

**Cloud computing** is the **on-demand availability** of computer system resources, especially data storage (cloud storage) and computing power, without direct active management by the user. Large clouds often have functions distributed over multiple locations, each of which is a data center. Cloud computing relies on sharing of resources to achieve coherence and typically uses a "pay as you go" model, which can help in reducing capital expenses but may also lead to unexpected operating expenses for users.

1. on-demand availability of computer resource
2. over the internet
3. pay as you go pricing

#### Features of Cloud computing

##### 1. Cost Savings

Cloud computing reduces both hardware and software maintenance costs for organizations

##### 2. Security

Cloud offers many advanced features related to security and ensures that data is securely stored and handled.

##### 3. Disaster Recovery

Many copies of data is stored in different places so if due to any reasons data is lost in one data center we can recover the data from other data centers

##### 4. Speed

With availability of high speed computing resources speed of overall work is increased

##### 5. Global

Data is stored globally. We are able to access any data stored in any part of world from anywhere in the world

##### 6. Productivity

Productivity in work is increased as speed is increased

## ***What computing paradigms are there?***

### 1. Distributed Computing

Distributed computing is the method of making multiple computers work together to solve a common problem. It makes a computer network appear as a powerful single computer that provides large-scale resources to deal with complex challenges.

## 2. Parallel Computing

Parallel computing is a type of computing in which one computer or multiple computers in a network carry out many calculations or processes simultaneously

## 3. Cloud Computing

# ***Types of cloud computing/Cloud Deployment Model***

### **1. Public cloud**

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.

### **2. Private cloud**

The private cloud provides computing services to a private internal network (within the organization) and selected users instead of the general public.

### **3. Hybrid cloud**

A Hybrid cloud is an IT infrastructure that connects at least one public cloud and at least one private cloud

# **Components**

## 1. Client Infrastructure - User interface for interaction

Client Infrastructure contains the applications and user interfaces which are required to access the cloud platform. It provides a GUI( Graphical User Interface ) to interact with the cloud.

## 2. Application/Service - Process user wants to access

Application refers to a software or platform to which client accesses. Means it provides the service in backend as per the client requirement.

Service refers to the major three types of cloud based services like [SaaS, PaaS and IaaS](#). Also manages which type of service the user accesses

## 3. Management/Security - Infrastructure to use the services.

refers to management of backend components like application, service, runtime cloud, storage, infrastructure, and other security mechanisms etc.

Security in backend refers to implementation of different security mechanisms in the backend for secure cloud resources, systems, files, and infrastructure to end-users.

## 4. Internet - Layer between client and Services

# SaaS

Software as a service (or SaaS) is a way of delivering applications over the Internet—as a service. Instead of installing and maintaining software, you simply access it via the Internet, freeing yourself from complex software and hardware management.

1. Gmail
2. Github

## Pro

### Cost

You save the cost of maintaining and installing software as here we are only using the software

### Maintenance

The complexity of maintaining the software and hardware management is reduced

### Mobility

We can access the software from anywhere over the internet

## Cons

### 1. Security

As when we store our data in a software which is third party there is a risk that our personal information can be misused. So security is kind of disadvantage of SaaS

### 2. Contractual

We have to use the software with the limited services provided by them. We cannot modify it as per our needs.

### 3. Loss of control

There is no control of end user over the software

Examples—Tableau Skype

## PaaS

### Platform as a service

Platform as a Service (PaaS) provides the developers with a complete development and deployment environment in the cloud.

Example - Databases, Beanstalk

## Pros

Simplified Development

Prebuilt functionality

Scalability

the ability to increase or decrease IT resources as needed to meet changing demand.

## Cons

Vendor lock-in

If you have built a application on a particular platform, then it will be difficult or expensive to switch it to a different platform

Data Privacy

Since data is stored on server which is provided by the platform it is at a risk of data breaching

Integration

IaaS

known as Infrastructure as a Service. IaaS provides servers, hard drives, networking, and storage.

Example - EC2

# Introduction to virtualization

Virtualization uses software to create an abstraction layer over computer hardware that allows the hardware elements of a single computer—processors, memory, storage and more—to be divided into multiple virtual computers, commonly called virtual machines (VMs). Each VM runs its own operating system (OS) and behaves like an independent computer, even though it is running on just a portion of the actual underlying computer hardware. This enables cloud users to purchase only the computing resources they need when they need it, and to scale those resources cost-effectively as their workloads grow.

A hypervisor is software that creates and runs virtual machines (VMs). A hypervisor, sometimes called a virtual machine monitor (VMM).

A hypervisor allows one host computer to support multiple guest VMs by virtually sharing its resources, such as memory and processing.

## Type of Hypervisor

### Type 1 hypervisor

The hypervisor which directly runs on the host's hardware to control the hardware and manage the guest operating system

Also called as naive or bare metal hypervisor

Runs directly on host hardware

### Example

Vmware ESXi,...

### Type 2 Hypervisor

The hypervisor which runs on host operating system just like other computer program does is called type 2 hypervisor

Also called as Host OS hypervisor

Runs on host operating system

### Example

Vmware player, virtual box, Parallel desktop

## Uses of Virtualization

Faster provisioning - On click

Minimal downtime - Maintained by provider

Resource efficiency - Pay for what you use

## Virtual Machine Provisioning

The process of creating a new VM is known as VM Provisioning.

## Virtual Machine Migration Services

The movement of VMs from one resource to another, such as from one physical host to another physical host, or data store to data store, is known as VM migration. There are two types of VM migration: cold and live.

Cold migration occurs when the VM is shutdown.

Live migration occurs while the VM is actually running.

## Challenges of cloud computing

### Security and privacy

Managing cloud spend

Lack of resources expertise

Governance/ control

Compliance

Managing multiple cloud

Availability reliability

Interoperability– It means the application on one platform should be able to incorporate services from the other platforms.

Service quality–

Portability– This is another challenge to cloud computing that applications should easily be migrated from one cloud provider to another. There must not be vendor lock-in. However, it is not yet made possible because each of the cloud provider uses different standard languages for their platforms.

Building a private cloud computing performance

