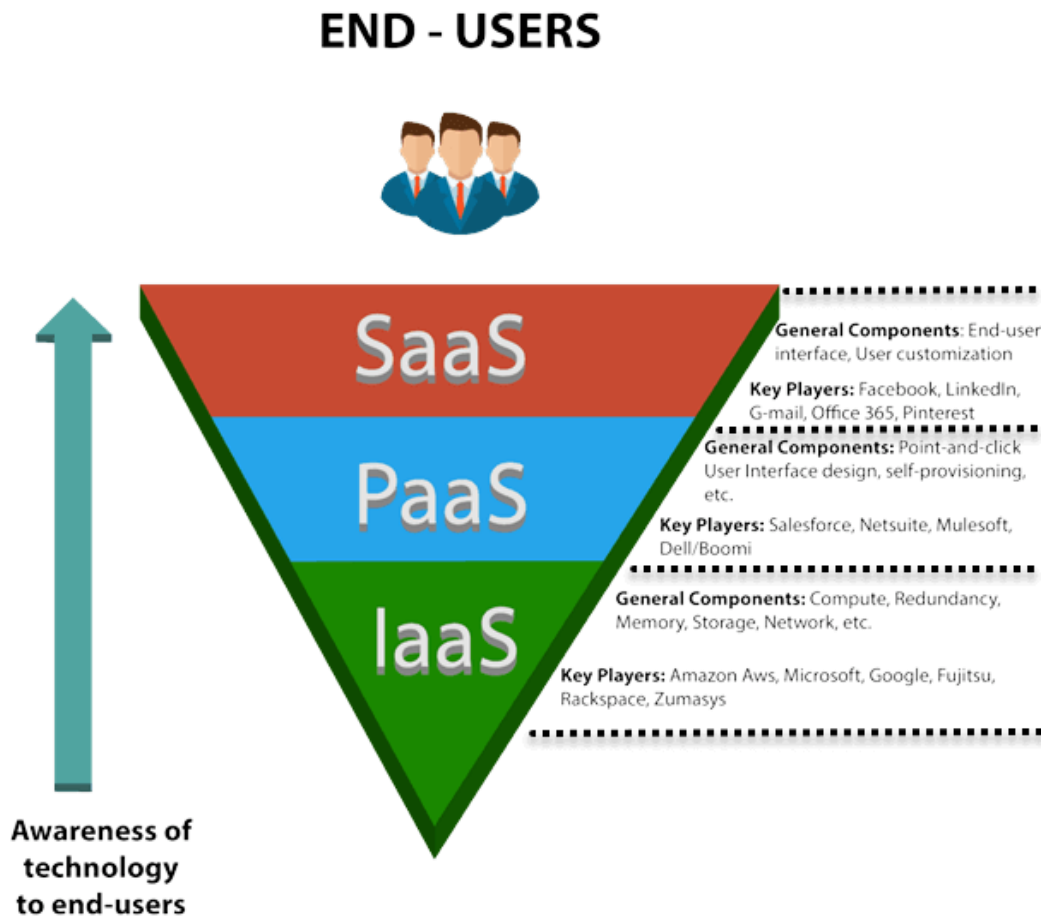**Cloud Service Models**

SaaS, PaaS, and IaaS are the three main cloud computing service model categories. You can access all three via an Internet browser or online apps available on different devices. The cloud service model enables the team to collaborate online instead of offline creation and then share online.

END - USERS

SaaS

General Components: End-user interface, User customization

Key Players: Facebook, LinkedIn, G-mail, Office 365, Pinterest

PaaS

General Components: Point-and-click User Interface design, self-provisioning, etc.

Key Players: Salesforce, Netsuite, Mulesoft, Dell/Boomi

IaaS

General Components: Compute, Redundancy, Memory, Storage, Network, etc.

Key Players: Amazon Aws, Microsoft, Google, Fujitsu, Rackspace, Zumasys

Awareness of technology to end-users

Software as a Service (SaaS)

Software as a Service (SaaS) is a web-based deployment model that makes the software accessible through a web browser. SaaS software users don't need to care where the software is hosted, which operating system it uses, or even which programming language it is written in. The SaaS software is accessible from any device with an internet connection.

This cloud service model ensures that consumers always use the most current version of the software. The SaaS provider handles maintenance and support. In the SaaS model, users don't control the infrastructure, such as storage, processing power, etc.

Characteristics of SaaS

There are the following characteristics of SaaS:

- It is managed from a central location.
- Hosted directly on a remote server.
- It is accessible over the Internet.
- SaaS users are not responsible for hardware and software updates.
- The services are purchased on a pay-as-per-use basis.

Advantages SaaS

Here are the important advantages/pros of SaaS:

- The biggest benefit of using SaaS is that it is easy to set up, so you can start using it instantly.
- Compared with on-premises software, it is more cost-effective.
- You don't need to manage or upgrade the software, as it is typically included in a SaaS subscription or purchase.
- It won't use your local resources, such as the hard disk typically required to install desktop software.
- It is a cloud computing service category that provides a wide range of hosted capabilities and services.
- Developers can easily build and deploy web-based software applications.
- You can easily access it through a browser.

Disadvantages SaaS

Here are the important cons/drawbacks of SaaS:

- Integrations are up to the provider, so it's impossible to "patch" an integration on your end.
- SaaS tools may become incompatible with other tools and hardware already used in your business.
- You depend on the SaaS company's security measures, so your data may be compromised if any leaks occur.

Consider Before SaaS Implementation

Need to consider before SaaS implementation:

- It would help if you opted for configuration over customization within a SaaS-based delivery model.
- You must carefully understand the usage rates and set clear objectives to achieve the SaaS adoption.
- You can complement your SaaS solution with integrations and security options to make it more user-oriented.

Platform as a Service (PaaS)
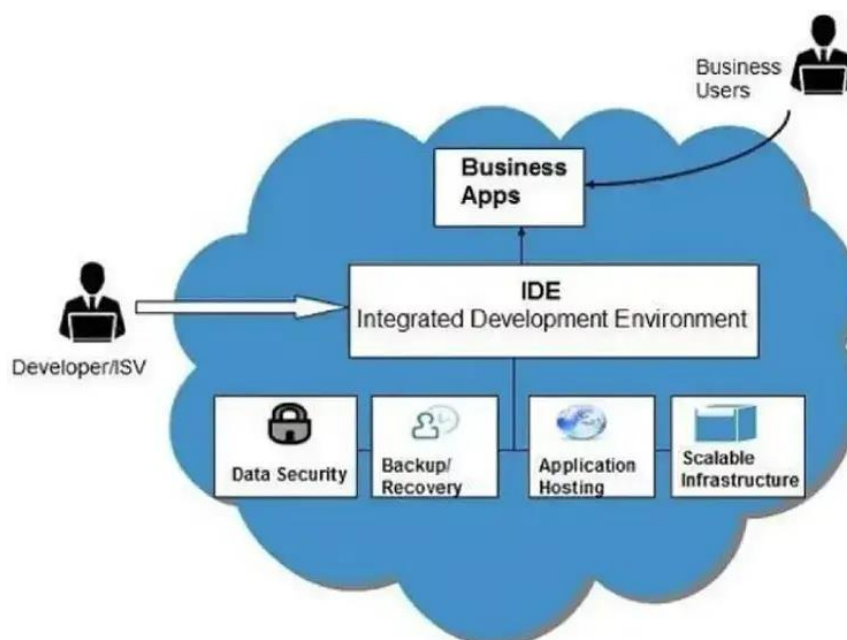
Platform-as-a-Service (PaaS) provides a cloud computing framework for software application creation and deployment. It is a platform for the deployment and management of software apps. This flexible cloud computing model scales up automatically on demand. It also manages the servers, storage, and networking, while the developers manage only the application part. It offers a runtime environment for application development and deployment tools.

This Model provides all the facilities required to support the complex life cycle of building and delivering web applications and services entirely for the Internet. This cloud computing model enables developers to rapidly develop, run, and manage their apps without building and maintaining the infrastructure or platform.

Characteristics of PaaS

There are the following characteristics of PaaS:

- Builds on virtualization technology, so computing resources can easily be scaled up (Auto-scale) or down according to the organization's needs.
- Support multiple programming languages and frameworks.
- Integrates with web services and databases.

Advantages PaaS

Here are the important benefits/pros of PaaS:

- Simple, cost-effective development and deployment of apps
- Developers can customize SaaS apps without the headache of maintaining the software
- Provide automation of Business Policy
- Easy migration to the Hybrid Model
- It allows developers to build applications without the overhead of the underlying operating system or cloud infrastructure
- Offers freedom to developers to focus on the application's design while the platform takes care of the language and the database
- It helps developers to collaborate with other developers on a single app

Disadvantages of SaaS

Here are the important cons/drawbacks of PaaS:

- You have control over the app's code and not its infrastructure.
- The PaaS organization stores your data, so it sometimes poses a security risk to your app's users.
- Vendors provide varying service levels, so selecting the right services is essential.
- The risk of lock-in with a vendor may affect the ecosystem you need for your development environment.

Consider Before PaaS Implementation

Here are essential things you need to consider before PaaS implementation:

- Analyze your business needs, decide the automation levels, and also decides whether you want a self-service or fully automated PaaS model.
- You need to determine whether to deploy on a private or public cloud.
- Plan through the customization and efficiency levels.

Infrastructure as a Service (IaaS)

Infrastructure-as-a-Service (IaaS) is a cloud computing service offering on-demand computing, storage, and networking resources. It usually works on a pay-as-you-go basis.

Organizations can purchase resources on-demand and as needed instead of buying the hardware outright.

The IaaS cloud vendor hosts the infrastructure components, including the on-premises data center, servers, storage, networking hardware, and the hypervisor (virtualization layer).

IaaS
Infrastructure as a Servise
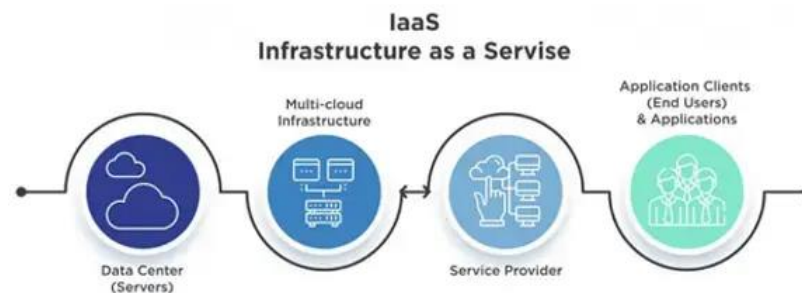
This Model contains the basic building blocks for your web application. It provides complete control over the hardware that runs your application (storage, servers, VMs, networks & operating systems). IaaS model gives you the best flexibility and management control over your IT resources.

Characteristics of IaaS

There are the following characteristics of IaaS:

- Resources are available as a service
- Services are highly scalable
- Dynamic and flexible Cloud Service Model
- GUI and API-based access
- Automate the administrative tasks

Advantages of IaaS

Here are the important benefits/pros of PaaS:

- Easy to automate the deployment of storage, networking, and servers.
- Hardware purchases can be based on consumption.
- Clients keep complete control of their underlying infrastructure.
- The provider can deploy the resources to a customer's environment anytime.
- It can be scaled up or downsized according to your needs.

Disadvantages of IaaS

Here are the important Cons/drawbacks of IaaS:

- You should ensure that your apps and operating systems are working correctly and providing the utmost security.
- You're in charge of the data, so if any of it is lost, it's up to you to recover it.
- IaaS firms only provide the servers and API, so you must configure everything else.

Consider Before IaaS Implementation

Here are some specific considerations you should remember before IaaS Implementation:

- You should clearly define your access needs and your network's bandwidth to facilitate smooth implementation and functioning.
- Plan out detailed data storage and security strategy to streamline the business process.
- Ensure that your organization has a proper disaster recovery plan to keep your data safe and accessible.

How can select the Best SaaS Service Provider

Here are some essential criteria for selecting the best cloud service provider:

- **Financial stability**: Look for a well-financed cloud provider that has steady profits from the infrastructure. If the company shuts down because of monetary issues, your solutions will also be in jeopardy.
- **Industries that prefer the solution**: Before finalizing cloud services, examine its existing clients and markets. Your cloud service provider should be popular among companies in your niche or neighboring ones.
- **Datacenter locations**: To avoid safety risks, ensure that cloud providers enable your data's geographical distribution.
- **Encryption standards**: You should make sure the cloud provider supports major encryption algorithms.
- **Check accreditation and auditing**: The widely used online auditing standard is SSAE. This procedure helps you to verify the safety of online data storage. ISO 27001 certificate verifies that a cloud provider complies with international safety standards for data storage.
- **Backup**: The provider should support incremental backups so that you can store offsite and quickly restore.

Driving Factors and Challenges of Cloud

Data Security and Privacy

Data security is a major concern when switching to cloud computing. User or organizational data stored in the cloud is critical and private. Even if the cloud service provider

assures data integrity, it is your responsibility to carry out user authentication and authorization, identity management, data encryption, and access control. Security issues on the cloud include identity theft, data breaches, malware infections, and a lot more which eventually decrease the trust amongst the users of your applications. This can in turn lead to potential loss in revenue alongside reputation and stature. Also, dealing with cloud computing requires sending and receiving huge amounts of data at high speed, and therefore is susceptible to data leaks.

Cost Management

Even as almost all cloud service providers have a "Pay As You Go" model, which reduces the overall cost of the resources being used, there are times when there are huge costs incurred to the enterprise using cloud computing. When there is under optimization of the resources, let's say that the servers are not being used to their full potential, add up to the hidden costs. If there is a degraded application performance or sudden spikes or overages in the usage, it adds up to the overall cost. Unused resources are one of the other main reasons why the costs go up. If you turn on the services or an instance of cloud and forget to turn it off during the weekend or when there is no current use of it, it will increase the cost without even using the resources.

Multi-Cloud Environments

Due to an increase in the options available to the companies, enterprises not only use a single cloud but depend on multiple cloud service providers. Most of these companies use hybrid cloud tactics and close to 84% are dependent on multiple clouds. This often ends up being hindered and difficult to manage for the infrastructure team. The process most of the time ends up being highly complex for the IT team due to the differences between multiple cloud providers.

Performance Challenges

Performance is an important factor while considering cloud-based solutions. If the performance of the cloud is not satisfactory, it can drive away users and decrease profits. Even a little latency while loading an app or a web page can result in a huge drop in the percentage of users. This latency can be a product of inefficient load balancing, which means that the server cannot efficiently split the incoming traffic so as to provide the best user experience.

Challenges also arise in the case of fault tolerance, which means the operations continue as required even when one or more of the components fail.

Interoperability and Flexibility

When an organization uses a specific cloud service provider and wants to switch to another cloud-based solution, it often turns up to be a tedious procedure since applications written for one cloud with the application stack are required to be re-written for the other cloud. There is a lack of flexibility from switching from one cloud to another due to the complexities involved. Handling data movement, setting up the security from scratch and network also add up to the issues encountered when changing cloud solutions, thereby reducing flexibility.

High Dependence on Network

Since cloud computing deals with provisioning resources in real-time, it deals with enormous amounts of data transfer to and from the servers. This is only made possible due to the availability of the high-speed network. Although these data and resources are exchanged over the network, this can prove to be highly vulnerable in case of limited bandwidth or cases when there is a sudden outage. Even when the enterprises can cut their hardware costs, they need to ensure that the internet bandwidth is high as well there are zero network outages, or else it can result in a potential business loss. It is therefore a major challenge for smaller enterprises that have to maintain network bandwidth that comes with a high cost.

Lack of Knowledge and Expertise

Due to the complex nature and the high demand for research working with the cloud often ends up being a highly tedious task. It requires immense knowledge and wide expertise on the subject. Although there are a lot of professionals in the field they need to constantly update themselves. Cloud computing is a highly paid job due to the extensive gap between demand and supply. There are a lot of vacancies but very few talented cloud engineers, developers, and professionals. Therefore, there is a need for upskilling so these professionals can actively understand, manage and develop cloud-based applications with minimum issues and maximum reliability.