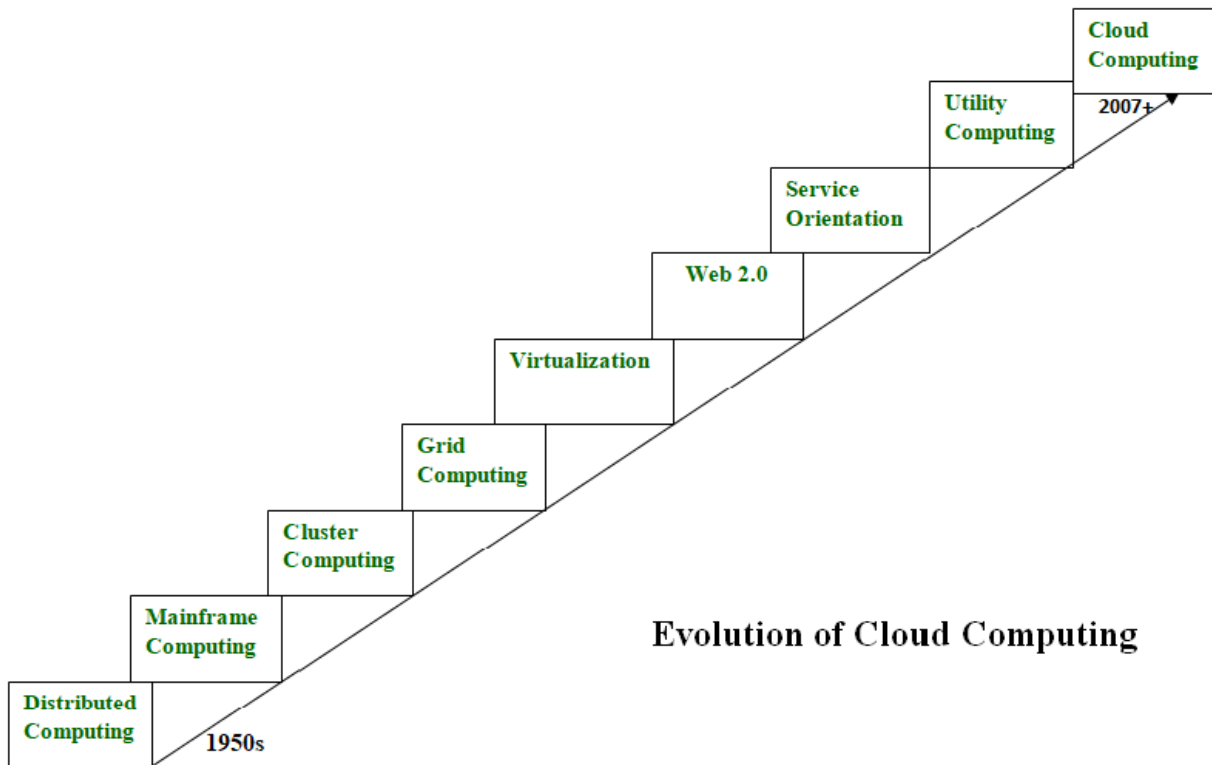


Unit 1: Introduction to Cloud Computing

Cloud computing consists of three distinct types of computing services delivered remotely to clients via the internet. Clients typically pay a monthly or annual service fee to providers, to gain access to systems that deliver software as a service, platforms as a service and infrastructure as a service to subscribers. Clients who subscribe to cloud computing services can reap a variety of benefits, depending on their particular business needs at a given point in time. The days of large capital investments in software and IT infrastructure are now a thing of the past for any enterprise that chooses to adopt the cloud computing model for procurement of IT services. The ability to access powerful IT resources on an incremental basis is leveling the playing field for small and medium sized organizations, providing them with the necessary tools and technology to compete in the global marketplace, without the previously requisite investment in on premise IT resources. Clients who subscribe to computing services delivered via the “cloud” • are able to greatly reduce the IT service expenditures for their organizations; and gain access to more agile and flexible enterprise level computing services, in the process.

Evolution of Cloud Computing

Cloud computing is all about renting computing services. This idea first came in the 1950s. In making cloud computing what it is today, five technologies played a vital role. These are distributed systems and its peripherals, virtualization, web 2.0, service orientation, and utility computing.



Distributed Systems:

It is a composition of multiple independent systems but all of them are depicted as a single entity to the users. The purpose of distributed systems is to share resources and also use them effectively and efficiently. Distributed systems possess characteristics such as scalability, concurrency, continuous availability, heterogeneity, and independence in failures. But the main problem with this system was that all the systems were required to be present at the same geographical location. Thus to solve this problem, distributed computing led to three more types of computing and they were-Mainframe computing, cluster computing, and grid computing.

Mainframe computing:

Mainframes which first came into existence in 1951 are highly powerful and reliable computing machines. These are responsible for handling large data such as massive input-output operations. Even today these are used for bulk processing tasks such as online transactions etc. These systems have almost no downtime with high fault tolerance. After

distributed computing, these increased the processing capabilities of the system. But these were very expensive. To reduce this cost, cluster computing came as an alternative to mainframe technology.

Cluster computing:

In 1980s, cluster computing came as an alternative to mainframe computing. Each machine in the cluster was connected to each other by a network with high bandwidth. These were way cheaper than those mainframe systems. These were equally capable of high computations. Also, new nodes could easily be added to the cluster if it was required. Thus, the problem of the cost was solved to some extent but the problem related to geographical restrictions still pertained. To solve this, the concept of grid computing was introduced.

Grid computing:

In 1990s, the concept of grid computing was introduced. It means that different systems were placed at entirely different geographical locations and these all were connected via the internet. These systems belonged to different organizations and thus the grid consisted of heterogeneous nodes. Although it solved some problems but new problems emerged as the distance between the nodes increased. The main problem which was encountered was the low availability of high bandwidth connectivity and with it other network associated issues. Thus, cloud computing is often referred to as “Successor of grid computing”.

Virtualization:

It was introduced nearly 40 years back. It refers to the process of creating a virtual layer over the hardware which allows the user to run multiple instances simultaneously on the hardware. It is a key technology used in cloud computing. It is the base on which major cloud computing services such as Amazon EC2, VMware vCloud, etc work on. Hardware virtualization is still one of the most common types of virtualization.

Web 2.0:

It is the interface through which the cloud computing services interact with the clients. It is because of Web 2.0 that we have interactive and dynamic web pages. It also increases flexibility among web pages. Popular examples of web 2.0 include Google Maps, Facebook, Twitter, etc. Needless to say, social media is possible because of this technology only. It gained major popularity in 2004.

Service orientation:

It acts as a reference model for cloud computing. It supports low-cost, flexible, and evolvable applications. Two important concepts were introduced in this computing model. These were Quality of Service (QoS) which also includes the SLA (Service Level Agreement) and Software as a Service (SaaS).

Utility computing:

It is a computing model that defines service provisioning techniques for services such as compute services along with other major services such as storage, infrastructure, etc which are provisioned on a pay-per-use basis.

Characteristics of Cloud Computing

There are basically 5 essential 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.

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.

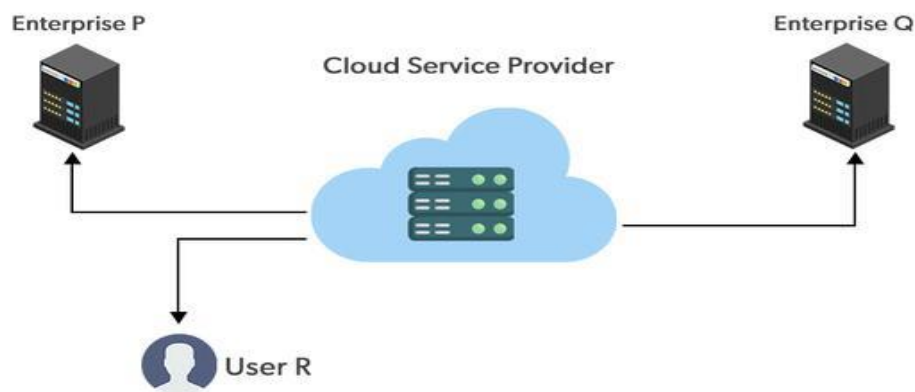
Types of cloud

Cloud computing is Internet-based computing in which a shared pool of resources is available over broad network access, these resources can be provisioned or released with minimum management efforts and service provider interaction.

1. Public cloud
2. Private cloud
3. Hybrid cloud
4. Community cloud

Public Cloud

Public clouds are managed by third parties which provide cloud services over the internet to the public; these services are available as pay-as-you-go billing models. They offer solutions for minimizing IT infrastructure costs and become a good option for handling peak loads on the local infrastructure. Public clouds are the go-to option for small enterprises, which are able to start their businesses without large upfront investments by completely relying on public infrastructure for their IT needs. The fundamental characteristics of public clouds are **multitenancy**. A public cloud is meant to serve multiple users, not a single customer. A user requires a virtual computing environment that is separated, and most likely isolated, from other users.

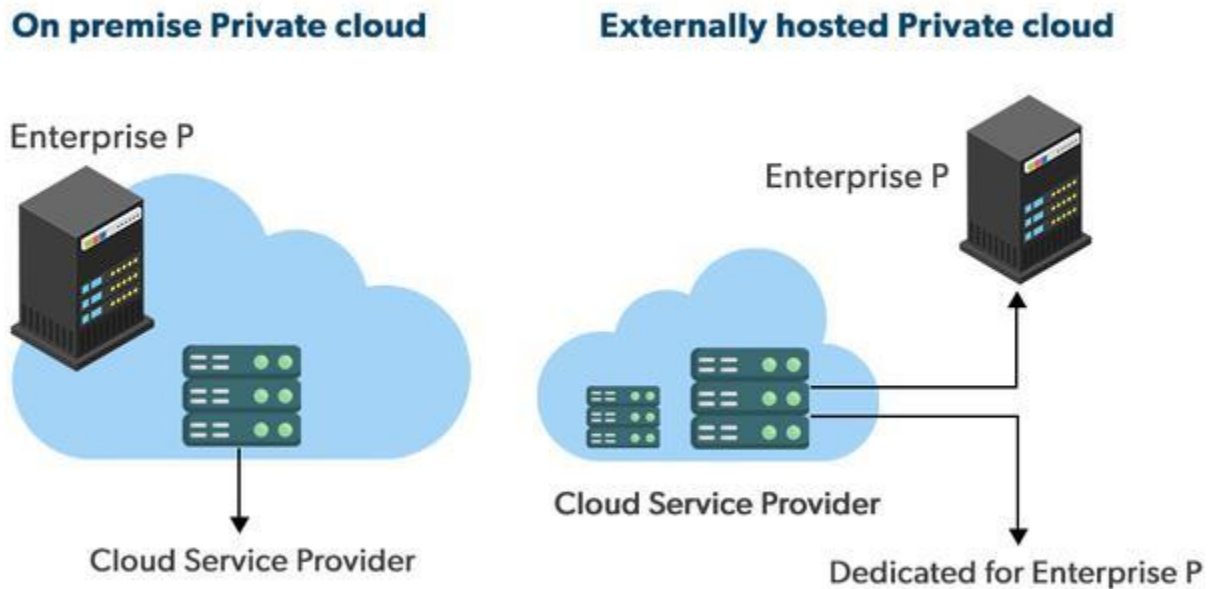


Public cloud

Private cloud

Private clouds are distributed systems that work on private infrastructure and provide the users with dynamic provisioning of computing resources. Instead of a pay-as-you-go model in private clouds, there could be other schemes that manage the usage of the cloud and proportionally billing of the different departments or sections of an

enterprise.



Private Cloud

Advantages of using a private cloud are:

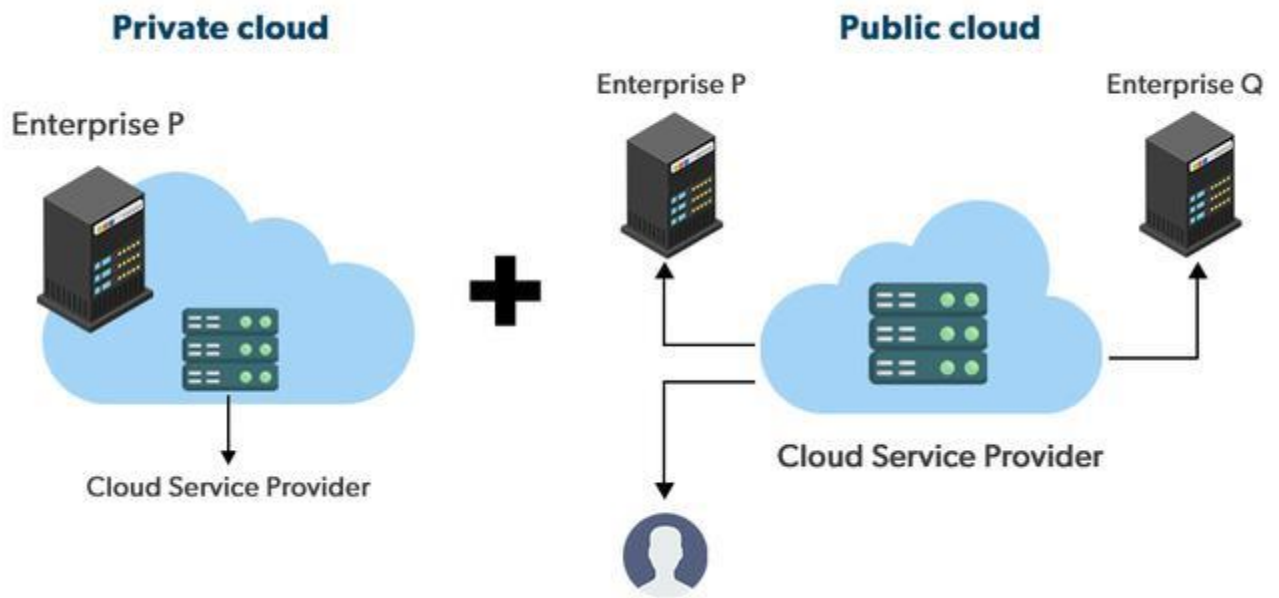
Customer information protection: In the private cloud security concerns are less since customer data and other sensitive information do not flow out of private infrastructure.

Infrastructure ensuring SLAs: Private cloud provides specific operations such as appropriate clustering, data replication, system monitoring, and maintenance, and disaster recovery, and other uptime services.

Compliance with standard procedures and operations: Specific procedures have to be put in place when deploying and executing applications according to third-party compliance standards. This is not possible in the case of the public cloud.

Hybrid cloud:

A hybrid cloud is a heterogeneous distributed system formed by combining facilities of public cloud and private cloud. For this reason, they are also called **heterogeneous clouds**. A major drawback of private deployments is the inability to scale on-demand and efficiently address peak loads. Here public clouds are needed. Hence, a hybrid cloud takes advantage of both public and private clouds.

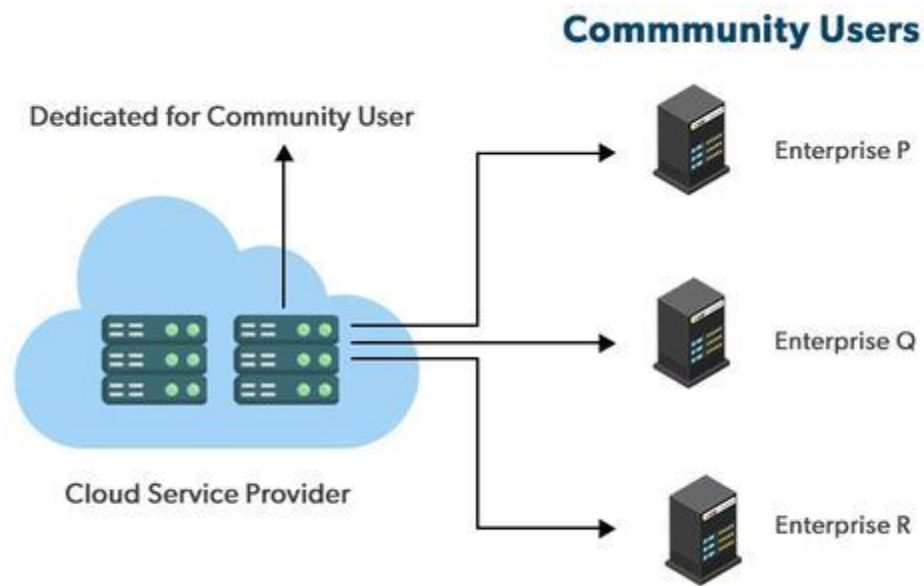


Hybrid Cloud

Community cloud:

Community clouds are distributed systems created by integrating the services of different clouds to address the specific needs of an industry, a community, or a business sector.

In the community cloud, the infrastructure is shared between organizations that have shared concerns or tasks. The cloud may be managed by an organization or a third party.



Community Cloud

Sectors that use community clouds are:

Media industry: Media companies are looking for quick, simple, low-cost ways for increasing the efficiency of content generation. Most media productions involve an extended ecosystem of partners. In particular, the creation of digital content is the outcome of a collaborative process that includes the movement of large data, massive compute-intensive rendering tasks, and complex workflow executions.

Healthcare industry: In the healthcare industry community clouds are used to share information and knowledge on the global level with sensitive data in the private infrastructure.

Energy and core industry: In these sectors, the community cloud is used to cluster a set of solution which collectively addresses management, deployment, and orchestration of services and operations.

Scientific research: In this organization with common interests in science share a large distributed infrastructure for scientific computing.

Cloud services

Cloud Computing can be defined as the practice of using a network of remote servers hosted on the Internet to store, manage, and process data, rather than a local server or a personal computer. Companies offering such kinds of cloud computing services are called *cloud providers* and typically charge for cloud computing services based on usage. Grid and cluster are the foundations for cloud computing.

Software as a service (SaaS)

Platform as a service (PaaS)

Infrastructure as a service (IaaS)

Anything as a service (XaaS)

These are sometimes called the **cloud computing stack** because they are built on top of one another. Knowing what they are and how they are different, makes it easier to accomplish our goals. These abstraction layers can also be viewed as a **layered architecture** where services of a higher layer can be composed from services of the underlying layer i.e, SaaS can provide Infrastructure.

Software as a Service (SaaS)

Software-as-a-Service (SaaS) is a way of delivering services and applications over the Internet. Instead of installing and maintaining software, we simply access it via the Internet, freeing ourselves from the complex software and hardware management. It removes the need to install and run applications on our own computers or in the data centers eliminating the expenses of hardware as well as software maintenance.

SaaS provides a complete software solution that you purchase on a **pay-as-you-go** basis from a cloud service provider. Most SaaS applications can be run directly from a web browser without any downloads or installations required. The SaaS applications are sometimes called **Web-based software, on-demand software, or hosted software**.

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.s

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

The various companies providing *Software as a service* are Cloud9 Analytics, Salesforce.com, Cloud Switch, Microsoft Office 365, Big Commerce, Eloqua, dropBox, and Cloud Tran.

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. Thus, the development and deployment of the application take place **independent of the hardware**.

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. To make it simple, take the example of an annual day function, you will have two options either to create a venue or to rent a venue but the function is same.

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.

The various companies providing *Platform as a service* are Amazon Web services Elastic Beanstalk, Salesforce, Windows Azure, Google App Engine, cloud Bess and IBM smart cloud.

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 an outsource to enterprises such as networking equipment, devices, database, and web servers.

It is also known as **Hardware as a Service (HaaS)**. IaaS customers pay on a per-user basis, typically by the hour, week, or month. Some providers also charge customers based on the amount of virtual machine space they use.

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

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.

The various companies providing *Infrastructure as a service* are Amazon web services, Bluestack, IBM, Openstack, Rackspace, and Vmware.

Anything as a Service

Most of the cloud service providers nowadays offer anything as a service that is a compilation of all of the above services including some additional services.

Advantages of XaaS: As this is a combined service, so it has all the advantages of every type of cloud service.

Benefits

Cloud computing offers your business many benefits. It allows you to set up what is essentially a virtual office to give you the flexibility of connecting to your business anywhere, any time. With the growing number of web-enabled devices used in today's business environment (e.g. smartphones, tablets), access to your data is even easier.

There are many benefits to moving your business to the cloud:

Reduced IT costs

Moving to cloud computing may reduce the cost of managing and maintaining your IT systems. Rather than purchasing expensive systems and equipment for your business, you can reduce your

costs by using the resources of your cloud computing service provider. You may be able to reduce your operating costs because:

- the cost of system upgrades, new hardware and software may be included in your contract
- you no longer need to pay wages for expert staff
- your energy consumption costs may be reduced
- There are fewer time delays.

Scalability

Your business can scale up or scale down your operation and storage needs quickly to suit your situation, allowing flexibility as your needs change. Rather than purchasing and installing expensive upgrades yourself, your cloud computer service provider can handle this for you. Using the cloud frees up your time so you can get on with running your business.

Business continuity

Protecting your data and systems is an important part of business continuity planning. Whether you experience a natural disaster, power failure or other crisis, having your data stored in the cloud ensures it is backed up and protected in a secure and safe location. Being able to access your data again quickly allows you to conduct business as usual, minimizing any downtime and loss of productivity.

Collaboration efficiency

Collaboration in a cloud environment gives your business the ability to communicate and share more easily outside of the traditional methods. If you are working on a project across different locations, you could use cloud computing to give employees, contractors and third parties access to the same files. You could also choose a cloud computing model that makes it easy for you to share your records with your advisers (e.g. a quick and secure way to share accounting records with your accountant or financial adviser).

Flexibility of work practices

Cloud computing allows employees to be more flexible in their work practices. For example, you have the ability to access data from home, on holiday, or via the commute to and from work (providing you have an internet connection). If you need access to your data while you are off-site, you can connect to your virtual office, quickly and easily.

Access to automatic updates

Access to automatic updates for your IT requirements may be included in your service fee. Depending on your cloud computing service provider, your system will regularly be updated with the latest technology. This could include up-to-date versions of software, as well as upgrades to servers and computer processing power.

Challenges of cloud computing

Cloud computing is the provisioning of resources like data and storage on demand, that is in real-time. It has been proven to be revolutionary in the IT industry with the market valuation growing at a rapid rate. Cloud development has proved to be beneficial not only for huge public and private enterprises but small-scale businesses as well as it helps to cut costs. It is estimated that more than 94% of businesses will increase their spending on the cloud by more than 45%. This also has resulted in more and high-paying jobs if you are a cloud developer.

Cloud technology was flourishing before the pandemic, but there has been a sudden spike in cloud deployment and usage during the lockdown. The tremendous growth can be linked to the fact that classes have been shifted online, virtual office meetings are happening on video calling platforms, conferences are taking place virtually as well as on-demand streaming apps have a huge audience. All this is made possible by us of **cloud computing** only. We are safe to conclude that the cloud is an important part of our life today, even if we are an enterprise, student, developer, or anyone else and are heavily dependent on it. But with this dependence, it is also important for us to look at the issues and challenges that arise with cloud computing. Therefore, today we bring you the most common challenges that are faced when dealing with cloud computing, let's have a look at them one by one:

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.

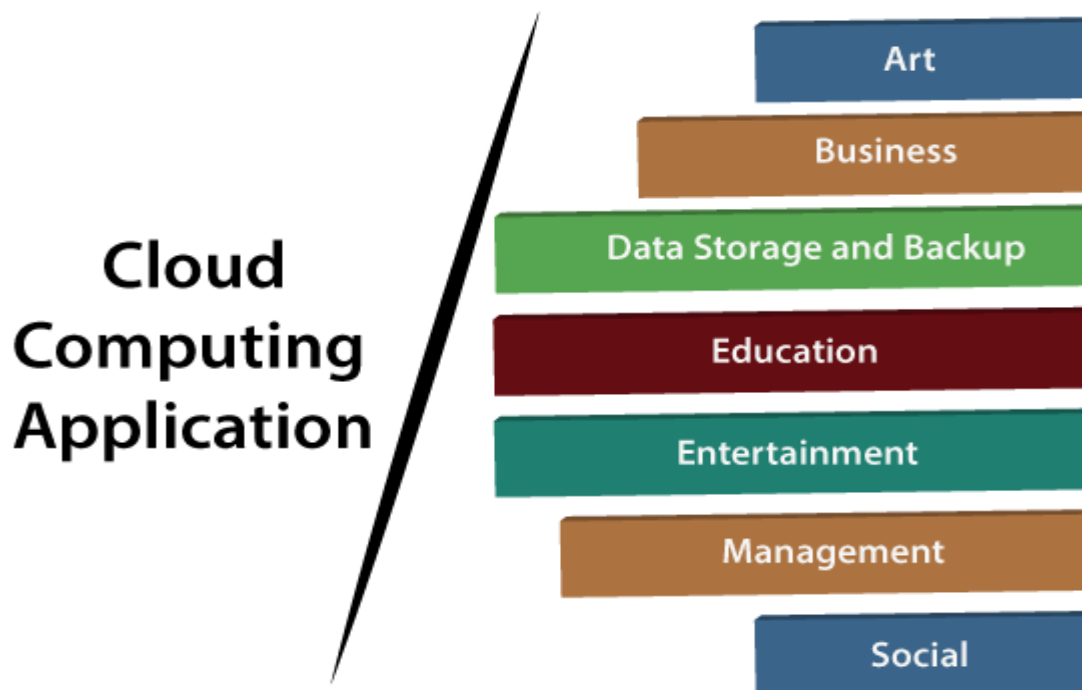
Lack of Knowledge and Expertise

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.

Applications cloud computing

Cloud service providers provide various applications in the field of art, business, data storage and backup services, education, entertainment, management, social networking, etc.

The most widely used cloud computing applications are given below –



Art Applications

Cloud computing offers various art applications for quickly and easily design **attractive cards, booklets, and images**. Some most commonly used cloud art applications are given below:

Moo Moo is one of the best cloud art applications. It is used for designing and printing business cards, postcards, and mini cards.

Vistaprint Vistaprint allows us to easily design various printed marketing products such as business cards, Postcards, Booklets, and wedding invitations cards.

Adobe Creative Cloud Adobe creative cloud is made for designers, artists, filmmakers, and other creative professionals. It is a suite of apps which includes PhotoShop image editing programming, Illustrator, InDesign, TypeKit, Dreamweaver, XD, and Audition.

Business Applications

Business applications are based on cloud service providers. Today, every organization requires the cloud business application to grow their business. It also ensures that business applications are 24*7 available to users.

There are the following business applications of cloud computing -

MailChimp MailChimp is an **email publishing platform** which provides various options to **design, send, and save** templates for emails.

Salesforce Salesforce platform provides tools for sales, service, marketing, e-commerce, and more. It also provides a cloud development platform.

Chatter Chatter helps us to **share important information** about the organization in real time.

Bitrix24 Bitrix24 is a **collaboration** platform which provides communication, management, and social collaboration tools.

Paypal Paypal offers the simplest and easiest **online payment** mode using a secure internet account. Paypal accepts the payment through debit cards, credit cards, and also from Paypal account holders.

Slack Slack stands for **Searchable Log of all Conversation and Knowledge**. It provides a **user-friendly** interface that helps us to create public and private channels for communication.

Quickbooks Quickbooks works on the terminology "**Run Enterprise anytime, anywhere, on any device.**" It provides online accounting solutions for the business. It allows more than 20 users to work simultaneously on the same system.

Data Storage and Backup Applications

Cloud computing allows us to store information (data, files, images, audios, and videos) on the cloud and access this information using an internet connection. As the cloud provider is responsible for providing security, so they offer various backup recovery application for retrieving the lost data.

A list of data storage and backup applications in the cloud are given below -

Box.com Box provides an online environment for **secure content management, workflow, and collaboration**. It allows us to store different files such as Excel, Word, PDF, and images on the cloud. The main advantage of using box is that it provides drag & drop service for files and easily integrates with Office 365, G Suite, Salesforce, and more than 1400 tools.

Mozy Mozy provides powerful **online backup solutions** for our personal and business data. It schedules automatically back up for each day at a specific time.

Joukuu Joukuu provides the simplest way to **share and track cloud-based backup files**. Many users use joukuu to search files, folders, and collaborate on documents.

Google G Suite Google G Suite is one of the best **cloud storage and backup** application. It includes Google Calendar, Docs, Forms, Google+, Hangouts, as well as cloud storage and tools for managing cloud apps. The most popular app in the Google G Suite is Gmail. Gmail offers free email services to users.

Education Applications

Cloud computing in the education sector becomes very popular. It offers various **online distance learning platforms** and **student information portals** to the students. The advantage of using cloud in the field of education is that it offers strong virtual classroom environments, Ease of accessibility, secure data storage, scalability, greater reach for the students, and minimal hardware requirements for the applications.

There are the following education applications offered by the cloud -

Google Apps for Education Google Apps for Education is the most widely used platform for free web-based email, calendar, documents, and collaborative study.

Chromebooks for Education Chromebook for Education is one of the most important Google's projects. It is designed for the purpose that it enhances education innovation.

Tablets with Google Play for Education It allows educators to quickly implement the latest technology solutions into the classroom and make it available to their students.

AWS in Education AWS cloud provides an education-friendly environment to universities, community colleges, and schools.

Entertainment Applications

Entertainment industries use a **multi-cloud strategy** to interact with the target audience. Cloud computing offers various entertainment applications such as online games and video conferencing.

Online games

Today, cloud gaming becomes one of the most important entertainment media. It offers various online games that run remotely from the cloud. The best cloud gaming services are Shaow, GeForce Now, Vortex, Project xCloud, and PlayStation Now.

Video Conferencing Apps

Video conferencing apps provides a simple and instant connected experience. It allows us to communicate with our business partners, friends, and relatives using a cloud-based video conferencing. The benefits of using video conferencing are that it reduces cost, increases efficiency, and removes interoperability.

Management Applications

Cloud computing offers various cloud management tools which help admins to manage all types of cloud activities, such as resource deployment, data integration, and disaster recovery. These management tools also provide administrative control over the platforms, applications, and infrastructure.

Some important management applications are -

Toggl

Toggl helps users to track allocated time period for a particular project.

Evernote

Evernote allows you to sync and save your recorded notes, typed notes, and other notes in one convenient place. It is available for both free as well as a paid version.

It uses platforms like Windows, macOS, Android, iOS, Browser, and Unix.

Outright

Outright is used by management users for the purpose of accounts. It helps to track income, expenses, profits, and losses in real-time environment.

GoToMeeting

GoToMeeting provides **Video Conferencing** and **online meeting apps**, which allows you to start a meeting with your business partners from anytime, anywhere using mobile phones or tablets. Using GoToMeeting app, you can perform the tasks related to the management such as join meetings in seconds, view presentations on the shared screen, get alerts for upcoming meetings, etc.

Social Applications

Social cloud applications allow a large number of users to connect with each other using social networking applications such as **Facebook, Twitter, LinkedIn**, etc.

There are the following cloud based social applications -

Facebook

Facebook is a **social networking website** which allows active users to share files, photos, videos, status, more to their friends, relatives, and business partners using the cloud storage system. On Facebook, we will always get notifications when our friends like and comment on the posts.

Twitter

Twitter is a **social networking** site. It is a **micro blogging** system. It allows users to follow high profile celebrities, friends, relatives, and receive news. It sends and receives short posts called tweets.

Yammer

Yammer is the **best team collaboration** tool that allows a team of employees to chat, share images, documents, and videos.

LinkedIn

LinkedIn is a **social network** for students, freshers, and professionals.

Cloud Storage

Cloud storage is a cloud computing model that stores data on the Internet through a cloud computing provider who manages and operates data storage as a service. It's delivered on demand with just-in-time capacity and costs, and eliminates buying and managing your own data

storage infrastructure. This gives you agility, global scale and durability, with “anytime, anywhere” data access.

Cloud storage is purchased from a third party cloud vendor who owns and operates data storage capacity and delivers it over the Internet in a pay-as-you-go model. These cloud storage vendors manage capacity, security and durability to make data accessible to your applications all around the world. Applications access cloud storage through traditional storage protocols or directly via an API. Many vendors offer complementary services designed to help collect, manage, secure and analyze data at massive scale.

Benefits of Cloud Storage

Storing data in the cloud lets IT departments transform three areas:

Total Cost of Ownership. With cloud storage, there is no hardware to purchase, storage to provision, or capital being used for "someday" scenarios. You can add or remove capacity on demand, quickly change performance and retention characteristics, and only pay for storage that you actually use. Less frequently accessed data can even be automatically moved to lower cost tiers in accordance with auditable rules, driving economies of scale.

Time to Deployment. When development teams are ready to execute, infrastructure should never slow them down. Cloud storage allows IT to quickly deliver the exact amount of storage needed, right when it's needed. This allows IT to focus on solving complex application problems instead of having to manage storage systems.

Information Management. Centralizing storage in the cloud creates a tremendous leverage point for new use cases. By using cloud storage lifecycle management policies, you can perform powerful information management tasks including automated tiering or locking down data in support of compliance requirements.

Types of Cloud Storage

There are three types of cloud data storage: object storage, file storage, and block storage. Each offers their own advantages and have their own use cases:

Objects Storage - Applications developed in the cloud often take advantage of object storage's vast scalability and metadata characteristics. Object storage solutions like Amazon

Simple Storage Service (S3) are ideal for building modern applications from scratch that require scale and flexibility, and can also be used to import existing data stores for analytics, backup, or archive.

File Storage - Some applications need to access shared files and require a file system. This type of storage is often supported with a Network Attached Storage (NAS) server. File storage solutions like Amazon Elastic File System (EFS) are ideal for use cases like large content repositories, development environments, media stores, or user home directories.

Block Storage - Other enterprise applications like databases or ERP systems often require dedicated, low latency storage for each host. This is analogous to direct-attached storage (DAS) or a Storage Area Network (SAN). Block-based cloud storage solutions like Amazon Elastic Block Store (EBS) are provisioned with each virtual server and offer the ultra low latency required for high performance workloads.

Cloud services requirements

1. Efficiency / cost reduction
2. Data security
3. Scalability
4. Mobility
5. Disaster recovery
6. Control
7. Market reach
8. Automatic Software Updates

Efficiency / cost reduction

By using cloud infrastructure, you don't have to spend huge amounts of money on purchasing and maintaining equipment.

Data security

Cloud offers many advanced security features that guarantee that data is securely stored and handled. Cloud storage providers implement baseline protections for their platforms and the data they process, such authentication, access control, and encryption.

Scalability

Different companies have different IT needs — a large enterprise of 1000+ employees won't have the same IT requirements as a start-up. Using cloud is a great solution because it enables enterprise to efficiently — and quickly — scale up/down according to business demands.

Mobility

Cloud computing allows mobile access to corporate data via smartphones and devices, which is a great way to ensure that no one is ever left out of the loop. Staff with busy schedules, or who live a long way away from the corporate office, can use this feature to keep instantly up-to-date with clients and coworkers.

Disaster recovery

Data loss is a major concern for all organizations, along with data security. Storing your data in the cloud guarantees that data is always available, even if your equipment like laptops or PCs, is damaged. Cloud-based services provide quick data recovery for all kinds of emergency scenarios.

Control

Cloud enables you complete visibility and control over your data. You can easily decide which users have what level of access to what data.

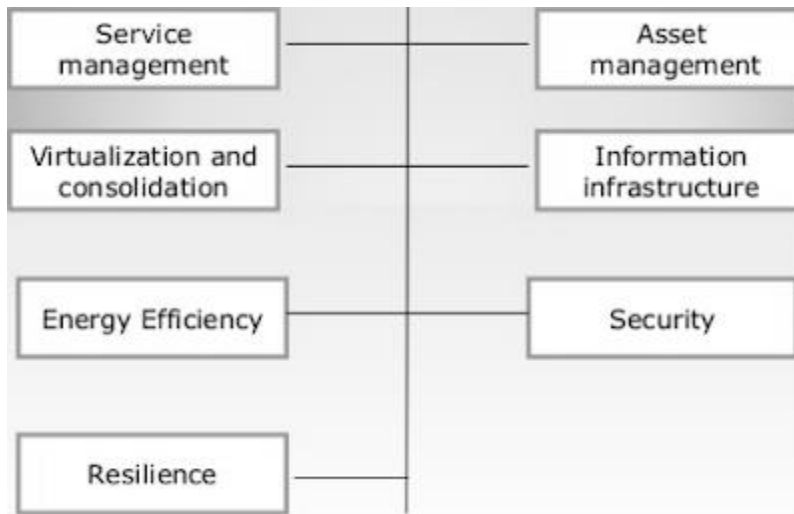
Market reach

Developing in the cloud enables users to get their applications to market quickly.

Automatic Software Updates

Cloud-based applications automatically refresh and update themselves.

Cloud and dynamic infrastructure



Cloud and Dynamic infrastructure

Service management

This type of special facility or functionality is provided to the cloud IT services by the cloud service providers. This facility includes visibility, automation and control to delivering the first class IT services.

Asset-Management

In this the assets or the property which is involved in providing the cloud services are getting managed.

Virtualization and consolidation

Consolidation is an effort to reduce the cost of a technology by improving its operating efficiency and effectiveness. It means migrating from large number of resources to fewer one, which is done by virtualization technology.

Information Infrastructure

It helps the business organizations to achieve the following : Information compliance, availability of resources retention and security objectives.

Energy-Efficiency

Here the IT infrastructure or organization sustainable. It means it is not likely to damage or effect any other thing.

Security

This cloud infrastructure is responsible for the risk management. Risk management Refers to the risks involved in the services which are being provided by the cloud-service providers.

Resilience

This infrastructure provides the feature of resilience means the services are resilient. It means the infrastructure is safe from all sides. The IT operations will not be easily get affected.

Cloud adoption

Cloud Adoption is a strategic move by organizations of reducing cost, mitigating risk and achieving scalability of data base capabilities. Cloud adoption may be up to various degrees in an organization, depending on the depth of adoption. In fact the depth of adoption yields insight into the maturity of best practices, enterprise-ready cloud services availability.

Organizations that go ahead with the strategic decision of adopting cloud based technologies have to identify potential security thefts and controls, required to keep the data and applications in the cloud secured. Hence there is a need for compliance assessment during cloud adoption. The following measures are taken for compliance assessment to ensure security and accountability of data and applications in the cloud services:

- Matching the security requirements of the organization with the security capabilities of the cloud service provider
- Analyzing the security policies of the cloud service provider along with history of transparency and security related practices
- Proper understanding of the technical aspects of data and traffic flow
- Proper understanding and documentation of the roles and responsibilities of the cloud service provider

- Understanding of the certifications and compliances that can be leveraged from the cloud service provider