Cloud Computing
DAY 1

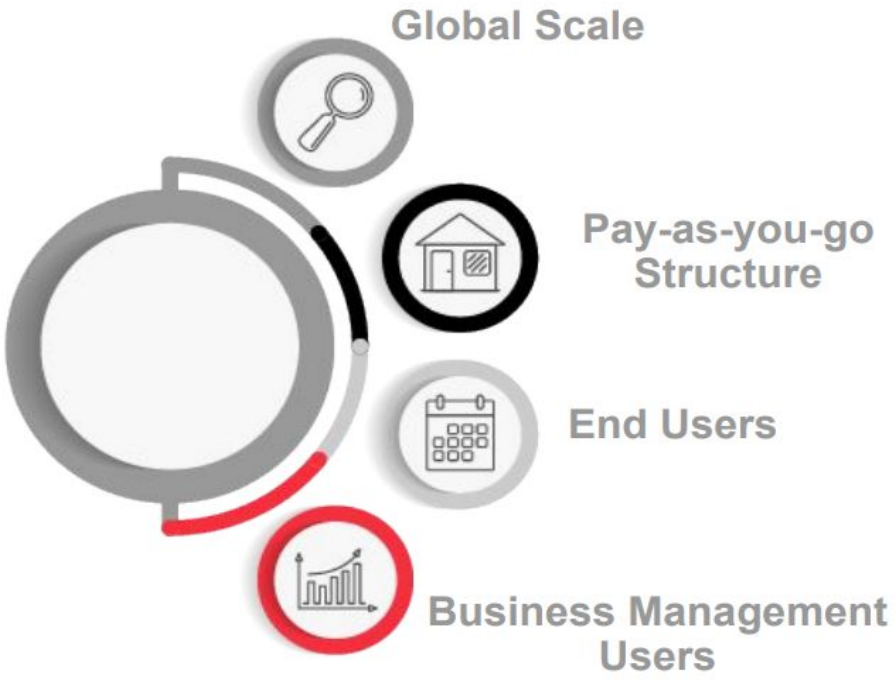
By VINEETA

Cloud Computing

Cloud computing refers to the delivery of services such as processing, storage, databases, networking, etc. to users and organisations based on their requirement, over the Internet. The servers on which these softwares and databases run are located in data centres across the world. Users and organisations can access these servers through the Internet from anywhere.

Cloud computing is a pay-as-you-go service, i.e., the users pay only for the services that they use.

Cloud Computing



Amazon Web Services (AWS)

aws

Centralised Development Platform

Launch of AWS

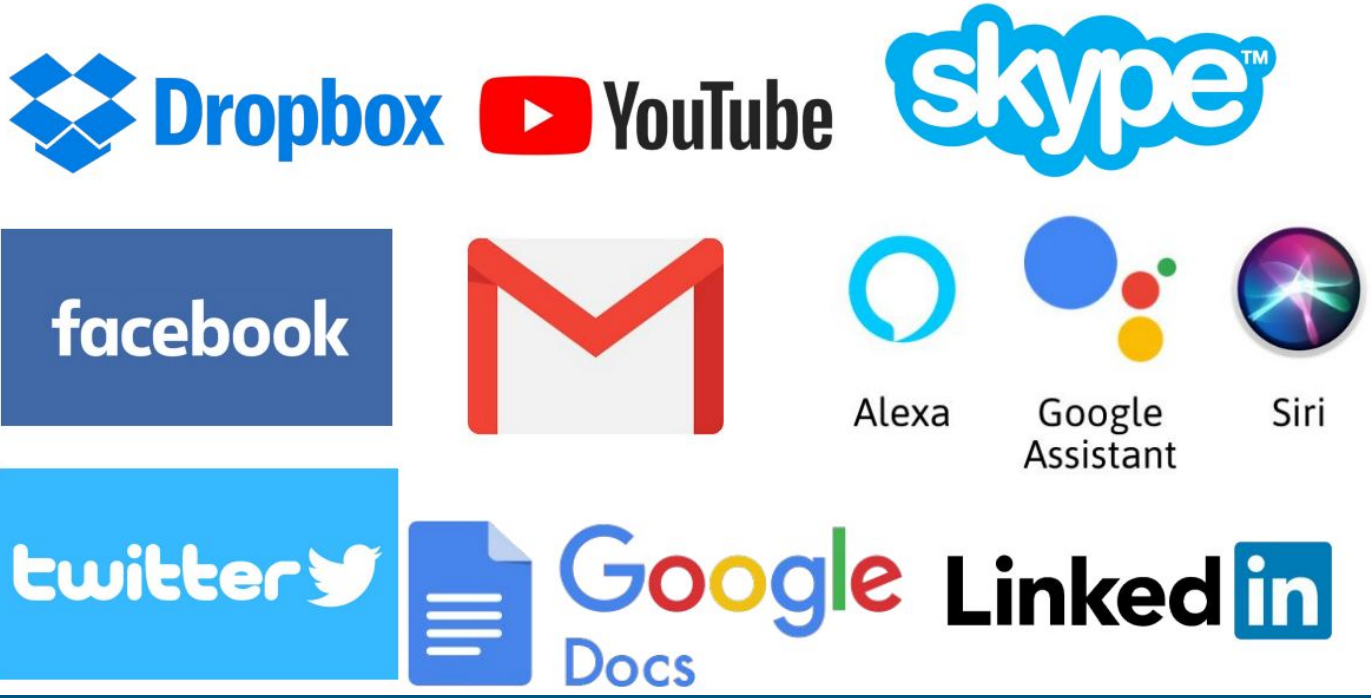
Merchant.com

Set of APIs

Launch of EC2

EC2

Cloud-based Applications



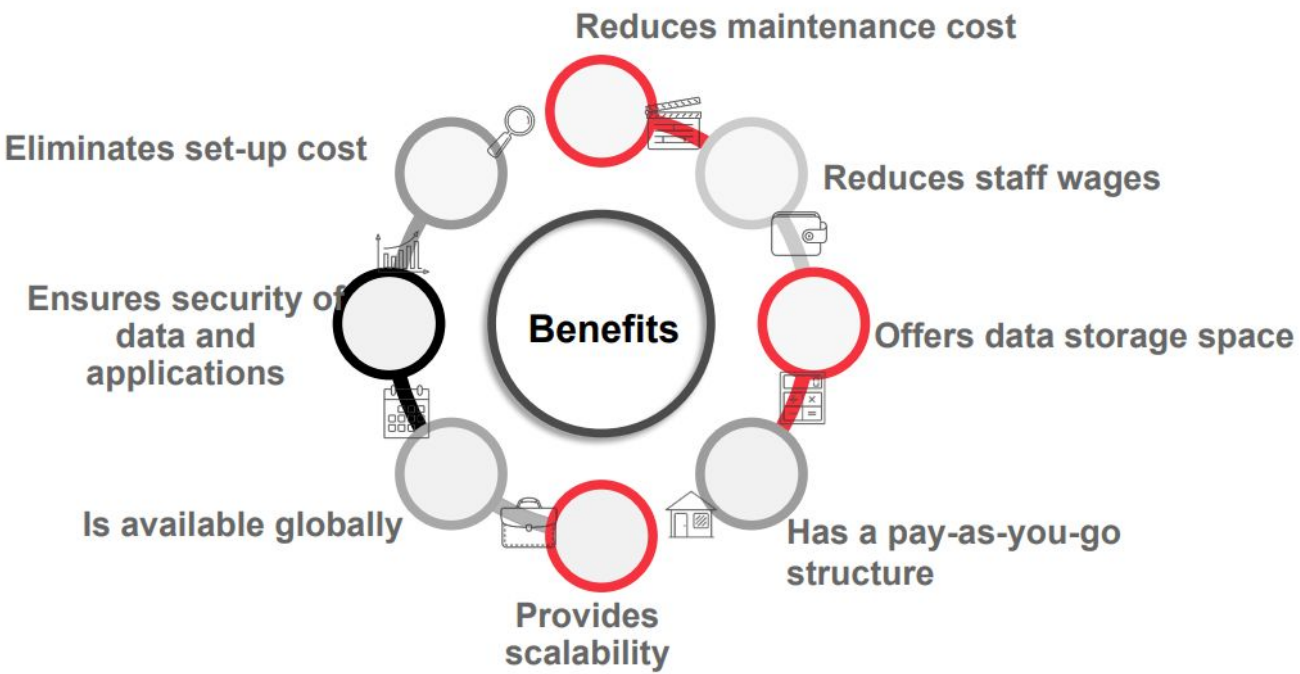
Cloud Service Providers

Cloud Platforms

amazon web services

Microsoft Azure

Google Cloud Platform


Reduces maintenance cost
Reduces staff wages
Offers data storage space
Has a pay-as-you-go structure
Provides scalability
Is available globally
Ensures security of data and applications
Eliminates set-up cost
Benefits

Traditional Data Centres

- The systems are hosted and maintained within the organisation.
- The organisation owns all the equipment.

Colocation On-Premise Systems

- The data centre used by an organisation is hosted by a third-party firm.
- The third party provides power, cooling and physical security for the data centres.
- The organisation provides the required computer servers, storage and networking.

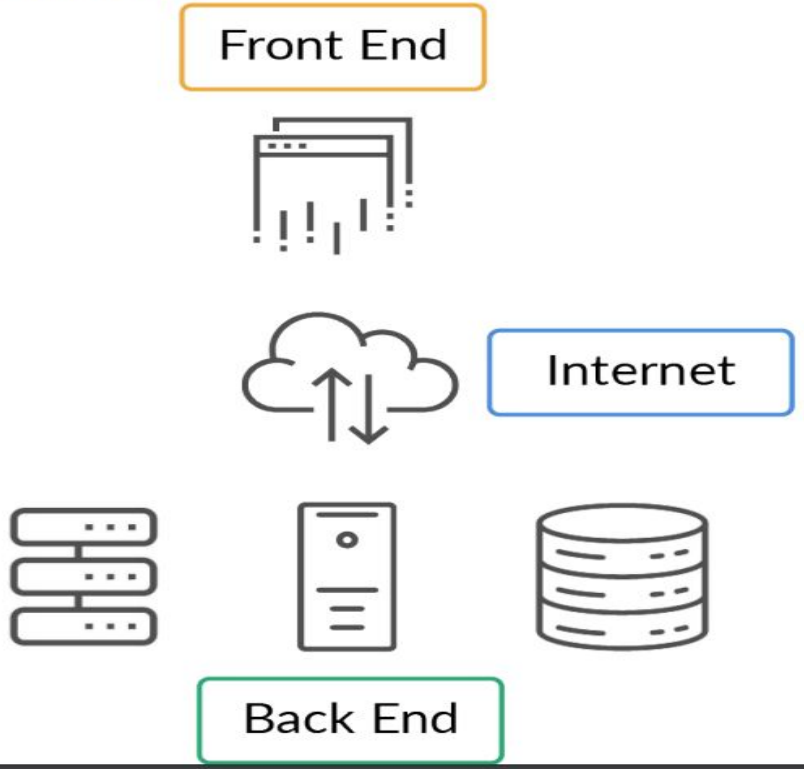
Drawbacks of Traditional Data Centres

- High cost investments and increase in maintenance cost
- Labour-intensive, less efficient, prone to human errors
- Built in confined space
- Increase in capital cost due to upgrading, patching & scaling up

How Netflix Scaled with AWS?

1. Rented out DVDs by mail
2. Delivery halted for three days
3. Moved all the data to AWS
4. Scales up or down as per requirement

Cloud-Based Architecture



The two main users of Cloud are:

- **End Users-** These users use cloud services for proprietary benefits.
- **Business Management Users-** These users utilise cloud services on an organisational level.

The three major cloud providers are:

- Amazon Web Service (AWS)
- Microsoft Azure
- Google Cloud Platform

Additional Reading

- How AWS evolved - This article shows how the evolution of cloud computing accelerated the growth of AWS.
- Real-world cloud computing examples - This article tells about the top five real-world examples which use cloud computing.
- Open-source Cloud Platforms - This article can tell you about some top open-source cloud platforms.
- Top Cloud Platforms - This article gives a brief about the top five existing cloud platforms.

The benefits of using the cloud over traditional data centres-

- **Cost Saving:** Cloud computing eliminates the need for buying or maintaining hardware and software resources and for setting up data centres. It also eliminates the need for maintaining computing infrastructure. Most of the cloud services are pay-as-you-go, which means customers only pay for the services that they use. Use of the cloud also reduces the cost associated with staff wages.

- **Scalability:** Cloud computing provides businesses with the ability to expand their resources when needed. Organisations need not worry about installing infrastructure, as it is done by the cloud service providers. They can also scale up their applications as per requirement.
- **Availability:** Cloud is available at different locations across the world. It allows companies to expand to new geographical regions and deploy the resources globally.
- **Security:** Cloud allows access to data and applications to authorised and authenticated users only.
- **Data Storage Space:** Organisations can opt for the exact amount of storage they need and pay only for the space that they use.

Additional Reading

- Comparison Between On-Premise Systems and Cloud - This article will give you an idea about the differences between cloud and on-premise systems.

Cloud-based Architecture & Deployment Models

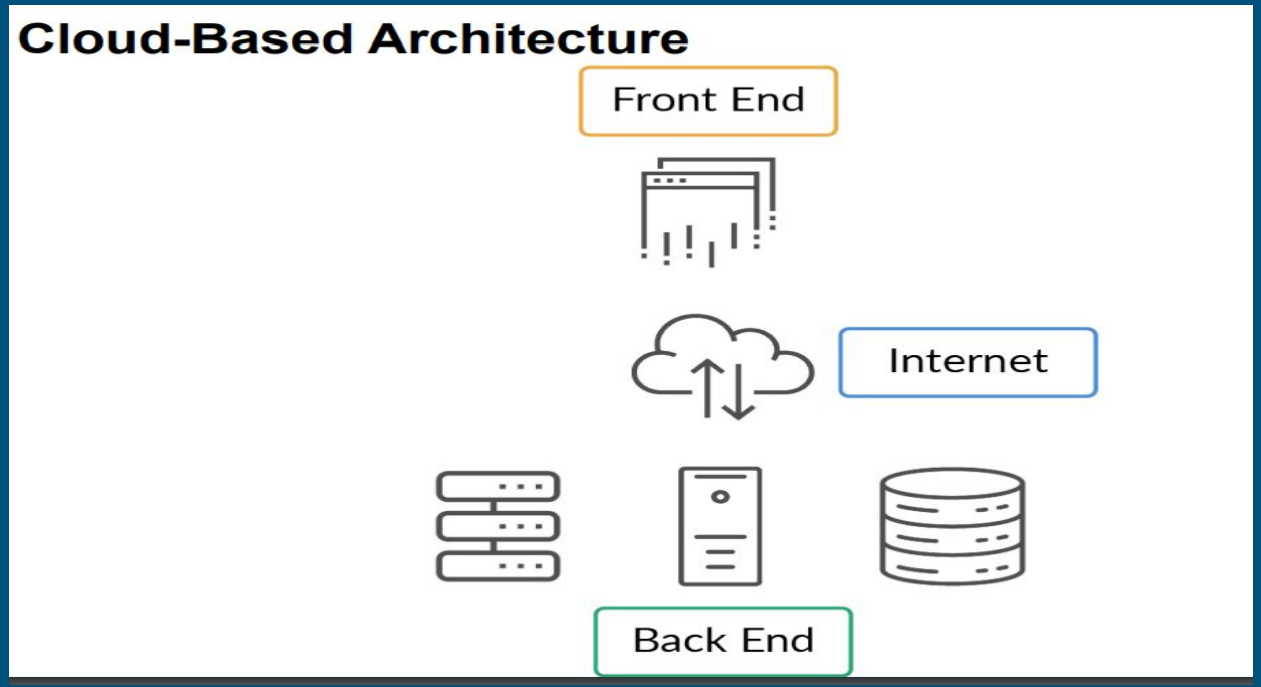
A cloud-based application has an architecture that contains two basic components: the front-end and the back-end. Both of these components are connected to each other through the internet.

Cloud-based Architecture

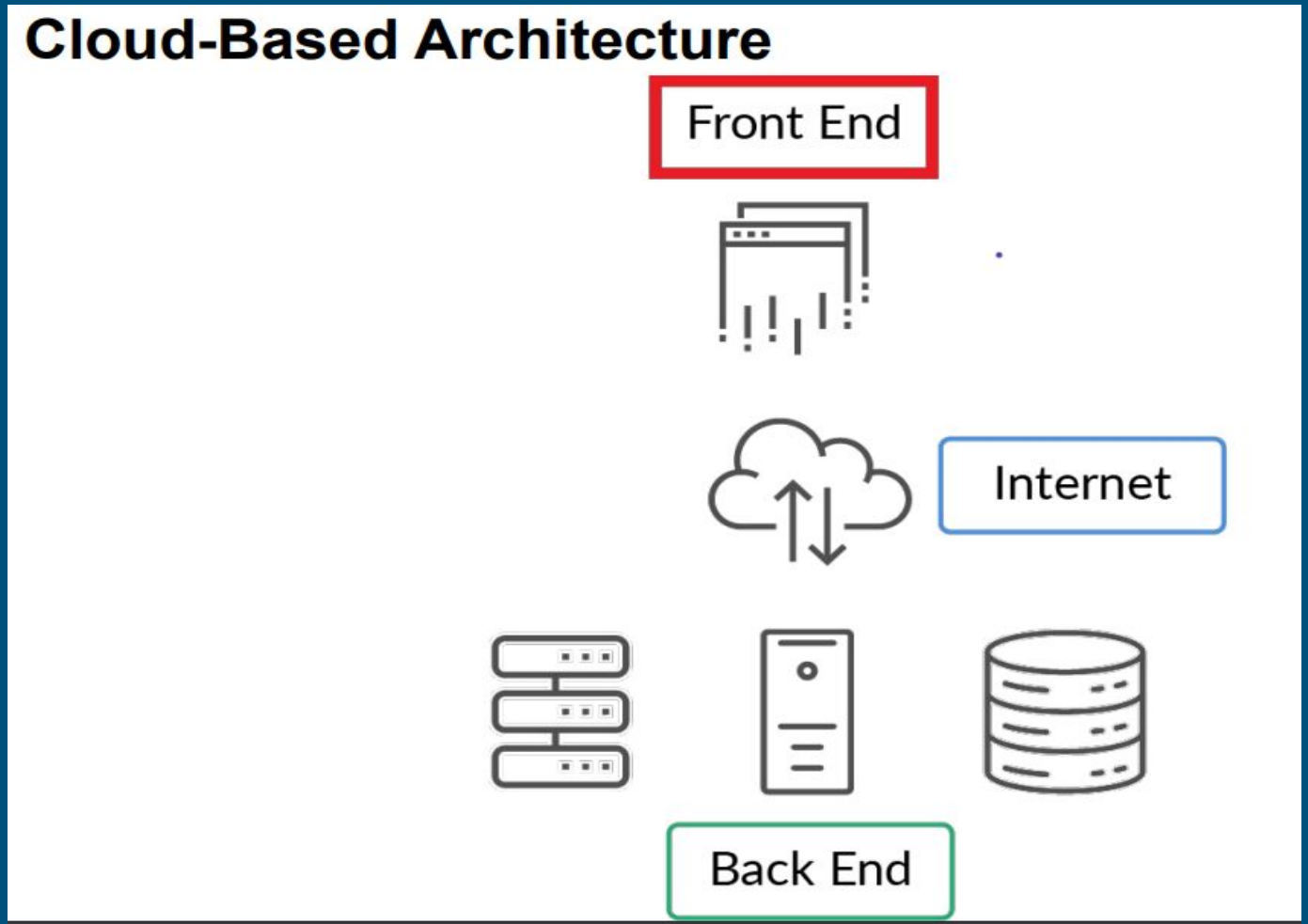
Cloud architecture is a combination of different technologies that are brought together to create the cloud, which provides shared scalable resources across a network.

Cloud architecture has the following two components:

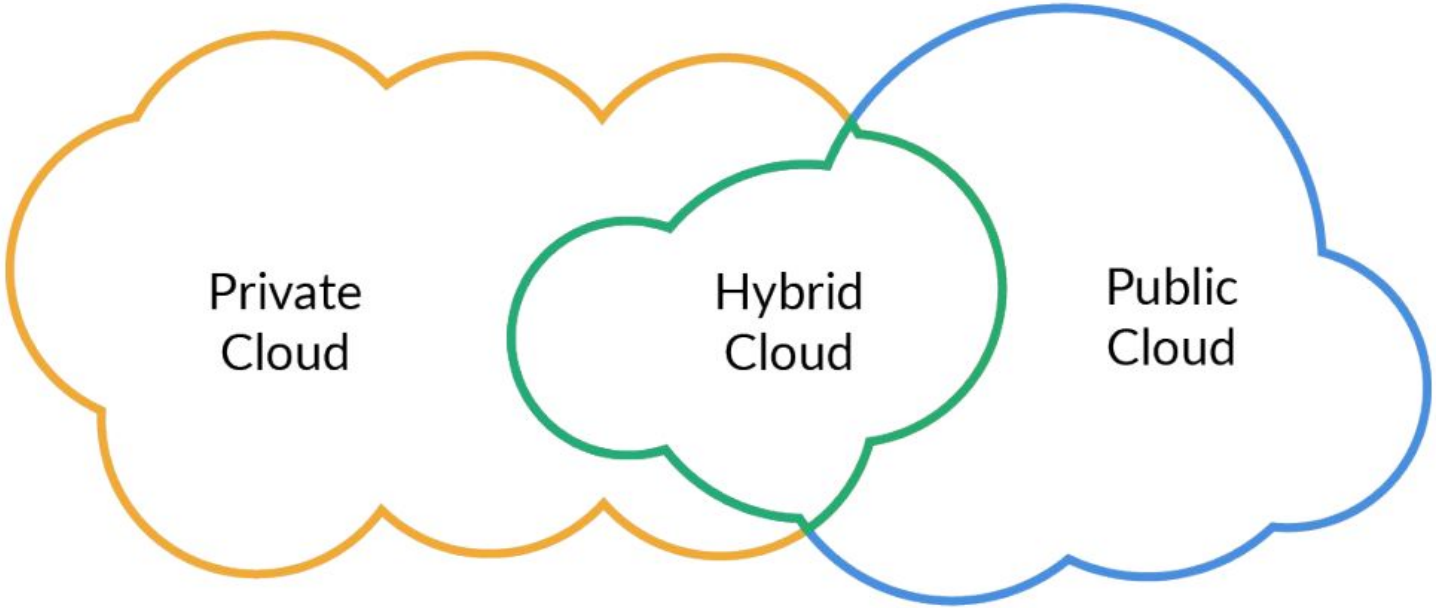
- **Front End:** This is the client or end-user. It consists of all the applications and interfaces that are used by clients to access cloud resources.
- **Back End:** It is the cloud itself, as it consists of infrastructure such as databases, computing resources, deployment models, etc. that are required to build the cloud


Cloud-Based Architecture
Front End
Internet
Back End

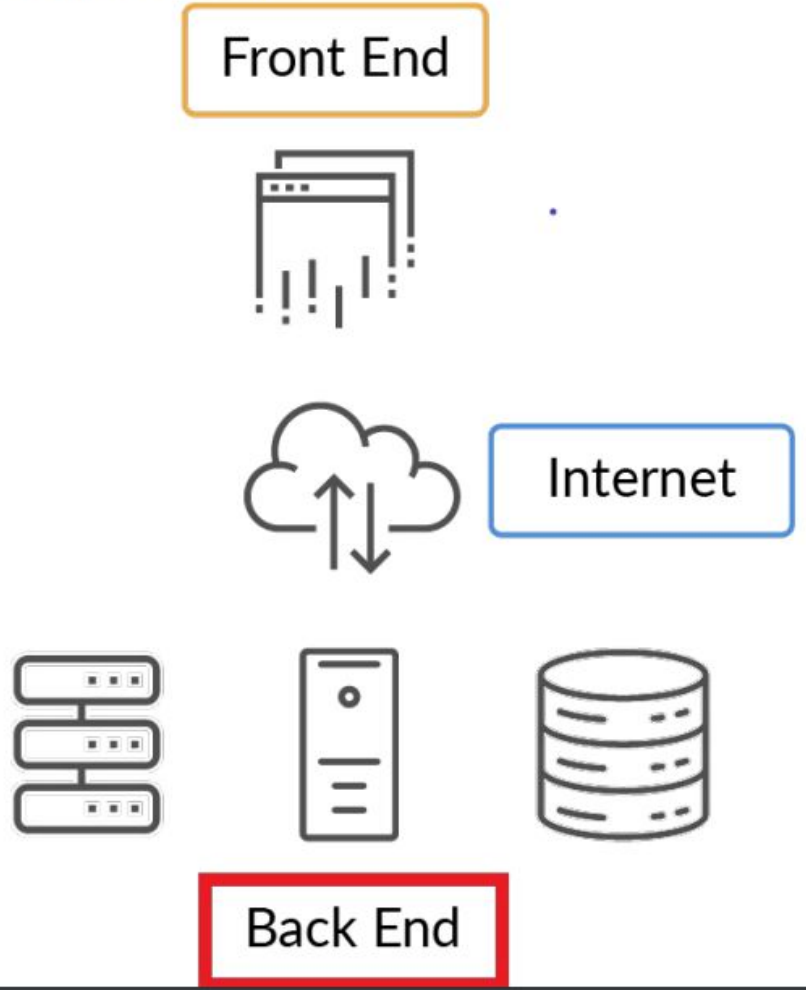
Cloud-Based Architecture



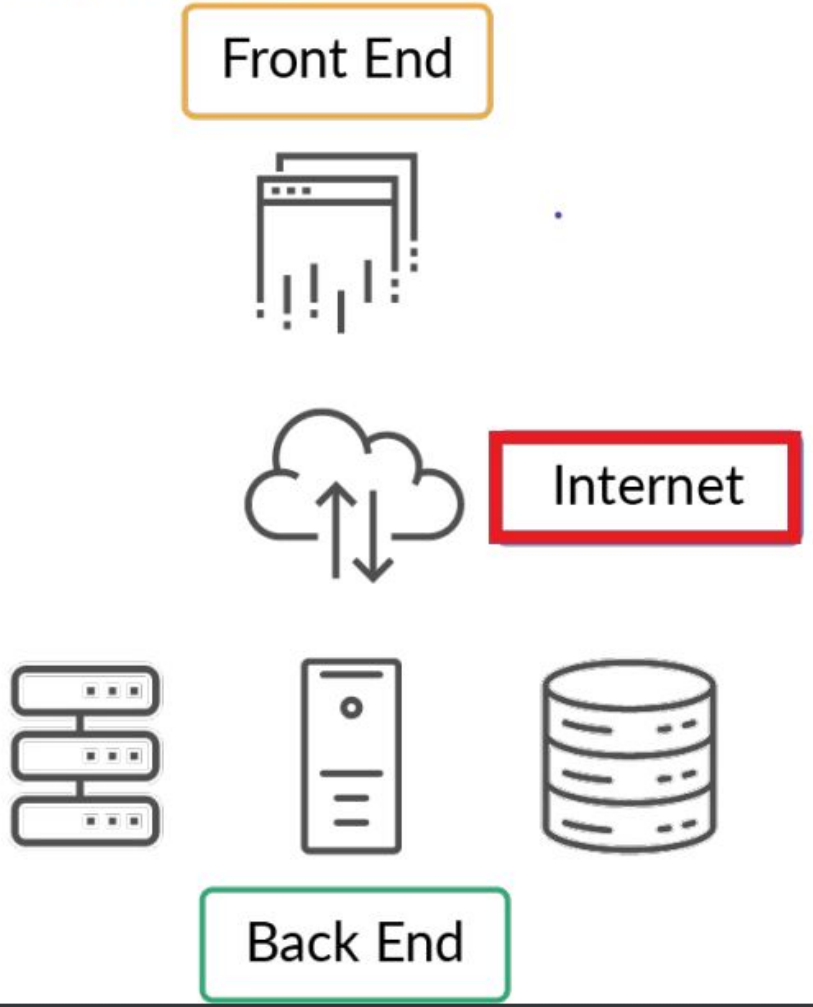
Deployment Models



Cloud-Based Architecture

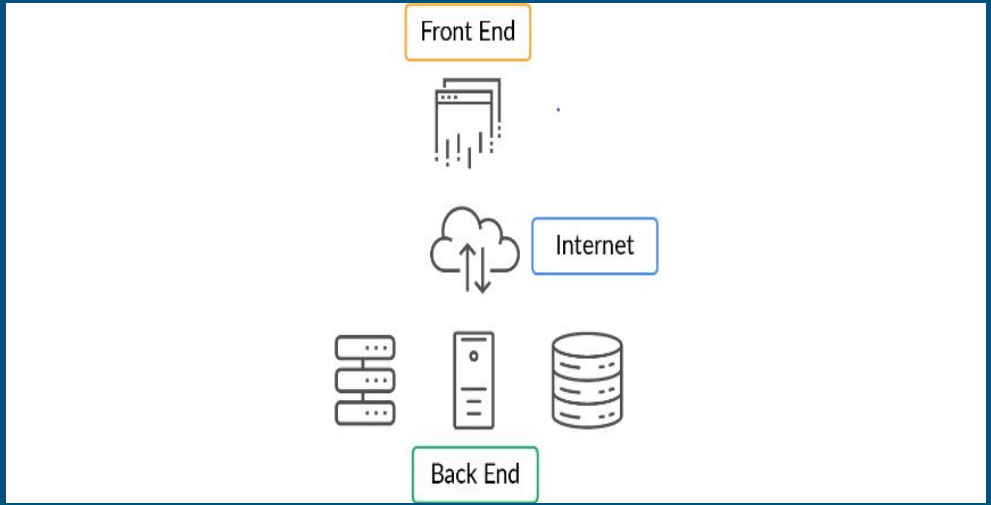


Cloud-Based Architecture



Both the **front end and back end are connected** to each other through a network, usually the **Internet**.

The following image illustrates the schematic structure of a cloud-based architecture.



Cloud Deployment Models

The following are the three major types of cloud deployment models available.

1. Private Cloud: In a private cloud, cloud resources are solely operated for a single organisation. The cloud is either managed by the organisation itself or by a third party and is hosted internally or externally.

These are some of the private cloud providers:

- IBM
- Oracle
- Vmware
- Hewlett Packard Enterprise (HPE)

Here are some of the advantages and disadvantages of a private cloud:

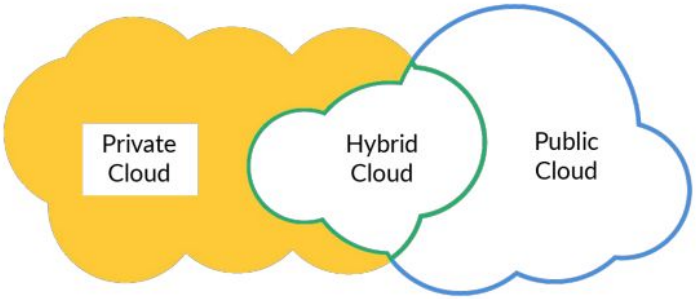
Advantages:

- It provides high security and also restricts access only to authorised users. Hence, this kind of infrastructure is generally preferred in financial institutions like banks, insurance firms, etc.
- It provides high control over the resources.

Disadvantages:

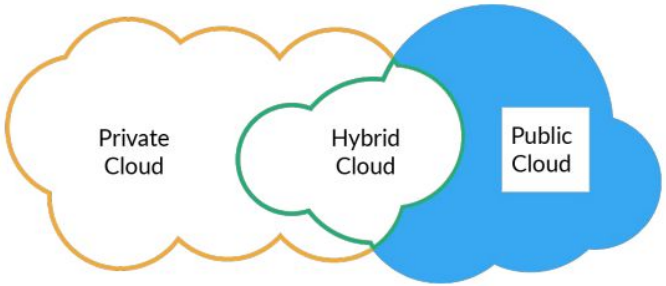
- It is not cost-effective when compared with a public cloud.
- It has limited scalability and can be scaled only up to the internal hosted resources.

Deployment Models: Private Cloud



1. Operated for a single organisation
2. Managed by the organisation itself or a third-party firm
3. Used by organisations with sensitive data
4. Providers: VMware, Oracle, IBM, etc.

Deployment Models: Public Cloud



1. Resources owned and operated by third-party firms
2. Services provided to users or companies over the Internet
3. Used for hosting a website or an application, data storage, etc.
4. Providers: Amazon Web Services, Microsoft Azure, etc.

Public Cloud: In a public cloud, cloud resources are owned and operated by a third party. The services are provided to the users through the Internet. The cloud service provider is solely responsible for maintaining the resources.

Following are some of the major public cloud service providers:

- **Google Cloud Platform**
- **Microsoft Azure**
- **Amazon Web Services**

Here are some of the advantages and disadvantages of a public cloud.

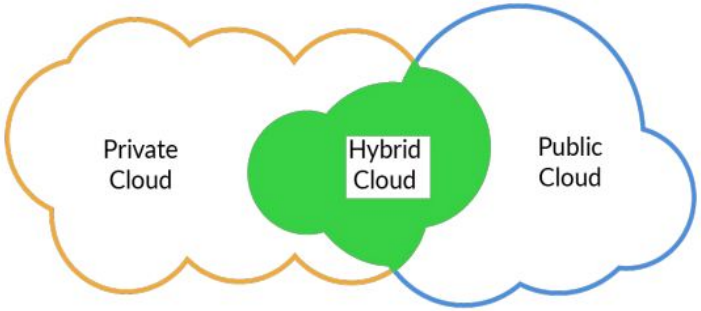
Advantages:

- It is highly scalable. It offers flexibility to either scale up or scale down the usage of resources as per the demand or based on a user’s request.
- It is also cost-effective. Users of a public cloud have to pay for only what they use.

Disadvantages:

- A public cloud might have security issues.
- It is not 100% customisable as per an organisation’s requirements.

Deployment Models: Hybrid Cloud



1. Combination of public and private clouds
2. Allows data sharing between the two clouds
3. Components, including LANs, APIs and VPNs, link the clouds
4. Connection providers: Dedicated Interconnect by Google, etc.

Hybrid Cloud: Hybrid cloud is a combination of public and private clouds, and allows organisations to share data between them.

- **It can be a combination of:**
  - **At least one private cloud and at least one public cloud,**
  - **Two or more private clouds, or**
  - **Two or more public clouds.**

The clouds chosen for the development of hybrid clouds should be able to connect multiple computers through a single network. These clouds should also be able to move workloads between one environment to the other. The ordered or consistent connections between separate clouds make it a hybrid cloud. Usually, the performance of a hybrid cloud is dependent on the development and management of its connections. The linking of public and private clouds is done using complex networks of LANs, APIs, VPNs, etc.

Several cloud providers give their customers preconfigured connections. For Example:

- **Dedicated Interconnect by Google Cloud**
- **Direct Connect by AWS, and**
- **ExpressRoute by Microsoft Azure.**

Here are some of the advantages and disadvantages of a hybrid cloud:

Advantages:

- **A private cloud is secure, and hence, a hybrid cloud is secure as well.**
- **Scalability: you already know that the public cloud is scalable. Therefore, the hybrid cloud which is the combination of public and private cloud is also scalable.**
- **Users can access both the private and the public cloud as per their requirements; thus, a hybrid cloud offers flexibility.**
- **Public cloud is cost-effective, hence hybrid cloud is also cost-effective if the user wants to use the public cloud properties.**

Disadvantages:

- Complex networking problems: Due to the complexity of having the public and the private cloud, there would be an issue in configuring the network.
- Organisation’s security compliance: Both the public and the private cloud should comply with the organisation’s security norms, and it is not easy to set up the clouds to meet this requirement.

Community Cloud

1. Different cloud services are integrated into a single cloud
2. Meets specific needs of an industry, a community or a sector
3. Infrastructure is shared among organisations
4. Industries include healthcare, media, etc.

Community Cloud

When different cloud services are integrated into a single cloud to meet the specific needs of an industry, community or business sector, the cloud is known as the community cloud.

The infrastructure of the community cloud is shared between organisations that have common concerns or interests. Industries such as healthcare, media, etc. opt for community clouds.

Here are some of the advantages and disadvantages of a community cloud:

Advantages:

- **The cost of maintenance can be shared among the organisations in the community.**
- **It is more secure than a public cloud and less expensive than a private cloud.**

Disadvantages:

- **It is difficult to distribute the responsibilities among the organisations in a community.**
- **It is difficult to segregate the data among the organisations in a community.**

Multi-Cloud Strategy

Multiple public or private clouds by different providers

Avoid lock-in with a single vendor

Utilise the best services provided by each cloud

Multi-Cloud Strategy

A multi-cloud strategy is when an organisation uses multiple public and private clouds by different providers. This is adopted in order to avoid lock-in with a single vendor and to make use of the best services provided by these cloud providers. Note that this is different from Hybrid Cloud as here, the purpose of this strategy is to not lock-in with a single service provider whereas you can implement Hybrid Cloud using the services of the same service provider.

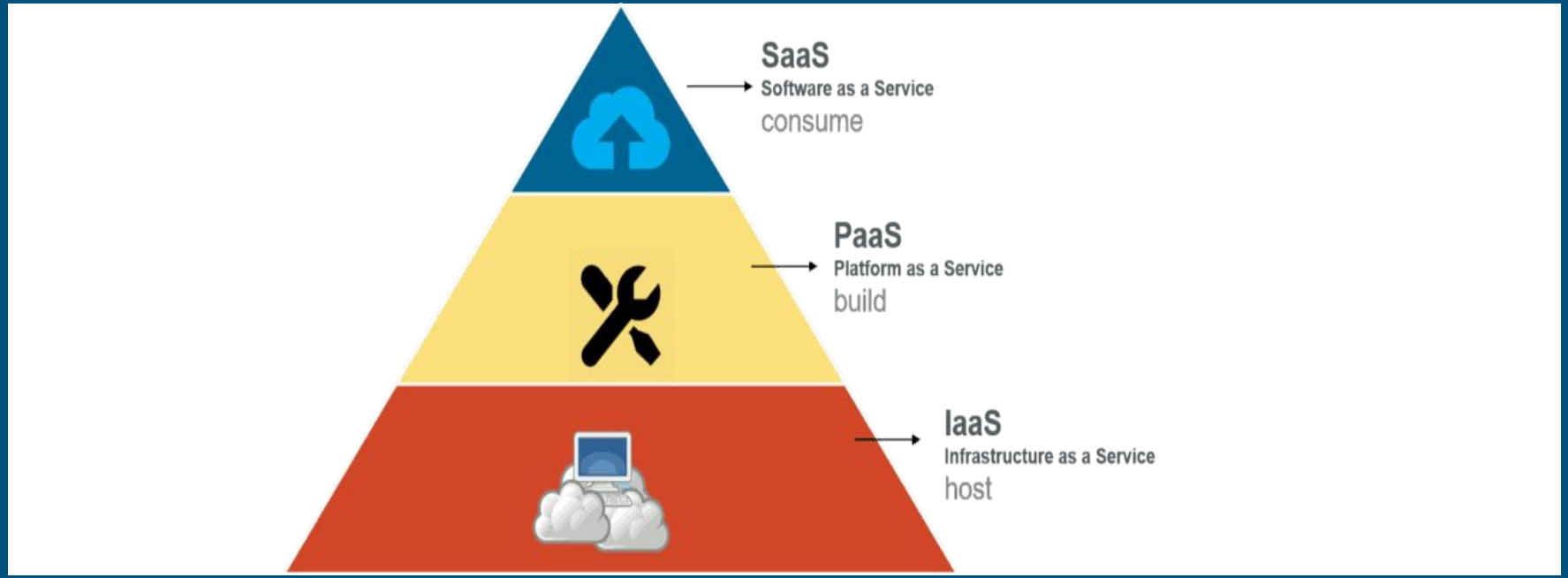
Additional Reading

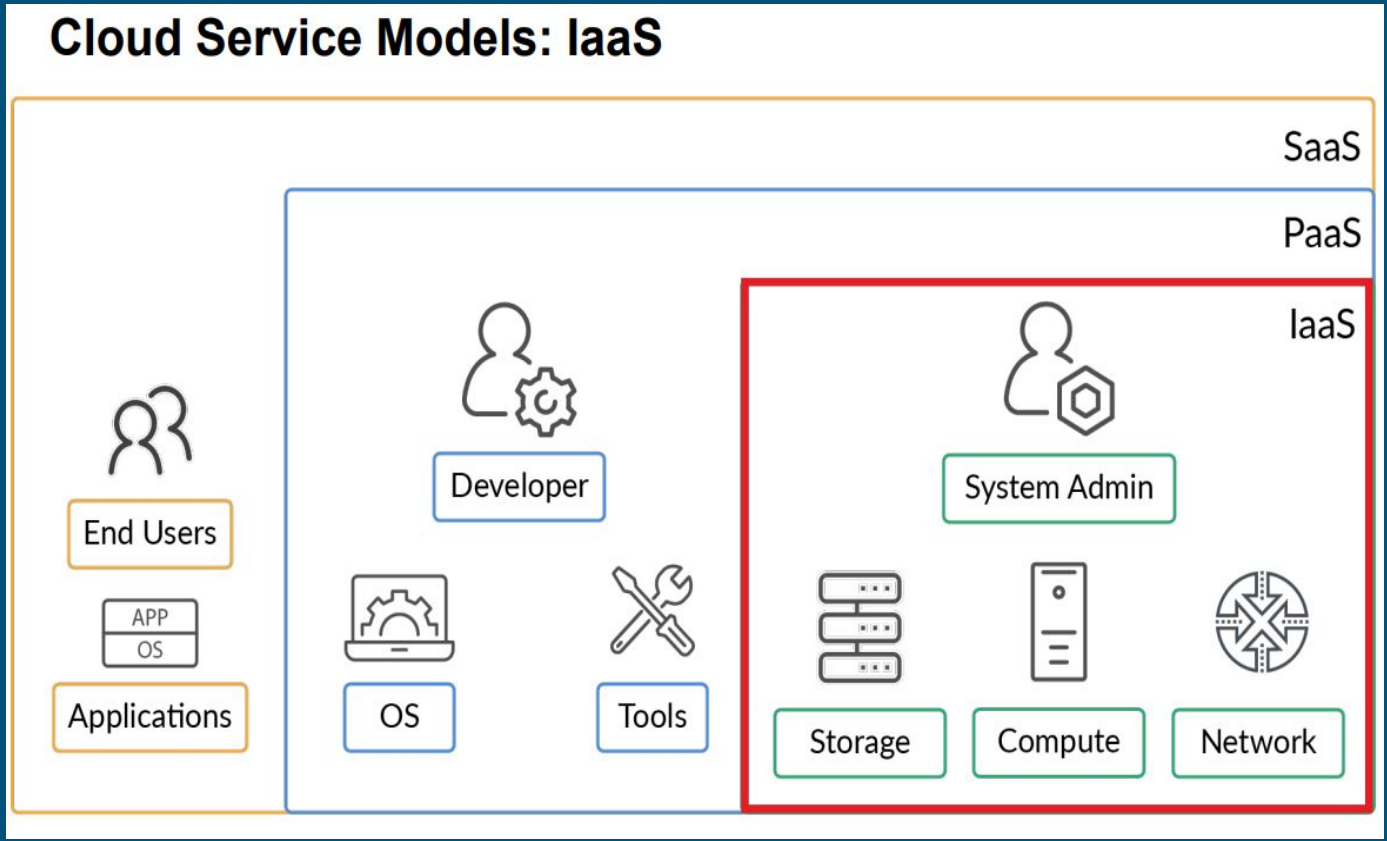
- Private Cloud - A detailed article about the private cloud and its differences with public and hybrid clouds.
- Features of Public Cloud - This article highlights the features provided by a public cloud.
- Benefits of Hybrid Cloud - This article explains in detail the benefits of using hybrid cloud solutions.

Key Takeaways

- Private clouds are operated for a single organisation.
- Public clouds are operated by a third-party firm. They offer services to users based on their demands.
- Hybrid clouds are a combination of both public or private clouds.
- A community cloud is created to meet the specific needs of an industry, a sector or a community.
- A multi-cloud strategy allows organisations to avoid lock-in with one cloud provider.

Types of Cloud Services




Cloud Service Models: IaaS
SaaS
PaaS
IaaS
End Users
APP
OS
Applications
Developer
OS
Tools
System Admin
Storage
Compute
Network

Cloud Service Models

On-demand cloud services are of mainly three types:

1. Infrastructure as a Service (IaaS): These services are a set of compute, storage and network that are virtualized by cloud providers so that users can access and configure resources according to their needs. With IaaS, a user can rent IT infrastructure.

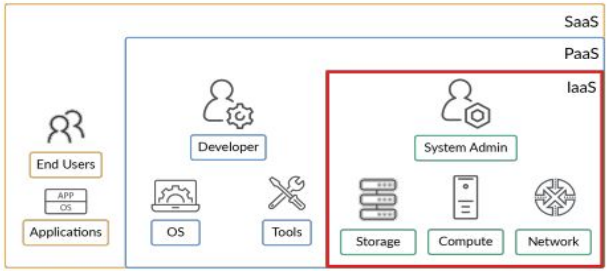
- Common examples of IaaS are as follows:
  - AWS EC2
  - Google Compute Engine (GCE)
  - Digital Ocean

Here are some of the advantages of Infrastructure as a Service:

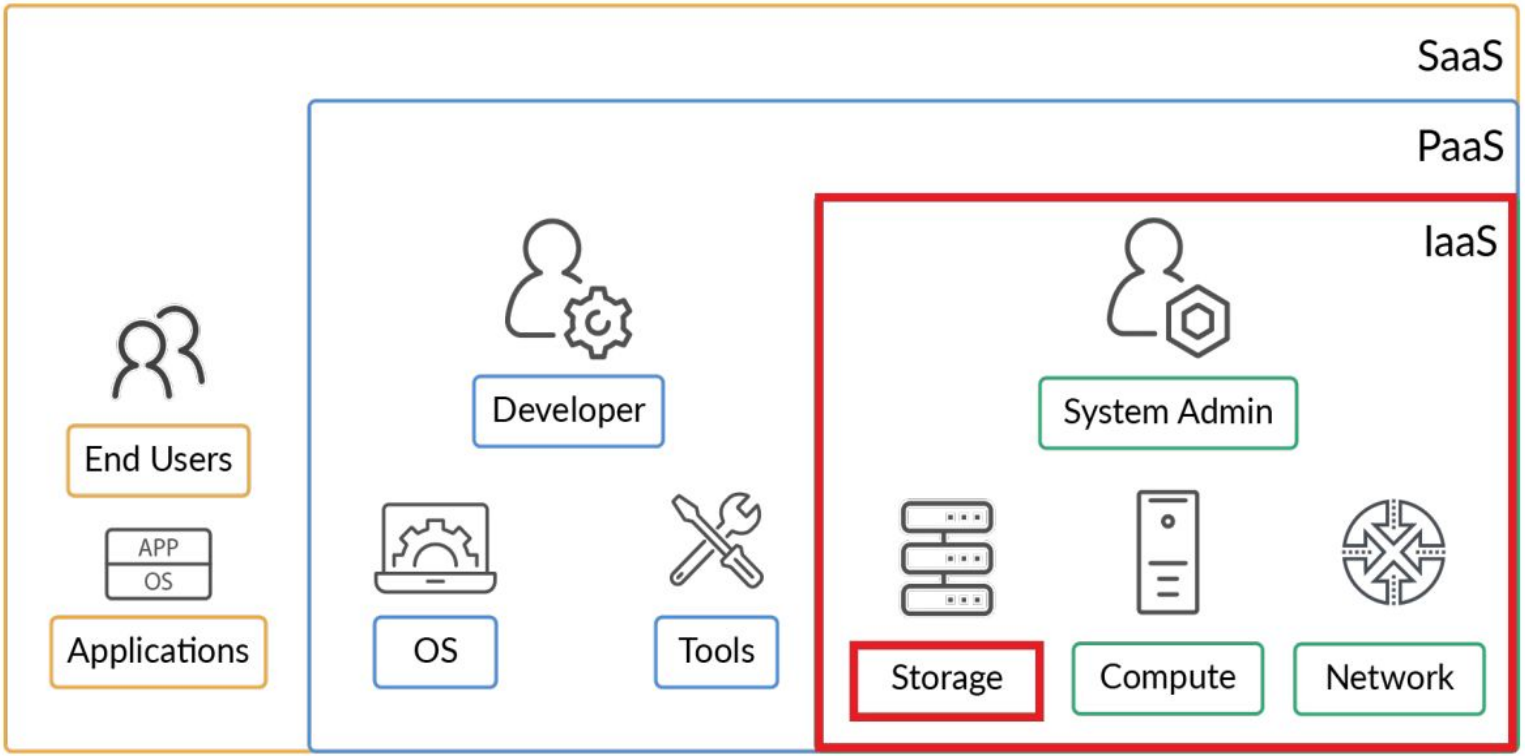
- The service provider provides the infrastructure, and the user has to just install an operating system of their requirements and work on it.
- The user can modify the architecture as per their requirements since it is basic cloud infrastructure.
- The user has full control over all the computing resources.

Infrastructure as a Service (IaaS)

- A set of computing, storage and networking services



Cloud Service Models: IaaS



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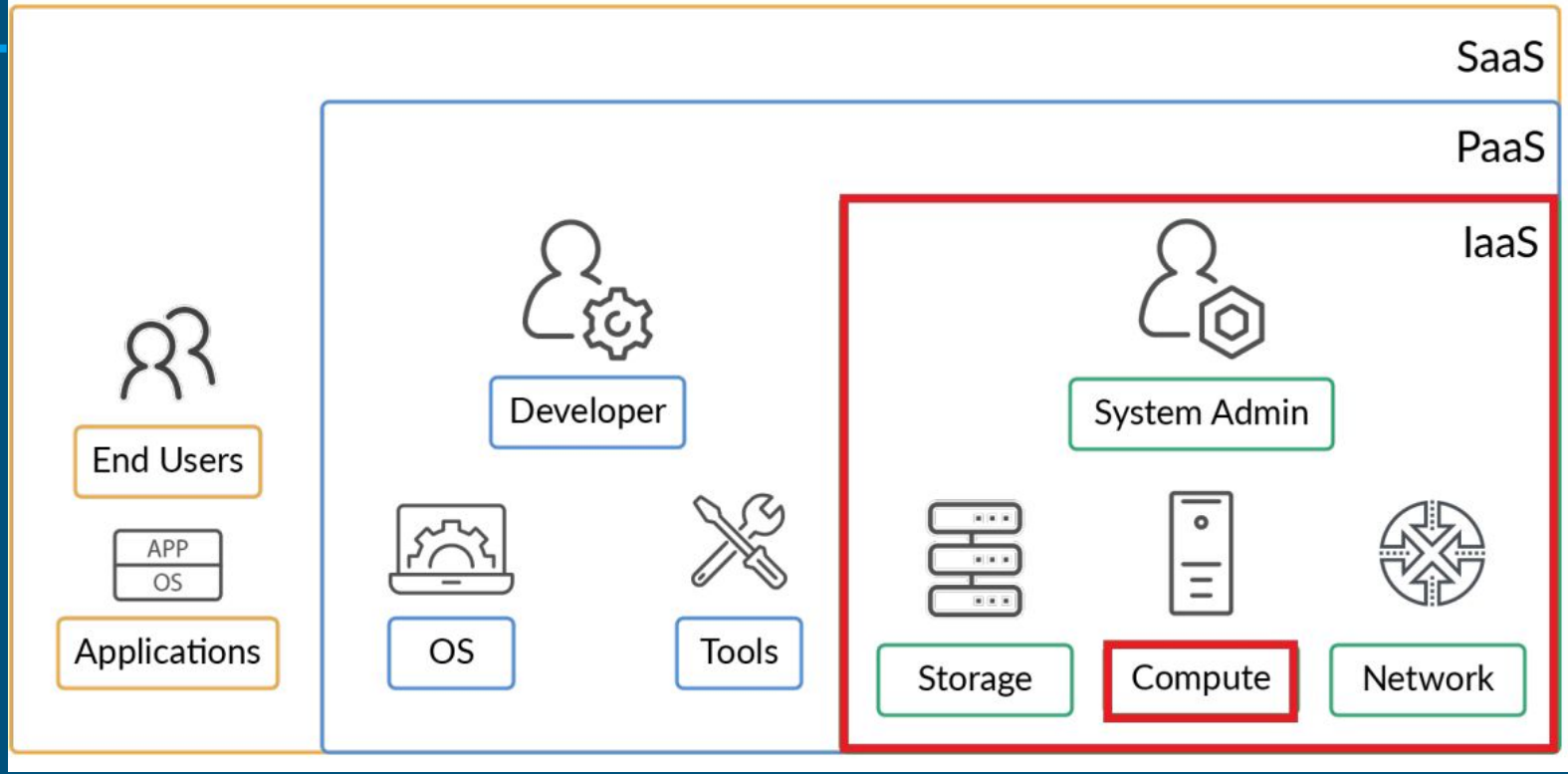

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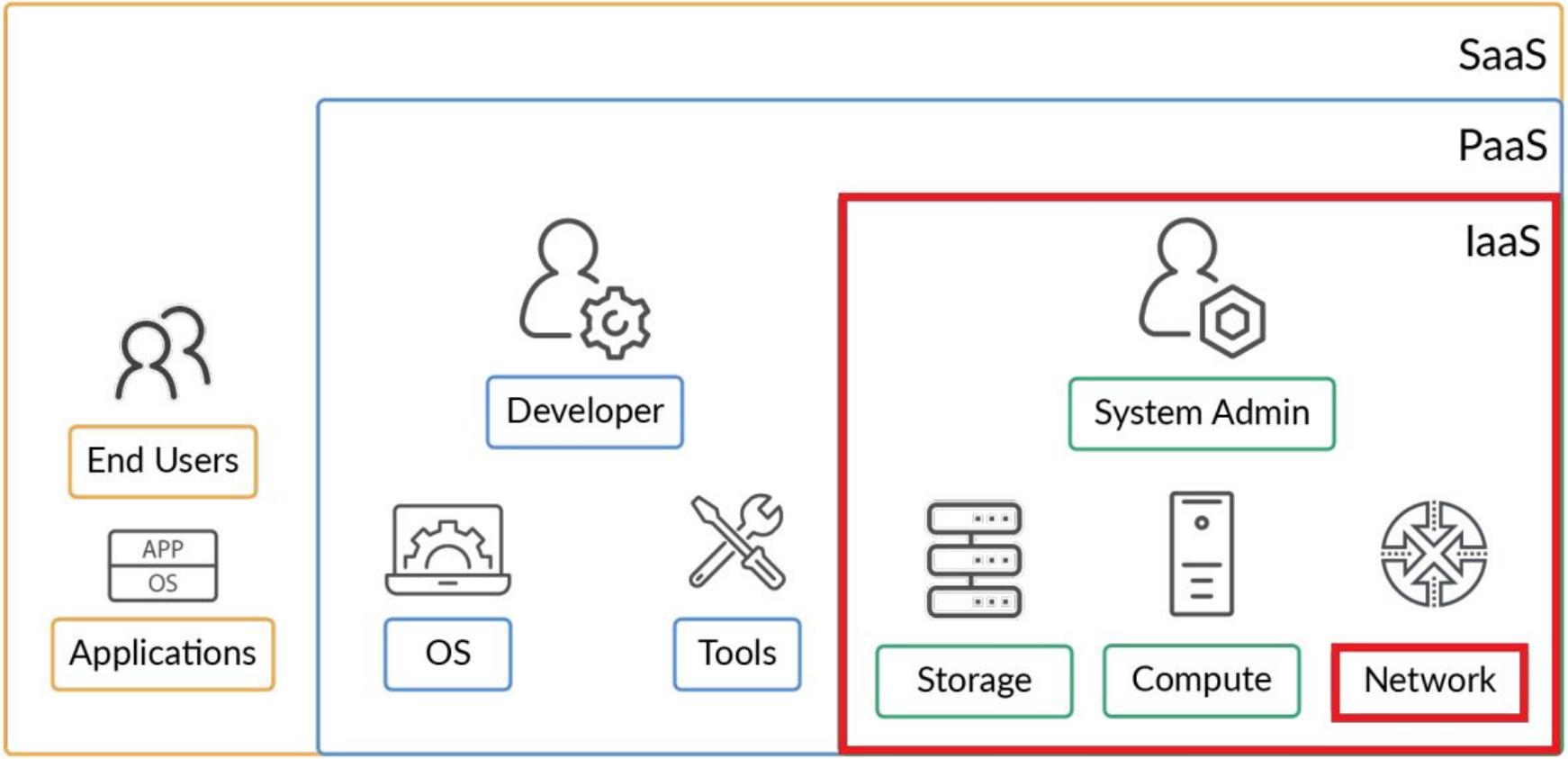
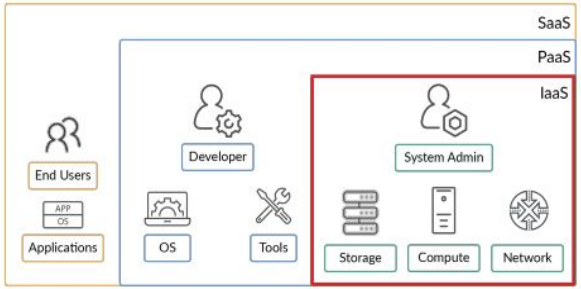


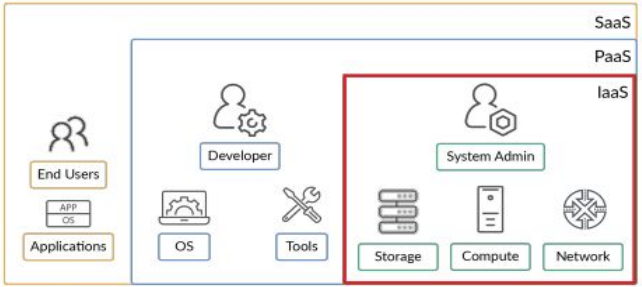
Infrastructure as a Service (IaaS)

- A set of computing, storage and networking services
- Allows users to rent IT infrastructure such as servers, storage, routers, etc.



Infrastructure as a Service (IaaS)

- A set of computing, storage and networking services
- Allows users to rent IT infrastructure such as servers, storage, routers, etc.
- IaaS providers manage data centres



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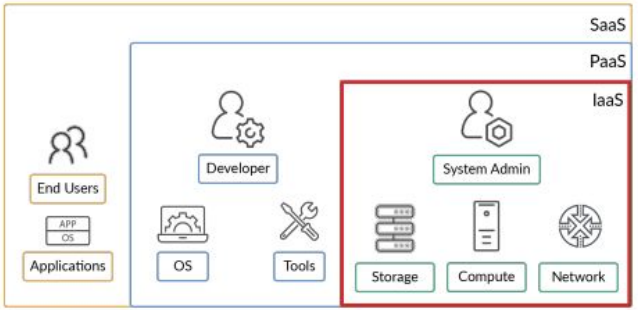
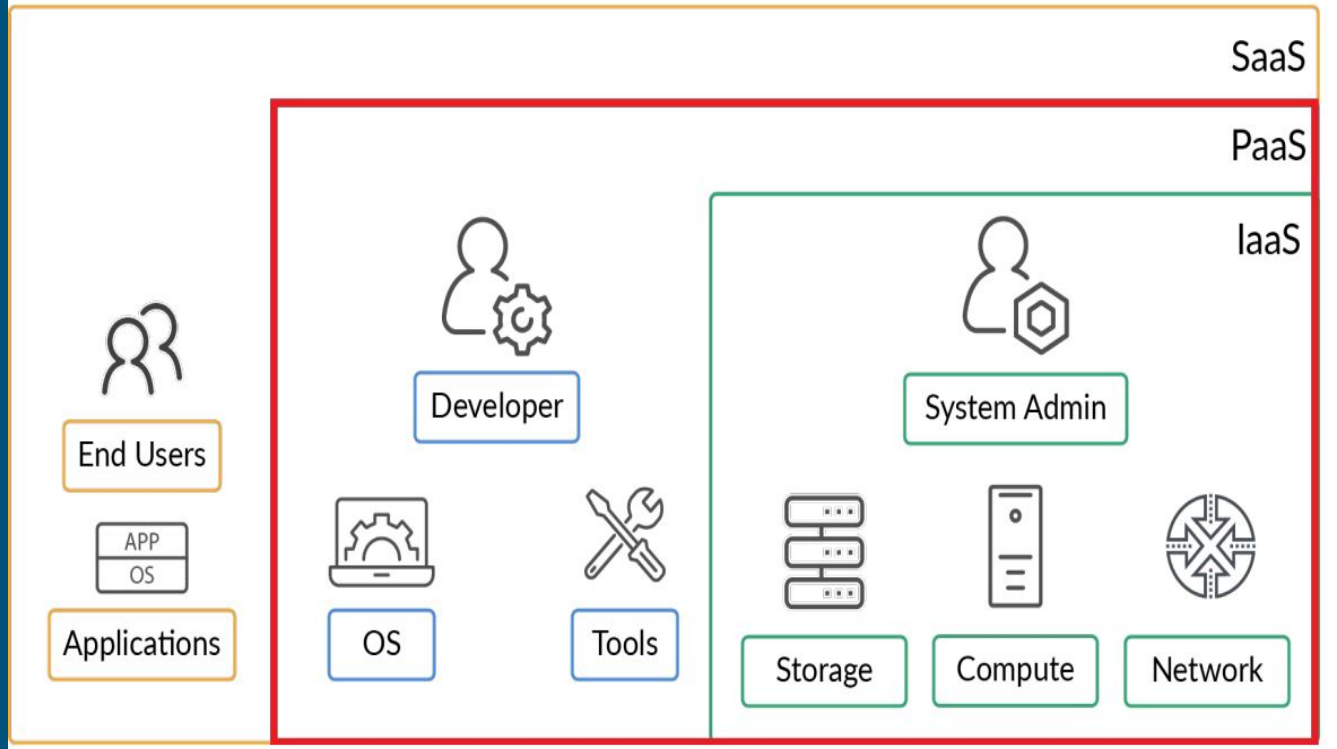


Cloud Service Models: PaaS



Platform as a Service (PaaS): These are cloud services that provide an on-demand environment for developing and managing a software application. PaaS can be used to build, run and manage application programming interfaces (APIs).

The following are some of the common examples of PaaS:

- Windows Azure
- OpenShift
- AWS Elastic Beanstalk.

Here are some of the advantages and disadvantages of PaaS:

Advantages:

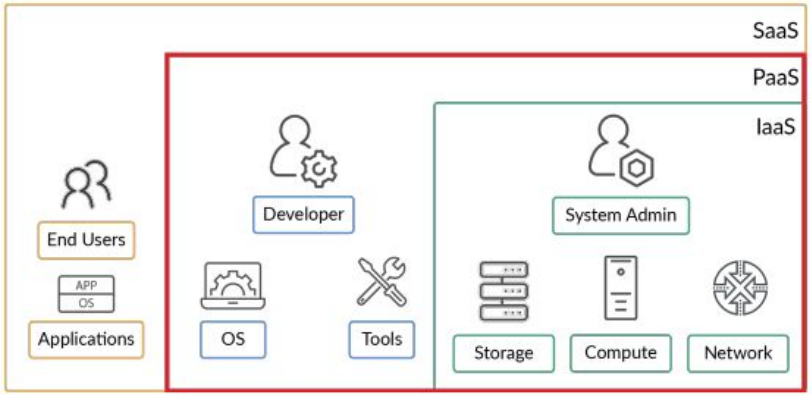
- Prebuilt platform: PaaS provides an already built platform for users to build and run their applications.
- It is a simple model to use and deploy applications.
- Low cost: Since the platform is already built, the user needs to create only their applications. This reduces the costs related to hardware and software.

Disadvantages:

- Migration issues: Migrating the user applications from one PaaS vendor to another might raise some issues.
- Platform restrictions: The platforms provided by some vendors may have certain restrictions, for instance, the user can use only certain specified languages.

Platform as a Service (PaaS)

- On-demand environment for developing and managing software applications



Platform as a Service (PaaS)

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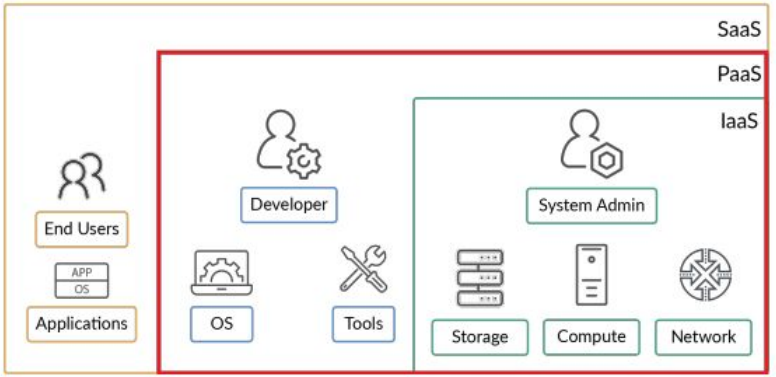
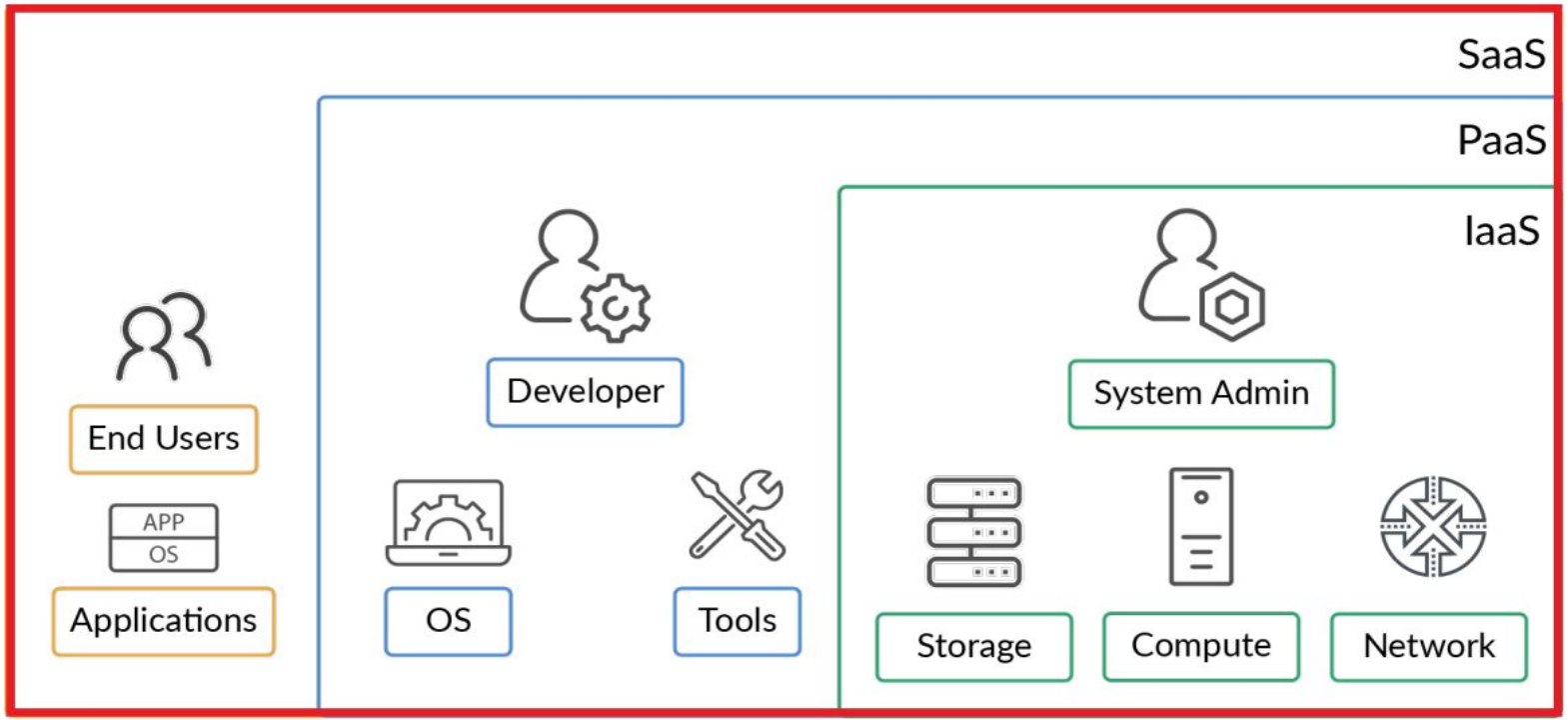


Cloud Service Models: SaaS



3. Software as a Service (SaaS): These are cloud services that provide the user with a complete software application over the Internet. All the infrastructure, application tools, data, etc. are located at data centres managed by the service providers.

- **Some of the examples of SaaS are as follows:**
  - **Google Apps**
  - **Salesforce**
  - **Dropbox.**

- There are two modes of SaaS:
  - **Simple Multi-Tenancy**: Each user has independent resources that are different from the resources of other users.
  - **Fine Grain Multi-Tenancy**: Resources are shared by several users but the functionality of these resources remains the same.

Advantages:

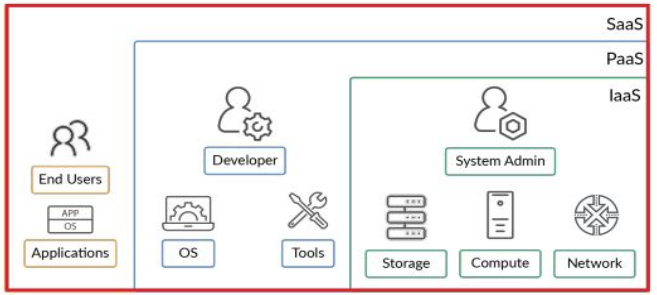
- Ease of access: Users can access the applications on the server from anywhere using any Internet-connected device. Most types of internet-connected devices can access SaaS applications.
- Low maintenance: Users need not update an application. The application is on the server, and it is the service provider’s responsibility to maintain the application.
- Quick setup: Users do not require any hardware to install the application. The SaaS application is already present on the cloud.

Disadvantages:

- Lack of control: Users do not have control over the SaaS applications. Only the vendor has full control of SaaS applications.
- Connectivity issue: The applications can only be accessed only via the Internet. Hence, if there is no Internet, then the users cannot access the applications.

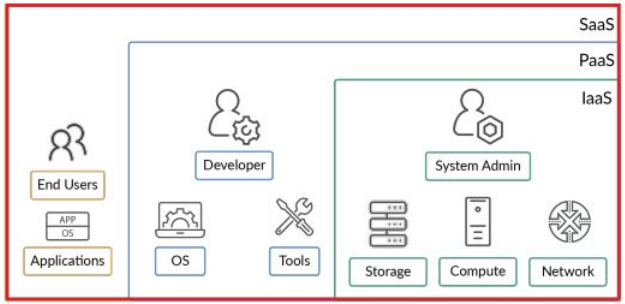
Software as a Service (SaaS)

- A complete software application provided over the Internet



Software as a Service (SaaS)

- A complete software application provided over the internet
- Components such as infrastructure, application tools, data, etc. are located at data centres managed by cloud providers



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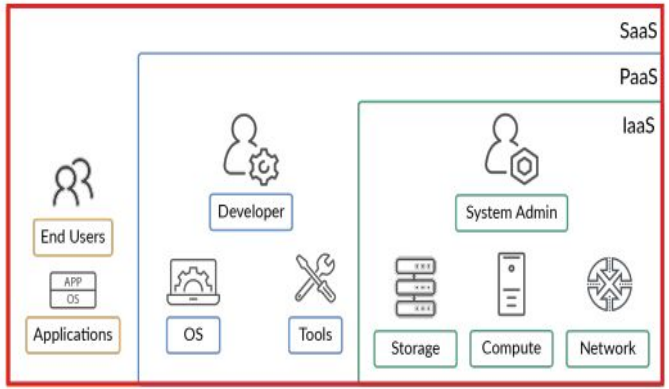
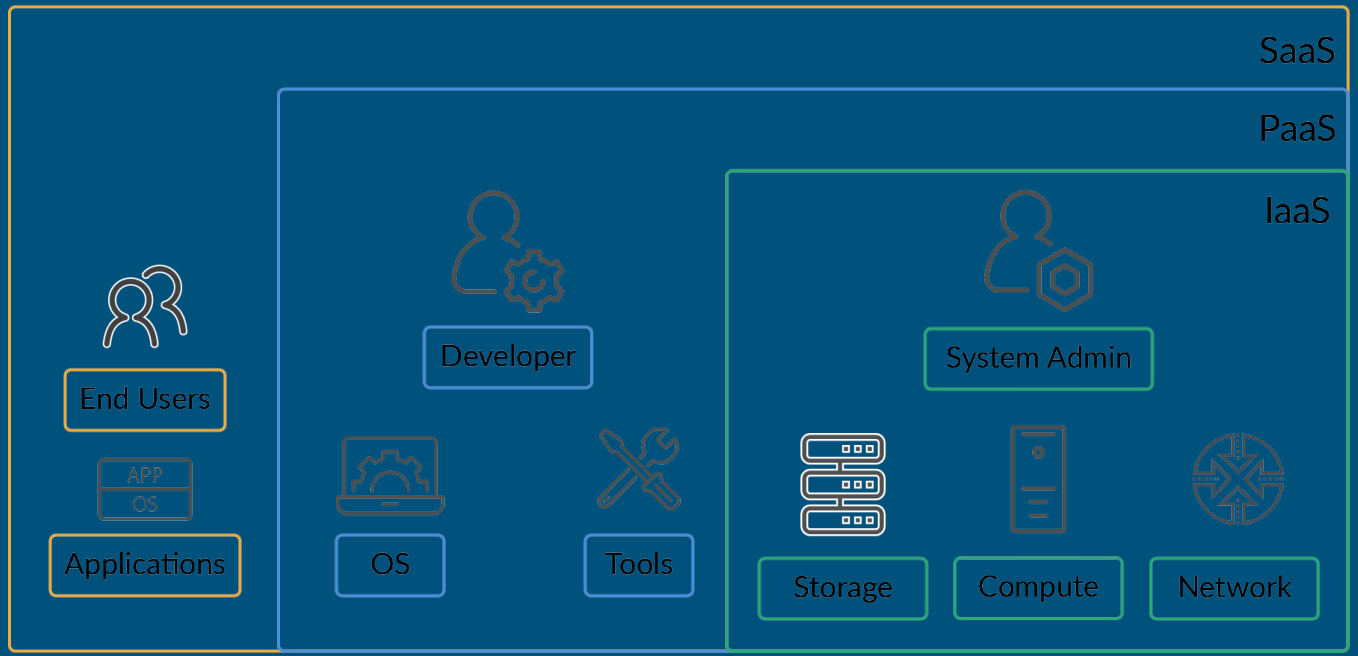


Key Takeaways

- Through IaaS, cloud providers offer computing. storage and networking services that users can access as per their requirement.
- PaaS is a computing model that provides a complete platform to users for developing, running and managing applications.
- SaaS is a model that provides users with a complete software application over the Internet.

The image illustrates the components of the different cloud service models:



Additional Reading

- Infrastructure as a Service - A very detailed explanation of infrastructure as a service model.
- Platform as a Service - A very detailed explanation of platform as a service model.
- Comparison between the Service Models - Highlights the differences between the service models i.e.IaaS, PaaS and SaaS.

Session Summary

- Cloud Computing refers to the process of delivering IT services to users or organisations over the Internet.

- The two basic components of a cloud application are: the front end and the back end. Both these components are connected to each other through a network, usually the Internet.

- In a private cloud, the cloud resources are operated for a single organisation.

- In a public cloud, the resources are owned and operated by a third-party firm. The services are provided to the users over the Internet.

- A hybrid cloud is a combination of both public or private clouds

- Through IaaS, cloud providers offer computing. storage and networking services that users can access as per their requirement.
- PaaS is a computing model that provides a complete platform to users for developing, running and managing applications.
- SaaS is a model that provides users with a complete software application over the Internet.