networking, OS, runtime, data, and application.

Full control, but more responsibility and cost.

## 2. Infrastructure as a Service (IaaS) – Take and Bake

- You Manage: Dining table, drinks, electricity, oven, fire.
- Vendor Manages: Pizza ingredients (dough, sauce, toppings, cheese).
- Cloud provider gives you the infrastructure (servers, storage, networking), but you handle your application, data, and runtime.
-

### **3. Platform as a Service (PaaS) – Pizza Delivery**

- You Manage: Dining table and drinks.
- Vendor Manages: All technical aspects (infra, pizza, oven, fire, ingredients).
- Cloud provider gives you both infrastructure and platform tools. You only develop and deploy apps.

Great for developers who want to focus only on code.

### **4. Software as a Service (SaaS) – Dining Out**

- Vendor Manages Everything.
- You just consume the service (sit, eat, and enjoy).
- Example: Gmail, Google Docs.

Minimal effort from user; great for business use.



# Pizza as a service

The variety of cloud services can obfuscate the level of an organization's ownership of the stack. Albert Barron, executive software client architect at IBM, uses this analogy to provide clarity:



**ON-PREMISES MANAGEMENT**

Making a pizza  
at home



**IAAS**

Take-and-bake  
service



**PAAS**

Delivery



**SAAS**

Eat-in  
restaurant

# **Pizza as a Service Models: Explained**

## **1. On-Premises Management = Making a Pizza at Home**

You do everything yourself: buy ingredients, prepare the dough, cook the pizza, and set the table.

Just like in traditional IT where your organization owns and manages everything — from hardware to applications.

Full control, High effort and cost.

## **2. IaaS (Infrastructure as a Service) = Take-and-Bake Service**

The pizza is pre-assembled, but you bake it at home.

You get infrastructure (like virtual machines, storage), but you manage OS, middleware, and your application.

Example: Amazon EC2, Microsoft Azure VM

You save time but still maintain control over core operations.

### **3. PaaS (Platform as a Service) = Delivery**

Pizza is delivered fully cooked, you just eat it at home.

The vendor manages infrastructure, OS, and runtime. You only manage your app and data.

Example: Google App Engine, Heroku

Focus only on development, not setup.

### **4. SaaS (Software as a Service) = Eat-in Restaurant**

You just sit and enjoy — everything is taken care of by the vendor.

Vendor manages the full stack: from hardware to the application.

Example: Gmail, Salesforce, Google Docs

No technical management required; perfect for end-users.

# SaaS

SaaS is known as 'On-Demand Software'. Less control compare to other service modes No privilege to select operating system, cannot change runtime environment, no need to maintain h/w s/w.

Service which you can access through internet. you can access using a web browser. No need to worry about where the software is located or where the storage space is.

**Example:** gmail, dropbox, google drive, office 365, google sheets No need to download or install on our machine Pay as per use, Automatically upgraded Available on demand Easy scale up and down Shared model like google sheets: one instance can be shared One software is used by multiple clients

# SaaS

- No need to purchase costly softwares
- Can take from csp
- Platform independent services
- Multitenant solution /shared
- Reduce time
- Cost-effective (pay as u use)
- Exampe Cisco webex
- Used by end users

# SaaS

SaaS is known as '**On-Demand Software**'.

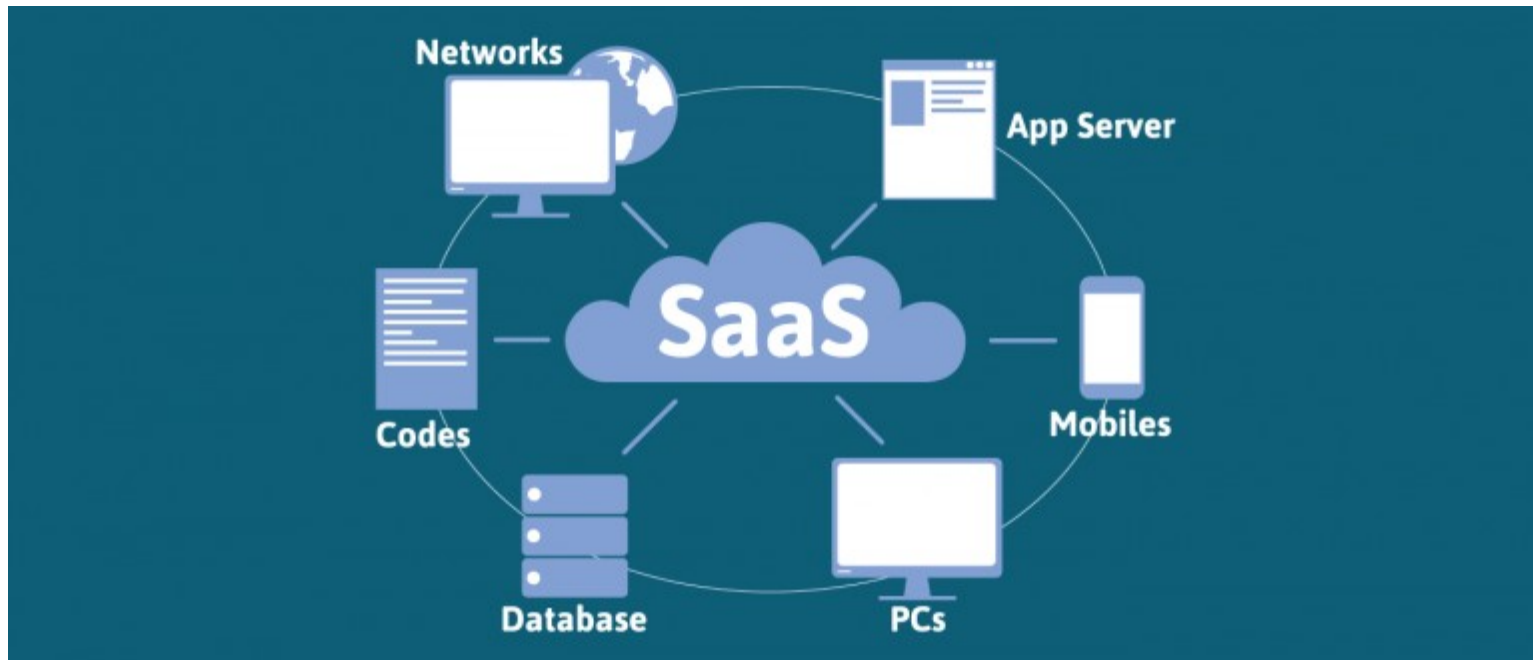
SaaS or Software as a Service is a model that gives quick access to **cloud-based web applications**.

The vendor controls the entire computing stack, which you can access using a web browser.

These applications run on the cloud and you can use them by a paid licensed subscription or for free with limited access.

- SaaS does not require any installations or downloads in your existing computing infrastructure.
- This eliminates the need for installing applications on each of your computers with the maintenance and support taken over by the vendor.

# SaaS



# Why SaaS



## **SaaS Software**

VS



## **Traditional Software**

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### **Subscription**

Users subscribe to the software without paying any money up front



### **One-time fee**

Users purchase the software up front and install it on their own computers

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### **Multiple devices**

Applications can be used across multiple devices with a single login, the application can be updated online instantaneously



### **Single device**

Licensed individually and usually limited to a single device and when updates come out, they must be downloaded or purchased and installed



# Why SaaS?

- No upfront payment
- Web browser is sufficient to access the application
- Quick deployment or is readily established for use
- Better scalable

# Who can use SaaS?

- SaaS is typically accessed by users using a thin client, e.g. via a web browser. SaaS has become a common delivery model for many business applications, including :
  - Office software, messaging software,
  - Payroll processing software,
  - DBMS software,
  - Management software,
  - CAD software,
  - Development software,
  - Virtualization,
  - Accounting,
  - Customer relationship management (CRM),
  - Management Information Systems (MIS),
  - Enterprise resource planning (ERP),
  - Invoicing, human resource management (HRM), etc
- SaaS has been incorporated into the strategy of nearly all leading enterprise software companies.

# When to use SaaS?

There are many different situations in which SaaS may be the most beneficial option, including:

If you are a **startup or small company** that needs to launch ecommerce quickly and don't have time for server issues or software

For **short-term projects** that require collaboration

If you use applications that **aren't in-demand** very often, such as tax software

For applications that need both **web and mobile access**.

# Categories of SaaS

Line of enterprise service and customer oriented service  
SaaS can be divided into three categories:

- Packaged software
- Collaborative software
- Enabling and management tools

# Categories of SaaS

## **Packaged software:**

- This is the biggest area of the SaaS market.
- Packaged software comes in many different flavors: customer relationship management, supply chain management, financial management, and human resources, to name the most common.
- These integrated offers focus on a specific process, such as managing employees' benefits, salaries, and annual performance reviews.
- These products tend to have several characteristics in common: They're designed with specific business processes built in that customers can modify.
- They have moved in great numbers to the cloud because customers were finding the platforms too hard to manage.

# Categories of SaaS

## **Collaborative software:**

- This increasingly vibrant area of the market is driven by the ubiquitous availability of the Internet, combined with the fact that teams are located all over the world.
- This area is dominated by software that focuses on all sorts of collaborative efforts including Web conferencing, document collaboration, project planning, instant messaging, and even email.
- In a sense, it was inevitable that these platforms would move to the cloud: These tasks occur throughout the organization and need to be easily accessed from many locations.

# Categories of SaaS

## **Enabling and management tools:**

Think about the development tools that developers need when creating and extending a SaaS platform; also think about the testing, monitoring, and measuring that a customer and the developer need.

Also consider the compliance issues related to the use of this type of software in the real world.

These issues are included in this third category.

## 1. Package

- Salesforce CRM – Customer relationship management
- QuickBooks Online – Accounting and invoicing
- Adobe Creative Cloud (Photoshop, Illustrator) – Design and multimedia editing
- Microsoft 365 (Word, Excel, PowerPoint) – Office productivity

## 2. Collaborative

- Slack – Team chat and messaging
- Zoom – Video conferencing and webinars
- Google Workspace (Docs, Drive, Meet) – Document collaboration and cloud storage
- Microsoft Teams – Chat, meetings, and file collaboration in one platform



### 3. Enabling and Management Tools

- WS CloudWatch – Monitoring cloud resources and applications
- Datadog – Performance monitoring for cloud infrastructure
- Okta – Identity and access management (IAM)
- New Relic – Application performance monitoring (APM)
- Docker Hub – Container management and image hosting

# Advantages of SaaS

## Advantages of SaaS

SaaS is **easy to buy** because the pricing of SaaS is based on monthly or annual fee and it allows the organizations to access business functionalities at a small cost, which is less than licensed applications.

SaaS needed **less hardware**, because the software is hosted remotely, hence organizations do not need to invest in additional hardware.

**Less maintenance cost** is required for SaaS and do not require special software or hardware versions.

# Disadvantages of SaaS

## Disadvantages of SaaS

- SaaS applications are **totally dependent on Internet** connection. They are not usable without Internet connection.
- It is **difficult to switch** amongst the SaaS vendors.

# SaaS Examples

- CRM, Office Suite, Email, games, etc. are the software applications which are provided as a service through Internet.
- Google Apps, Dropbox, Salesforce, Cisco WebEx, Concur, GoToMeeting
- The companies like Google, Microsoft provide their applications as a service to the end users.

# PaaS

- Uses the Internet to host software applications.
- Used by developers to make applications.
- Provides runtime environment when making softwares/applications.
- Provides platform and environment to build application
- Cannot choose/switch operating system.
- Offers development and deployment tools required to develop application.
- More functionalities and control compare to SAAS
- Access through web browser.
- No control over infrastructure.
- Interact with UI and OS will be provided by vendor
- Vendor host h/w and background s/w.
- Customer can control over deployed applications and configuration settings for hosting.
- Tools to develop and host app.

# PaaS

- Cost effective (pay as u go)
- No need to purchase
- Scale up and scale down according to ur requirement
- S/W management by providers regarding updates
- Example Eclipse and jdk
- Easy deployment of web applications

## Examples

Windows Azure

Google App engine

# PaaS

- PaaS evolved from software as a service (SaaS), which uses the Internet to host software applications.
- PaaS is the **center of the five layers** of cloud computing.
- The **two layers** above PaaS are the **client** (hardware and software) and **application** (including SaaS) layers.
- PaaS are the infrastructure – including **infrastructure** as a service (IaaS) - and **server (hardware and software)** layers.

- The PaaS service delivery model allows a customer to rent virtualized servers and associated services used to run existing applications, or to design, develop, test, deploy and host applications.



# The Traditional Model v/s PaaS

## **Traditional Model**

- Set up the application server (e.g. Apache, Nginx, etc.)
- Set up MySQL database
- Setting up the run-time platform like PHP, Ruby, etc.
- Something isn't working. - Diagnose, re-configure/re-setup, try again.
- Dependencies... right, have to setup those up too.
- Setup FTP to deploy your code.
- Setup security and firewall.
- It worked on localhost, why isn't it working now!!!

# The Traditional Model v/s PaaS

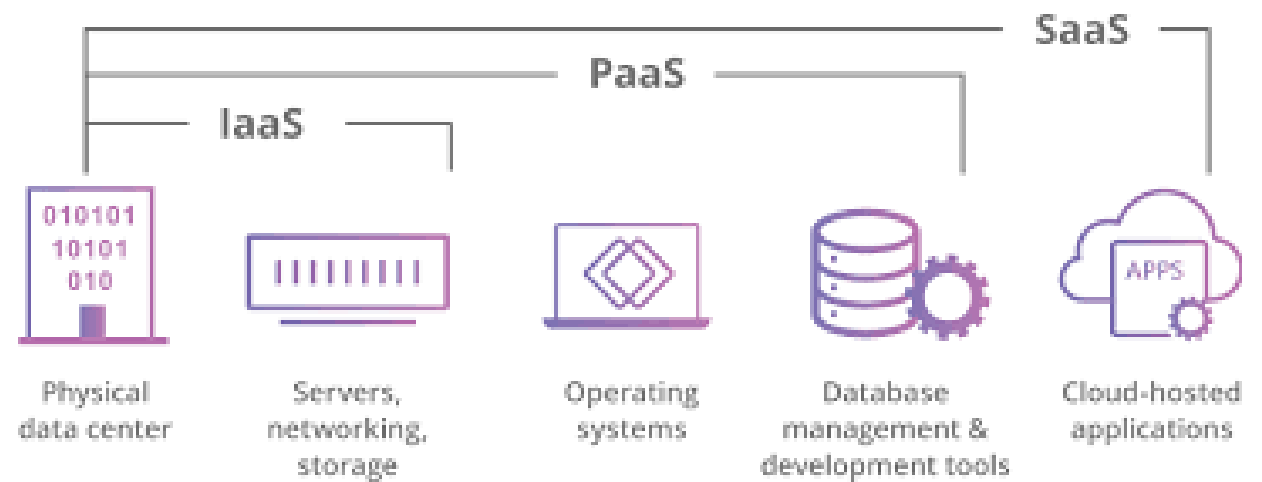
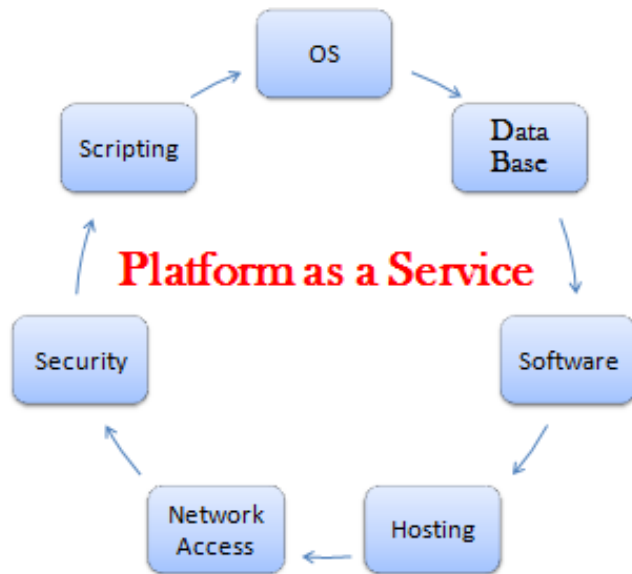
## PAAS

- **HTTP Caching Server** will allow your application to load significantly faster as static contents will be loaded from cache.
- **Redundancy, Fail-over, Backups** are built into the system end-to-end. DNS, load balancers, caching server, application server, and the databases all run on multiple servers in different availability zones such that if failures do occur there will be little or no downtime.
- **Scale** out your application by adding more servers to run your application.
- **No setup or configuration** of servers. You don't need to setup any server software like Apache, MySQL, FTP, and you don't have to worry about firewalls or security.
- **Easily deploy your application** to all the servers with a single command.

# Defination of PaaS

- The acronym PaaS stands for Platform as a Service.
- PaaS is an **extension of the SaaS** (Software as a Service) model, which allows for the use of applications hosted remotely.
- Platform as a service (PaaS) is a cloud computing model in which a third-party provider delivers hardware and software tools -- usually those needed for application development -- to users over the internet.
- A PaaS provider hosts the hardware and software on its own infrastructure. As a result, PaaS frees users from having to install in-house hardware and software to develop or run a new application.

# PaaS



# Types of PaaS

There are several types of PaaS, including public, private and hybrid.

- **Public PaaS** is derived from software as a service (SaaS), and is situated in cloud computing between SaaS and infrastructure as a service (IaaS).
- A **Private PaaS** can typically be downloaded and installed either in a company's on-premises data center, or in a public cloud. Once the software is installed on one or more machines, the private PaaS arranges the application and database components into a single hosting platform.
- 
- **Hybrid PaaS** is typically a deployment consisting of a mix of public and private deployments.

# Characteristics of PaaS

PaaS has many characteristics that define it as a cloud service, including:

It is built on **virtualization technology**, meaning resources can easily be scaled up or down as your business changes  
Provides a **variety of services** to assist with the development, testing, and deployment of apps **Numerous users** can access the same development application **Web services and databases** are integrated.

# Examples of PaaS



- AWS Elastic Beanstalk
- Heroku
- Windows Azure (mostly used as PaaS)
- Force.com
- OpenShift
- Apache Stratos
- Magento Commerce Cloud



# Advantages of PaaS

- **Cut coding time** : PaaS development tools can cut the time it takes to code new apps with pre-coded application components built into the platform, such as workflow, directory services, security features, search and so on.
- **Add development capabilities without adding staff** : Platform as a Service components can give your development team new capabilities without your needing to add staff having the required skills.
- **Develop for multiple platforms** : including mobile—more easily. Some service providers give you development options for multiple platforms, such as computers, mobile devices and browsers making cross-platform apps quicker and easier to develop.
- **Use sophisticated tools affordably** : A pay-as-you-go model makes it possible for individuals or organisations to use sophisticated development software and business intelligence and analytics tools that they could not afford to purchase outright.



# Advantages of PaaS

- **Support geographically distributed development teams:** Because the development environment is accessed over the Internet, development teams can work together on projects even when team members are in remote locations.
- **Efficiently manage the application lifecycle:** PaaS provides all of the capabilities that you need to support the complete web application lifecycle: building, testing, deploying, managing and updating within the same integrated environment.

# mPaaS

**Mobile Platform as a Service (mPaaS)** is the paid provision of an Interactive Development Environment (IDE) for the creation of mobile apps.

No coding skill is required.

An mPaaS IDE usually features an object-oriented drag-and-drop interface to simplify development of HTML5 or native apps with direct access to a device's sensors, GPS, accelerometer, camera, microphone and other functions.

MPaaS often supports multiple mobile operating systems.

Companies like Microsoft Azure, Google App Engine, AWS Elastic Beanstalk, etc provide platforms.S

# cPaaS

cPaaS stands for **Communications Platform as a Service**. A CPaaS is a cloud-based platform that enables developers to add **real-time communications** features to their own applications without needing to build backend infrastructure and interfaces.

**Real-time communications (RTC)** have taken place in applications built specifically for these functions.

For example, you might use your native mobile phone app to dial your bank, but have you ever wondered why you can't video chat a representative right in your banking app?

These dedicated RTC applications - the traditional phone, Skype, FaceTime, WhatsApp, etc. - have been the paradigm for a long time because it's costly to build and operate a communications stack, from the real-time network infrastructure to the interfaces to common programming languages.

# cPaaS

A CPaaS offers a complete development framework for building **real-time communications** features without having to build your own.

This typically includes **software tools, standards-based application programming interfaces (APIs), sample code, and pre-built applications.**

CPaaS providers also **provide support and product documentation** to help developers throughout the development process.

Some companies also offer **software development kits (SDKs) and libraries** for building applications on different desktop and mobile platforms.

# IaaS

**Infrastructure as a service (IaaS)** is a type of cloud computing model that allocates virtualized computing resources to the user through the internet.

The IaaS technology helps the users to **avoid the cost and complexity of purchasing and managing their own physical servers.**

Every resource of IaaS is offered as an individual service component and the users only have to use the particular one they need.

The cloud service provider manages the IaaS infrastructure while the users can concentrate on installing, configuring and managing their software.

# IaaS

As the cloud buyers rent a space in the virtual data center of the IaaS provider, they get the access to the virtual data center through the internet.

IaaS **provides the raw materials and basic infrastructure for IT** and ensures affordability as the users only have to pay for the resources they use.

The cloud service providers enable the users to rent the virtual servers and storage while forming networks in order to tie them all together.

While renting from a cloud IaaS provider, users are essentially renting hardware along with the provisioning software that automates it.

# Defination of IaaS

Infrastructure as a service (IaaS) is a service model that delivers computer infrastructure on an outsourced basis to support enterprise operations.

Typically, IaaS provides hardware, storage, servers and data center space or network components; it may also include software.

Infrastructure as a service (IaaS) is also known as **hardware as a service (HaaS)**.

# How it works?

In the IaaS technology, the cloud service provider hosts the IaaS infrastructure components that are traditionally present in a data center including **network hardware, servers, storage and the virtualization** of the hypervisor layer.

The IaaS provider also provides a wide range of services to accompany the infrastructure components.

- Cloud
- Virtualized Hardware
- Cloud Servers



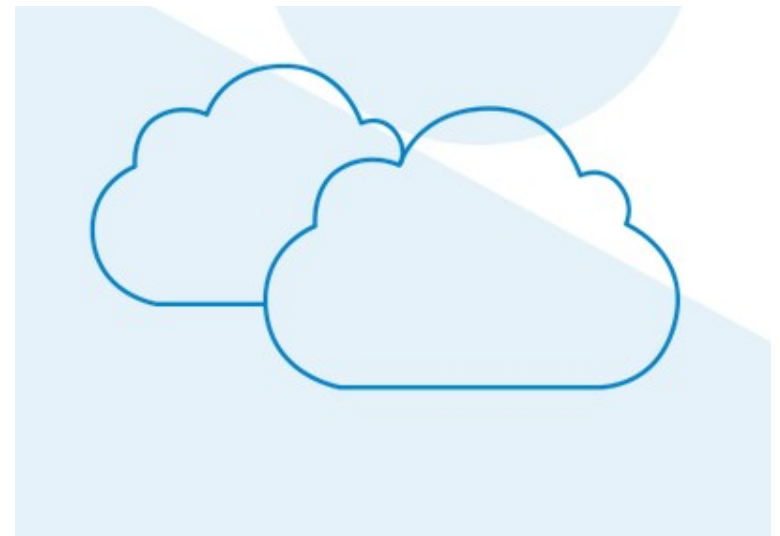
# How it works?

## The Cloud

All the cloud computing services, IaaS provides the users the access to computing resources in a virtualized environment.

This is done through a public connection usually through the internet.

IaaS provides the users the access to the virtualized environment for establishing their own IT platforms.

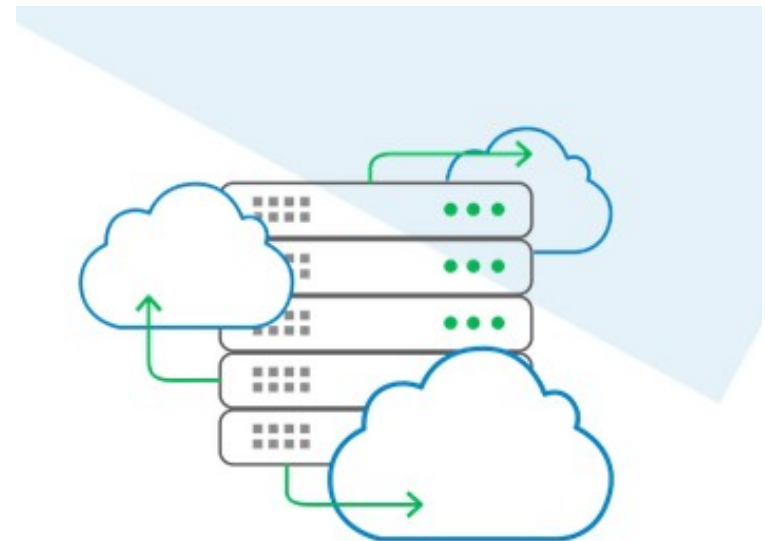


# How it works?

## Virtualized Hardware

IaaS provides resources that are especially belonging to virtualized hardware which is also known as the **computing infrastructure**.

The offerings in an IaaS environment include network connections, virtual server space, load balancers and IP addresses.

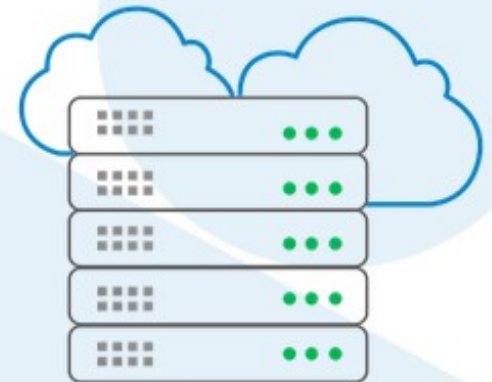


# How it works?

## Cloud Servers

In physical terms, the cloud service provider extracts the pool of hardware resource from a group of servers and networks that are usually spread across various data centers and the cloud service provider is responsible for managing all the resources.

IaaS provider also offers relative services to the users for supporting the infrastructure components that include monitoring, detailed billing, security, load balancing, clustering along with storage services like data backup, replication and recovery.



# Characteristics of IaaS

- **Resources** are provided as a service.
- Allows for **dynamic scaling and elasticity**.
- Has a **variable cost**, usage based pricing model (pay per go and pay per use).
- Has **multi-tenant architecture**, includes multiple users on a single piece of hardware. (like hardware sharing)
- IaaS has **enterprise grade infrastructure**.

# Advantages of IaaS

- **Dynamic:** Users can dynamically opt & configure devices such as CPU, storage drive, etc.
- **Easy Access:** Users can easily access the vast cloud computing power.
- **Renting:** Flexible and efficient while renting IT infrastructures.
- **Full control** of computer resources along with portability.

# Disadvantages of IaaS

- IaaS depends on virtualization services.
- This service restricts user-privacy & customization.
- Internet connection is must.

# Example of IaaS

- Amazon Web Services (AWS) – EC2, S3, VPC
- Microsoft Azure – Azure Virtual Machines, Blob Storage, Virtual Network
- Google Cloud Platform (GCP) – Compute Engine, Cloud Storage, VPC
- IBM Cloud, Oracle Cloud Infrastructure (OCI)