

Cloud Models

Module 2

Characteristics of Cloud Computing

Measured service: The resource utilization is tracked for each application and occupant, it will provide both the user and the resource provider with an account of what has been used. This is done for various reasons like monitoring billing and effective use of resource.

Multi-tenancy: Cloud computing providers can support multiple tenants (users or organizations) on a single set of shared resources.

Virtualization: Cloud computing providers use virtualization technology to abstract underlying hardware resources and present them as logical resources to users.

Resilient computing: Cloud computing services are typically designed with redundancy and fault tolerance in mind, which ensures high availability and reliability

Characteristics of Cloud Computing

On-demand self-services: The Cloud computing services does not require any human administrators, user themselves are able to provision, monitor and manage computing resources as needed.

Broad network access: The Computing services are generally provided over standard networks and heterogeneous devices.

Rapid elasticity: The Computing services should have IT resources that are able to scale out and in quickly and on as needed basis. Whenever the user require services it is provided to him and it is scale out as soon as its requirement gets over.

Resource pooling: The IT resource (e.g., networks, servers, storage, applications, and services) present are shared across multiple applications and occupant in an uncommitted manner. Multiple clients are provided service from a same physical resource.

Characteristics of Cloud Computing

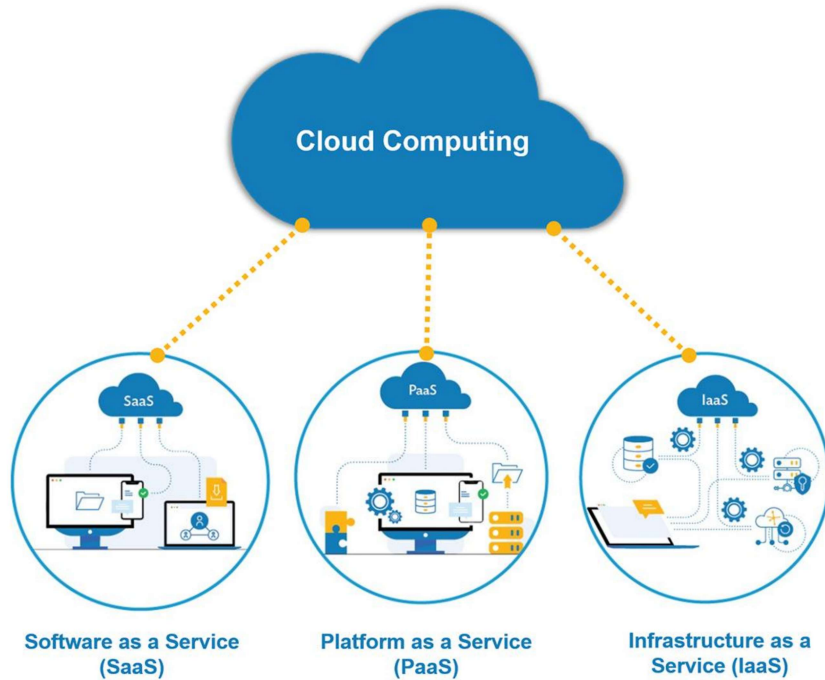
Flexible pricing models: Cloud providers offer a variety of pricing models, including pay-per-use, subscription-based, and spot pricing, allowing users to choose the option that best suits their needs.

Security: Cloud providers invest heavily in security measures to protect their users' data and ensure the privacy of sensitive information.

Automation: Cloud computing services are often highly automated, allowing users to deploy and manage resources with minimal manual intervention.

Sustainability: Cloud providers are increasingly focused on sustainable practices, such as energy-efficient data centers and the use of renewable energy sources, to reduce their environmental impact.

Cloud Services



Advantages of SaaS

Cost-Effective: Pay only for what you use.

Reduced time: Users can run most SaaS apps directly from their web browser without needing to download and install any software. This reduces the time spent in installation and configuration and can reduce the issues that can get in the way of the software deployment.

Accessibility: We can Access app data from anywhere.

Automatic updates: Rather than purchasing new software, customers rely on a SaaS provider to automatically perform the updates.

Scalability: It allows the users to access the services and features on-demand.

Software as a Service (SaaS)

Providers offer subscribers the use of their software running on a cloud infrastructure, which means the application can be widely distributed and accessed.

Common types of business technologies hosted by the SaaS vendor include productivity suites, customer relationship management (CRM) software, human resources management (HRM) software, and data management software.

Users have the option of accessing the application(s) through a program interface or a thin client interface, such as a web browser.

Instead of installing and maintaining software, we simply access it via the Internet, freeing ourselves from the complex software and hardware management.

Disadvantages of SaaS

Limited customization: SaaS solutions are typically not as customizable as on-premises software, meaning that users may have to work within the constraints of the SaaS provider's platform and may not be able to tailor the software to their specific needs.

Dependence on internet connectivity: SaaS solutions are typically cloud-based, which means that they require a stable internet connection to function properly. This can be problematic for users in areas with poor connectivity or for those who need to access the software in offline environments.

Security concerns: SaaS providers are responsible for maintaining the security of the data stored on their servers, but there is still a risk of data breaches or other security incidents.

Limited control over data: SaaS providers may have access to a user's data, which can be a concern for organizations that need to maintain strict control over their data for regulatory or other reasons.

SaaS examples



<https://www.office.com/?auth=2>

Advantages of PaaS:

Simple and convenient for users: It provides much of the infrastructure and other IT services, which users can access anywhere via a web browser.

Cost-Effective: It charges for the services provided on a per-use basis thus eliminating the expenses one may have for on-premises hardware and software.

Efficiently managing the lifecycle: It is designed to support the complete web application lifecycle: building, testing, deploying, managing, and updating.

Efficiency: It allows for higher-level programming with reduced complexity thus, the overall development of the application can be more effective.

Platform as a Service

PaaS is a category of cloud computing that provides a platform and environment to allow developers to build applications and services over the internet.

PaaS services are hosted in the cloud and accessed by users simply via their web browser.

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.

The consumer does not manage or control the underlying cloud infrastructure including network, servers, operating systems, or storage, but has control over the deployed applications and possibly configuration settings for the application-hosting environment.

Disadvantages of PaaS:

Limited control over infrastructure: PaaS providers typically manage the underlying infrastructure and take care of maintenance and updates, but this can also mean that users have less control over the environment and may not be able to make certain customizations.

Dependence on the provider: Users are dependent on the PaaS provider for the availability, scalability, and reliability of the platform, which can be a risk if the provider experiences outages or other issues.

Limited flexibility: PaaS solutions may not be able to accommodate certain types of workloads or applications, which can limit the value of the solution for certain organizations.

PaaS examples

Google Cloud

Microsoft Azure

AWS

IBM Cloud

VMware (Pivotal) Cloud Foundry

Github

<https://colab.research.google.com/>

Advantages of IaaS:

Cost-Effective: Eliminates capital expense and reduces ongoing cost and IaaS customers pay on a per-user basis, typically by the hour, week, or month.

Website hosting: Running websites using IaaS can be less expensive than traditional web hosting.

Security: The IaaS Cloud Provider may provide better security than your existing software.

Maintenance: There is no need to manage the underlying data center or the introduction of new releases of the development or underlying software. This is all handled by the IaaS Cloud Provider.

Infrastructure as a Service

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

Typically IaaS is a service where infrastructure is provided as outsourcing to enterprises such as networking equipment, devices, database, and web servers.

It is also known as **Hardware as a Service (HaaS)**.

It simply provides the underlying operating systems, security, networking, and servers for developing such applications, and services, and deploying development tools, databases, etc.

Disadvantages of IaaS :

Limited control over infrastructure: IaaS providers typically manage the underlying infrastructure and take care of maintenance and updates, but this can also mean that users have less control over the environment and may not be able to make certain customizations.

Security concerns: Users are responsible for securing their own data and applications, which can be a significant undertaking.

Limited access: Cloud computing may not be accessible in certain regions and countries due to legal policies.

IaaS examples

AWS

Google Compute Engine (GCE)

IBM Cloud.

Microsoft Azure.

Rackspace.

Linode.

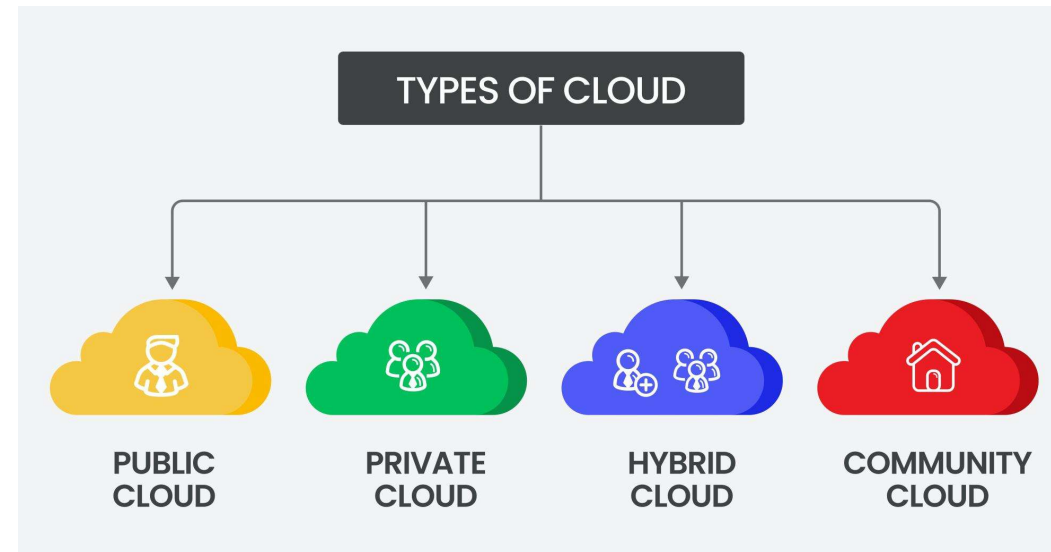
Cisco Metacloud.



A public cloud is an IT model where public cloud service providers make computing services—including compute and storage, develop-and-deploy environments, and applications—available on-demand to organizations and individuals over the public internet.

The main benefits of the public cloud are as follows:

- a reduced need for organizations to invest in and maintain their own on-premises IT resources;
- scalability to quickly meet workload and user demands; and
- fewer wasted resources, because customers only pay for what they use.



Public cloud architecture

A public cloud is a fully virtualized environment that relies on high-bandwidth network connectivity to access and exchange data.

Providers have a [multi-tenant](#) architecture that enables users -- or *tenants* -- to run workloads on shared infrastructure and use the same computing resources.

Each tenant's data and workloads in the public cloud are logically separated and remain isolated from the data of other tenants.

Providers operate cloud services in logically isolated locations within public cloud regions. These locations, called *availability zones*, typically consist of two or more connected, highly available physical data centers.

Availability Zones

Availability zones are highly available, fault tolerant, and more scalable than traditional single or multiple datacenter infrastructures deployed in different locations.

Organizations select availability zones based on compliance and proximity to end users. Cloud resources can be replicated across multiple availability zones for *redundancy and protection against outages*.

https://aws.amazon.com/about-aws/global-infrastructure/regions_az/

How private cloud works

Private cloud is a *single-tenant* environment, meaning all resources are accessible to one customer only—this is referred to as *isolated access*.

Private clouds are typically hosted on-premises in the customer's data center. But, private clouds can also be hosted on an independent cloud provider's infrastructure or built on rented infrastructure housed in an offsite data center.

Management models also vary—the customer can manage everything itself or outsource partial or full management to a service provider.



Private cloud is a cloud computing environment dedicated to a single customer. It combines many of the benefits of cloud computing with the security and control of on-premises IT infrastructure.

Private cloud (also known as an internal cloud or corporate cloud) is a cloud computing environment in which all hardware and software resources are dedicated exclusively to, and accessible only by, a single customer.

Private cloud combines many of the benefits of cloud computing—including elasticity, scalability, and ease of service delivery—with the access control, security, and resource customization of on-premises infrastructure.

Benefits of private cloud

Full control over hardware and software choices. Private cloud customers are free to purchase the hardware and software they prefer, vs. the hardware and software the cloud provider offers

Greater visibility into security and access control, because all workloads run behind the customers' own firewall

Fully enforced compliance with regulatory standards. Private cloud customers aren't forced to rely on the industry and regulatory compliance offered by the cloud service provider



| Public Cloud | Private Cloud |
|---|---|
| Cloud Computing infrastructure is shared with the public by service providers over the internet. It supports multiple customers i.e, enterprises. | Cloud Computing infrastructure is shared with private organizations by service providers over the internet. It supports one enterprise. |
| Multi-Tenancy i.e, Data of many enterprises are stored in a shared environment but are isolated. Data is shared as per rule, permission, and security. | Single Tenancy i.e, Data of a single enterprise is stored. |
| Cloud service provider provides all the possible services and hardware as the user-base is the world. Different people and organizations may need different services and hardware. Services provided must be versatile. | Specific services and hardware as per the need of the enterprise are available in a private cloud. |

| Public Cloud | Private Cloud |
|--|--|
| It is hosted at the Service Provider site. | It is hosted at the Service Provider site or enterprise. |
| It is connected to the public internet. | It only supports connectivity over the private network. |
| Scalability is very high, and reliability is moderate. | Scalability is limited, and reliability is very high. |
| Cloud service provider manages the cloud and customers use them. | Managed and used by a single enterprise. |
| It is cheaper than the private cloud. | It is costlier than the public cloud. |
| Security matters and dependent on the service provider. | It gives a high class of security. |

| Public Cloud | Private Cloud |
|---|---|
| Performance is low to medium. | Performance is high. |
| It has shared servers. | It has dedicated servers. |
| Example: Amazon web service (AWS) and Google AppEngine etc. | Example: Microsoft KVM, HP, Red Hat & VMWare etc. |

Hybrid cloud

A hybrid cloud is a mixed computing environment where applications are run using a combination of computing, storage, and services in different environments—public clouds and private clouds, including on-premises data centers or “edge” locations

Hybrid cloud solutions enable you to migrate and manage workloads between these various cloud environments, allowing you to create more versatile setups based on your specific business needs.

Many organizations choose to adopt hybrid cloud platforms to reduce costs, minimize risk, and extend their existing capabilities to support digital transformation efforts.

What is a hybrid cloud approach used for?

Modernize at your own pace. With a hybrid cloud you can migrate applications to the cloud at the pace that makes sense for your business and transform your technical infrastructure over time.

Maintain regulatory compliance. Many industries have rules surrounding where your app can operate. Hybrid can help you use private and public clouds while adhering to any regulatory requirements.

Running apps on-premises. You may have regulated applications that need to remain on-premises or mainframe systems that are difficult to move to the cloud.

Running apps at remote edge locations. If you are operating in industries that demand edge hybrid computing for low latency, such as kiosks in retail or networks in telecom, a hybrid approach lets you run select apps at the edge.

How does a hybrid cloud work?

Hybrid clouds work by combining the resources and services from two or more separate computing environments.

Hybrid cloud architectures require integration, orchestration, and coordination so you can share, shift, and synchronize information quickly.

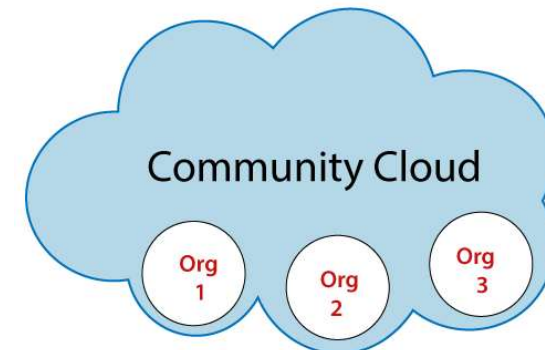
Strong hybrid cloud networking is critical for a hybrid cloud deployment to function correctly.

Interconnectivity between environments is typically established using a local area network (LAN), wide area network (WAN), virtual private network (VPN), and application programming interfaces (APIs).

Community cloud

Community cloud is a cloud infrastructure that allows systems and services to be accessible by a group of several organizations to share the information.

It is owned, managed, and operated by one or more organizations in the community, a third party, or a combination of them.



Advantages of Community Cloud

Cost effective

Community cloud is cost effective because the whole cloud is shared between several organizations or a community.

Flexible and Scalable

The community cloud is flexible and scalable because it is compatible with every user. It allows the users to modify the documents as per their needs and requirement.

Security

Community cloud is more secure than the public cloud but less secure than the private cloud.

Sharing infrastructure

Community cloud allows us to share cloud resources, infrastructure, and other capabilities among various organizations.

Disadvantages of Community Cloud

- Community cloud is not a good choice for every organization.
- Slow adoption to data
- The fixed amount of data storage and bandwidth is shared among all community members.
- Community Cloud is costly than the public cloud.
- Sharing responsibilities among organizations is difficult.

