INTRODUCTION TO CLOUD COMPUTING
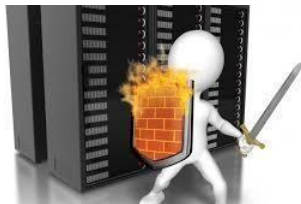
Why Cloud?

Before Cloud Computing

Buy Stack of Servers

Peak Traffic? More Servers

Maintenance of Servers

Security of Servers

Disadvantages

Expensive Setup

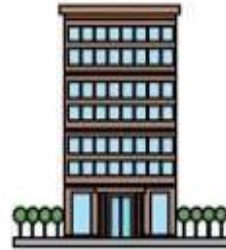Troubleshooting Problems

Servers will be Idle

Server Security

Why Cloud Computing?

On-premise vs Cloud Computing

ON-PREMISE

- Higher pay, less scalability

- Allot huge space for servers

- Appoint a team for hardware and software maintenance

- Poor data security

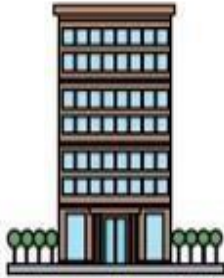- Less chance of data recovery

CLOUD COMPUTING

- Pay for what you use
    - Scale up= pay more
    - Scale down= pay less

- No server space required

- No experts required for hardware and software maintenance

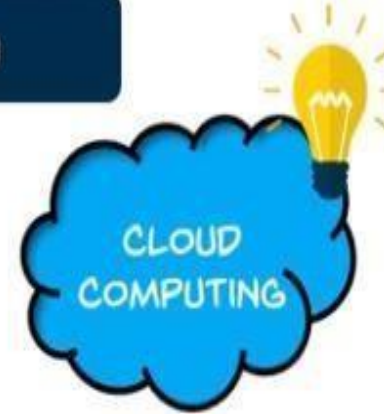- Better data security

- Disaster recovery

Why Cloud Computing?

On-premise vs Cloud Computing

ON-PREMISE

CLOUD COMPUTING

- Lack of flexibility
- No automatic updates
- Less collaboration
- Data cannot be accessed remotely
- Takes longer implementation time

- High Flexibility
- Automatic software updates
- Teams can collaborate from widespread locations
- Data can be accessed and shared anywhere over the internet
- Rapid implementation

Why Cloud?

What Is Cloud?

Just move your data to Cloud

Local system with limited space

Cloud with unlimited space

What Is Cloud Computing?

Cloud computing is:

- Storing data/applications on remote servers

- Processing data/applications from servers

- Accessing data/applications via Internet

Access data

Anywhere

Browser or Software
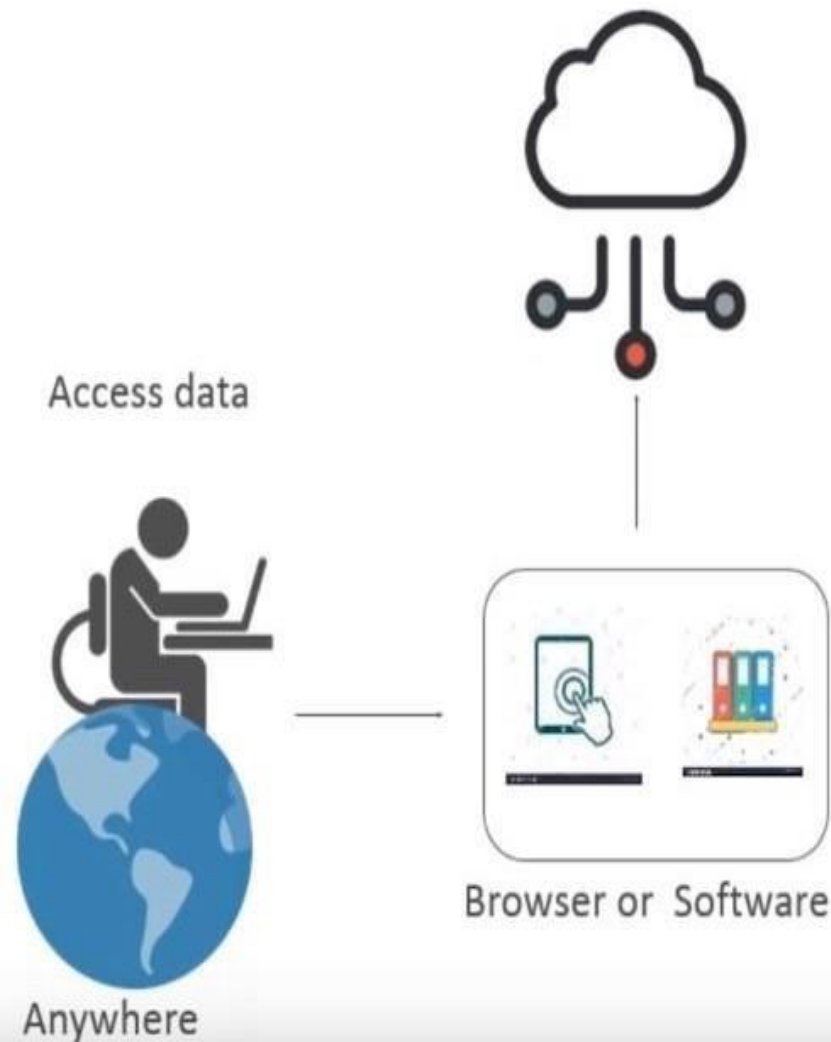
Cloud Computing

- Cloud computing is a computing paradigm shift where computing is moved away from personal computers or an individual application server to a "cloud" of computers.

- It is a service that charges based on the amount of computing resources that we use.

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What is Cloud Computing?

- The National Institute of Standards and Technology (NIST) defines cloud computing as "Cloud computing is a model for enabling **convenient, on-demand network access** to a **shared pool of configurable computing resources (e.g. networks, servers, storage application and services**) that can be rapidly provisioned and released with minimal management effort or service provider interaction".

- Cloud computing **utilizes distributed resources** by combining them to solve complex, large scale computation problems and to achieve higher throughput.

- Cloud Computing refers to **manipulating, configuring, and accessing the applications online.**

- It offers online data storage, infrastructure and application.

- Cloud Computing is both a **combination of software and hardware** based computing resources delivered as a network service.

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Advantages of Cloud Computing

- **Lower computer costs:**
    - **You do not need** a high-powered and **high-priced computer** to run cloud computing's web-based applications.
    - Since applications run in the cloud, not on the desktop PC, your desktop PC **does not need the processing power or hard disk space** demanded by traditional desktop software.
    - When you are using web-based applications, **your PC can be less expensive, with a smaller hard disk, less memory, more efficient processor**...
    - In fact, your PC in this scenario **does not even need a CD or DVD drive, as no software programs have to be loaded and no document files need to be saved.**

Advantages of Cloud Computing

- **Improved performance:**
  - With few large programs controlling your computer's memory, you will see **better performance from your PC**.
  - Computers in a cloud computing system **boot and run faster because they have fewer programs and processes loaded into memory**...
- **Reduced software costs:**
  - **Instead of purchasing expensive software** applications, you can get most of what you need for free-ish!
    - most cloud computing applications today, such as the Google Docs suite.
  - better than paying for similar commercial software
    - which alone may be justification for switching to cloud applications.

Advantages of Cloud Computing

- **Instant software updates:**
  - Another advantage to cloud computing is that you are no longer faced with choosing between **obsolete software and high upgrade costs**.
  - When the application is web-based, **updates happen automatically**
    - available the next time you log into the cloud.
  - When you access a web-based application, **you get the latest version**
    - **without needing to pay for or download an upgrade.**
- **Improved document format compatibility.**
  - There are potentially no format incompatibilities when everyone is sharing documents and applications in the cloud. Example **Google drive documents**

Advantages of Cloud Computing

- **Unlimited storage capacity:**
  - Cloud computing offers **virtually limitless storage**.

  - Your **computer's current 1** terabyte **hard drive** is small compared to the hundreds of **Petabyte** (1,024 **Terabytes), Exabyte** (1,024 **Petabytes**), **Zettabyte** (1,024 **Exabytes**) and **Yottabyte** (1,204 **Zettabytes)** etc available in the cloud.

- **Increased data reliability:**
  - Unlike **desktop computing, in which if a hard disk crashes and destroy all your valuable data**, a computer crashing in the cloud should not affect the storage of your data.
    - **if your personal computer crashes**, all your data is still out there **in the cloud, still accessible**
  - In a world where few individual desktop PC users back up their data on a regular basis, cloud computing is a data-safe computing platform!

Advantages of Cloud Computing

- **Universal document access:**
  - That is not a problem with cloud computing, because **you do not take your documents with you.**
  - **Instead, they stay in the cloud, and you can access them whenever you have a computer and an Internet connection**
  - **Documents are instantly available from wherever you are**

- Latest version availability:
  - **When you edit a document at home, that edited version is what you see when you access the document at work.**
  - **The cloud always hosts the latest version of your documents**
    - as long as you are connected, you are not in danger of having an outdated version

Advantages of Cloud Computing

- **Easier group collaboration:**
  - Sharing documents leads directly to better collaboration.
  - Many users do this as it is an important advantages of cloud computing
    - **multiple users can collaborate easily on documents and projects**
- **Device independence.**
  - **You are no longer bound to a single computer or network.**
  - Changes to computers, applications and documents follow you through the cloud.
  - **Move to a portable device, and your applications and documents are still available.**

Disadvantages of Cloud Computing

- **Requires a constant Internet connection:**
  - Cloud computing is impossible if you cannot connect to **the Internet**. **In** Rural area may be issue.
  - Since you use the Internet to connect to both your applications and documents, if you do not have an Internet connection you cannot access anything, **even your own documents.**
  - **A dead Internet connection** means no work, **no cloud concept** and in **areas where Internet connections are fe**w or inherently unreliable, this could be a deal-breaker.

Disadvantages of Cloud Computing

- **Does not work well with low-speed connections:**
  - Similarly, a low-speed Internet connection, such as that found with dial-up services, **makes cloud computing painful at best and often impossible**.
  - Web-based applications **require a lot of bandwidth to download**, as do large documents.
- **Features might be limited:**
  - This situation is bound to change, but today many web-based applications simply are not as full-featured as their desktop-based applications.
    - **For example, you can do a lot more with Microsoft PowerPoint than with Google Presentation's web-based offering**

Disadvantages of Cloud Computing

- **Can be slow:**
  - Even with a fast connection, **web-based applications can sometimes be slower than accessing a similar software program on your desktop PC.**
  - Everything about the program, from the interface to the current document, **has to be sent back and forth from your computer to the computers in the cloud.**
  - If the cloud servers happen to be backed up at that moment, or if the **Internet is having a slow day, you would not get the immediate access you might expect from desktop applications.**

Disadvantages of Cloud Computing

- **Stored data might not be secure:**
  - With cloud computing, all **your data is stored on the cloud.**
    - **The questions is How secure is the cloud?**
  - **Can unauthorised users gain access to your confidential data?**

- **Stored data can be lost:**
  - **Theoretically, data stored in the cloud is safe, replicated across multiple machines.**
  - **But on the off chance that your data goes missing, you have no physical or local backup.**
   - Put simply, **relying on the cloud puts you at risk** if the cloud lets you down.

Cloud User

- There are three types of stakeholders **cloud providers, cloud users and the end users .**

- Cloud providers provide cloud services to the cloud users.

- These cloud services are of the form of utility computing i.e. the **cloud users uses these services pay-as-you-go model.**

- The **cloud users develop their product using these services and deliver the product to the end users.**

.Cloud Providers' point of view

Most of the **data centers today are under utilized. They are mostly 15% utilized.** These data centers need spare capacity just to cope with the huge spikes that sometimes get in the server usage. **Large companies having those data centers can easily rent those computing power to other organizations and get profit out of it** and also make the resources needed for running data center **(like power) utilized properly**.

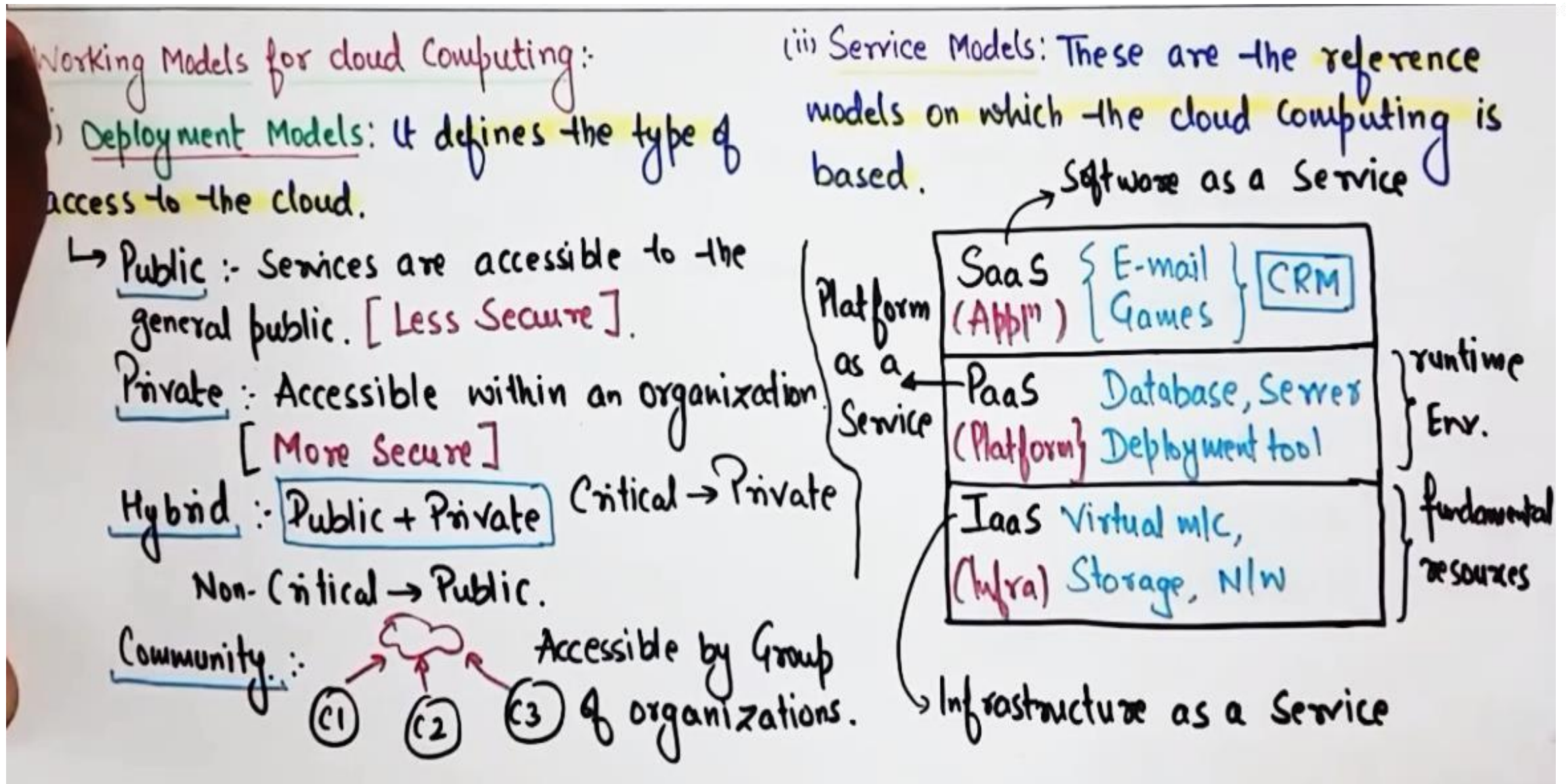# Cloud Computing Challenges: Dealing with too many issues
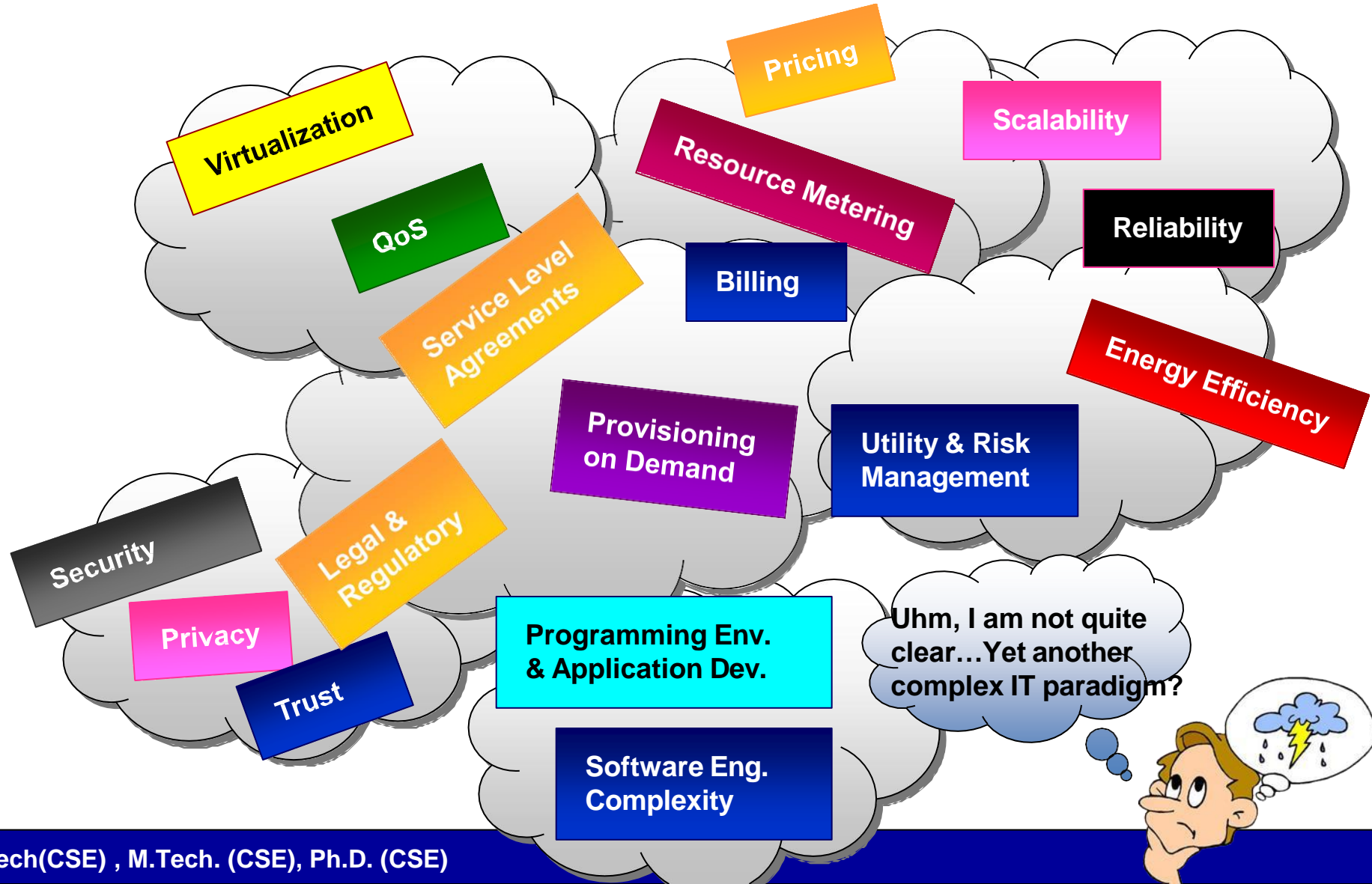
Challenges

Security and Privacy — Perhaps two of the more "hot button" issues surrounding cloud computing relate to **storing and securing data**, and monitoring the use of the cloud by the service providers. **These issues are generally attributed to slowing the deployment of cloud services. These challenges can be addressed, for example, by storing the information internal to the organization, but allowing it to be used in the cloud.**

Lack of Standards — Clouds have documented interfaces; however, **no standards are associated with these,** and thus it is unlikely that most clouds will be interoperable. **Standards are still in Initial Stage.**

Continuously Evolving — **User requirements are continuously evolving, as are the requirements for interfaces, networking, and storage. This means that a "cloud," especially a public one, does not remain static and is also continuously evolving. We all are still using local machine, laptop, mobile etc.**

Compliance Concerns — **The Sarbanes-Oxley Act (SOX) in the US** and **Data Protection directives in the EU are just two among many compliance issues affecting cloud computing, based on the type of data and application for which the cloud is being used. The EU has a legislative backing for data protection across all member states, but in the US data protection is different and can vary from state to state.** As with security and privacy mentioned previously, these typically result in Hybrid cloud deployment with one cloud storing the data internal to the organization.

Working Models for cloud Computing:

i) Deployment Models: It defines the type of access to the cloud.

↳ Public :- Services are accessible to the general public. [Less Secure].

Private :- Accessible within an organization [More Secure]

Hybrid :- Public + Private   Critical → Private

Non-Critical → Public.

Community :- ○C1 ○C2 ○C3   Accessible by Group of organizations.

(ii) Service Models: These are the reference models on which the cloud Computing is based.

→ Software as a Service

Platform as a Service

SaaS (Appln) { E-mail / Games } CRM

PaaS (Platform) Database, Server, Deployment tool } runtime Env.

IaaS (Infra) Virtual m/c, Storage, N/w } fundamental resources

↳ Infrastructure as a Service

Cloud Computing Models

Deployment Models

Public Cloud

➤ A cloud platform in which the cloud resources are owned and operated by a third-party cloud service provider and delivered over the Internet.

➤ The hardware resources in public cloud are shared among similar users and accessible over a public network such as the internet.

➤ Often used by : Budget conscious startups, Small and medium-sized enterprises (SMEs) not keen on high level of security features looking to save money can opt for Public Cloud Computing.

CLOUD MODEL- Types:-

(i) PUBLIC CLOUD MODEL:- { Small fee, cost, free }

↳ Systems and Services are easily accessible to general public.

Eg:- → GOOGLE
    → AMAZON   } Internet.
    → MICROSOFT

User 1, User 2, User3, ... User...n → Mail Services] Google
App1ⁿ Services] Microsoft
Storage Services] Dropbox.
Admin

Public cloud model.

Advantages:-
→ i) Reliability
→ ii) Flexibility
→ iii) Location independence
→ iv) High scalability
→ v) Cost effective
→ vi) utility style Costing.

Disadvantages:-
(i) Low Security
(ii) Less Customizable than private cloud.
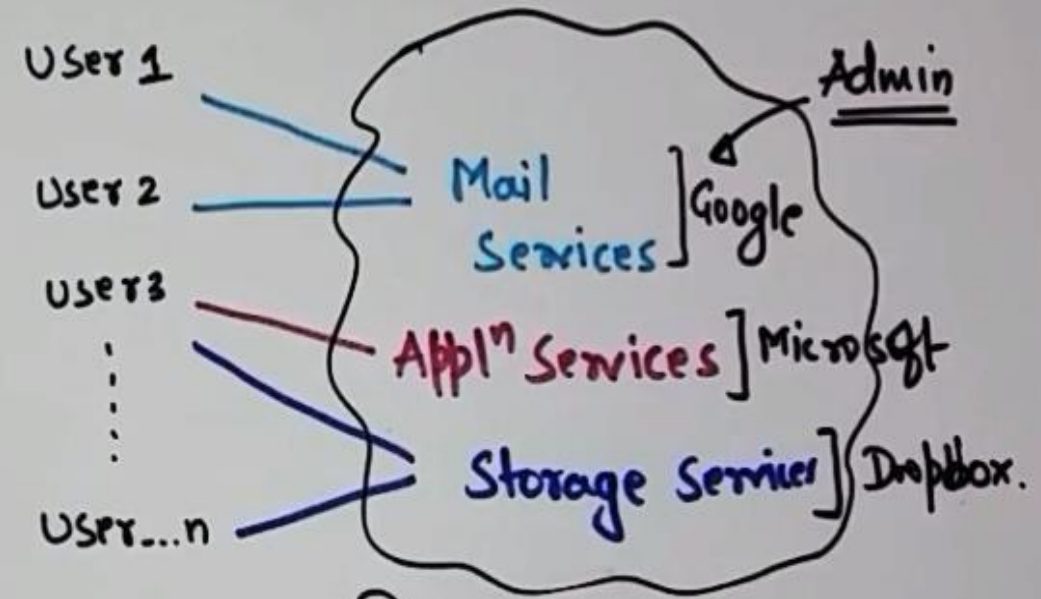
Free,
Gmail (15GB)
↓ >15GB
Fee

Private Cloud

➢ A private cloud consists of computing resources used exclusively by one business or organization.

➢ It can be physically located at your organization's on-site datacenter or it can be hosted by a third-party service provider.

➢ Makes it easier for an organization to customize its resources.

➢ Often used by government agencies, financial institutions, any other mid- to large-size organizations with **business-critical operations** seeking enhanced **control over their environment.**

Private Onsite Cloud

Private Offsite Cloud
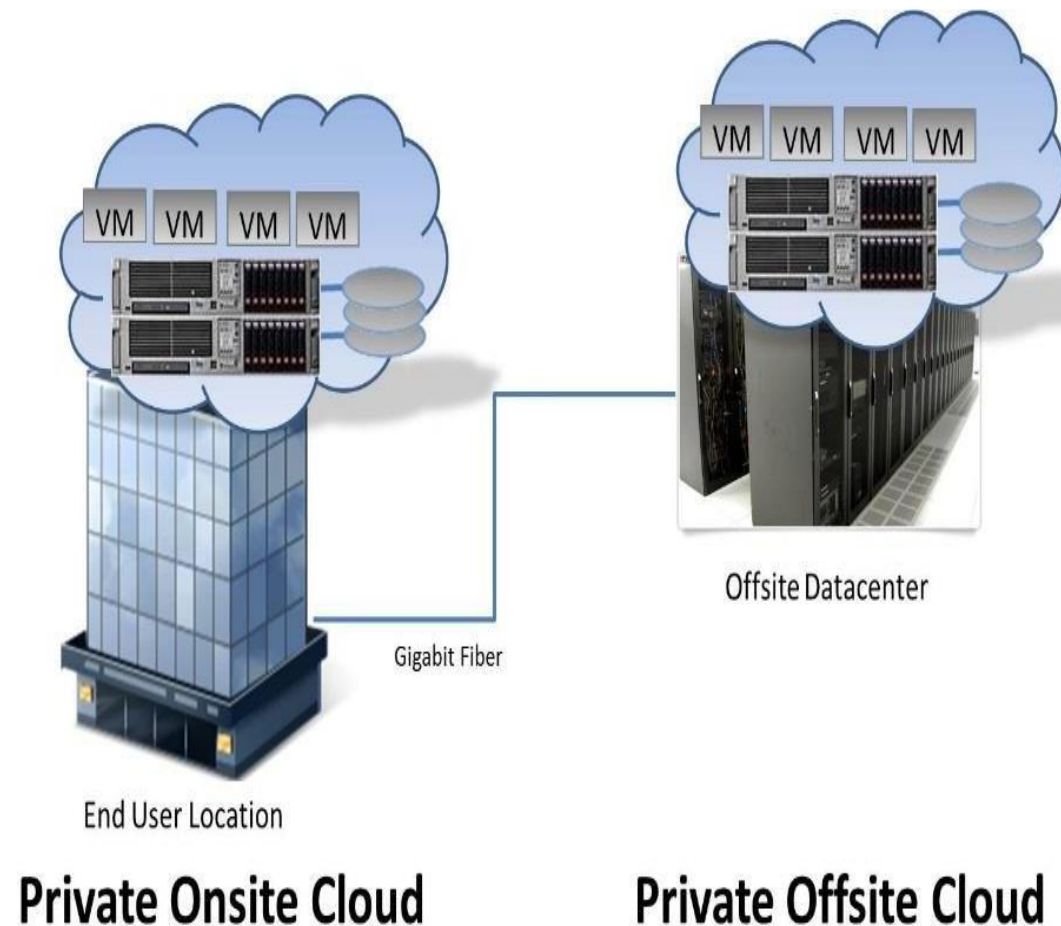
Private Cloud Model with Advantages and Disadvantages
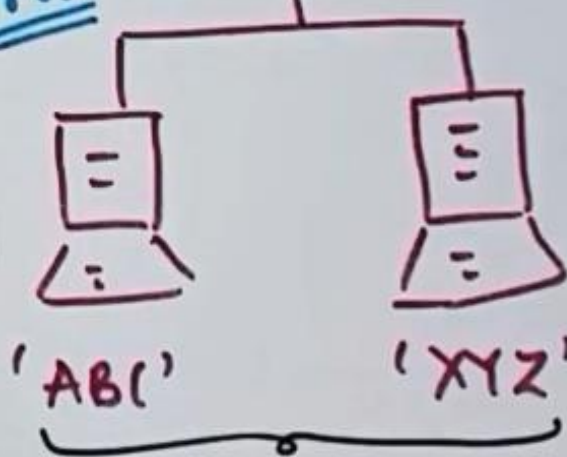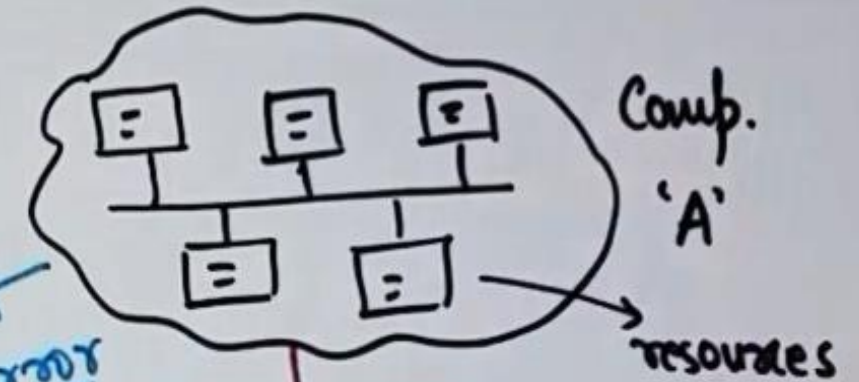
Hybrid Cloud

➢ Often called "the best of both worlds,"

➢ In a hybrid cloud, data and applications can move between private and public clouds for **greater flexibility** and more deployment options.

➢ In a hybrid cloud, "cloud bursting" is also an option. This is when an application or resource runs in the private cloud until there is a spike in demand at which point the organization can "burst through" to the public cloud to tap into additional computing resources.

Community Cloud Model: falls b/w Category of private and public cloud.

↳ Allows Systems and Services to be accessible by group of organizations.

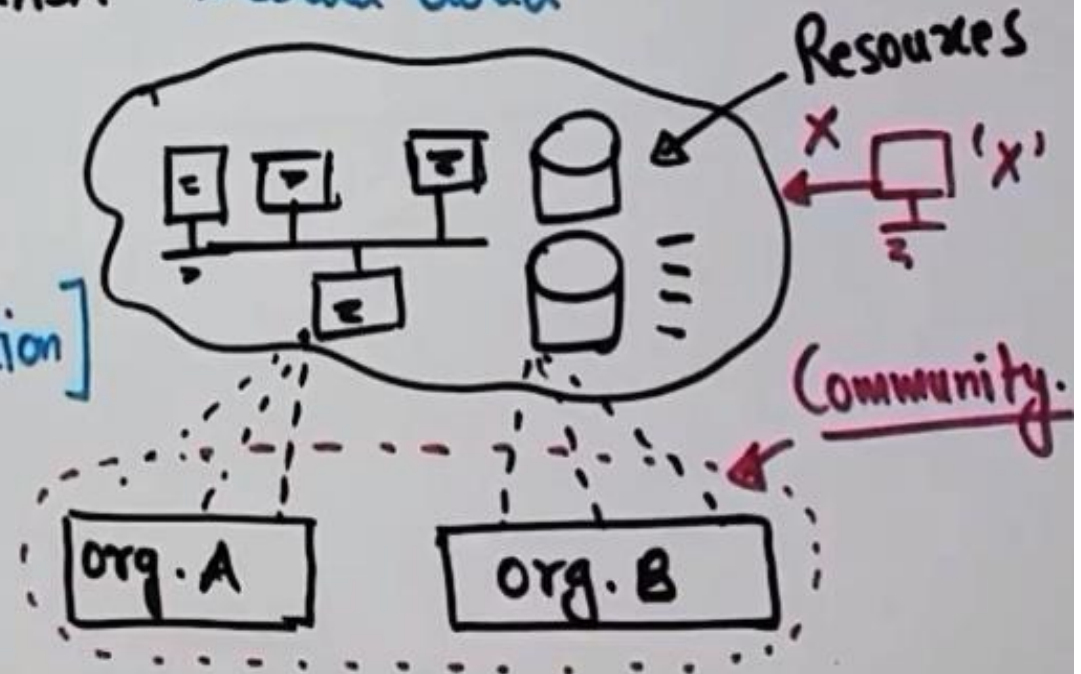} COSTLY than public cloud.

→ Google 'Gov Cloud'
→ NASA 'Nebula cloud'

Advantages:

↳ i) Low Cost than private cloud.
ii) Sharing among org.
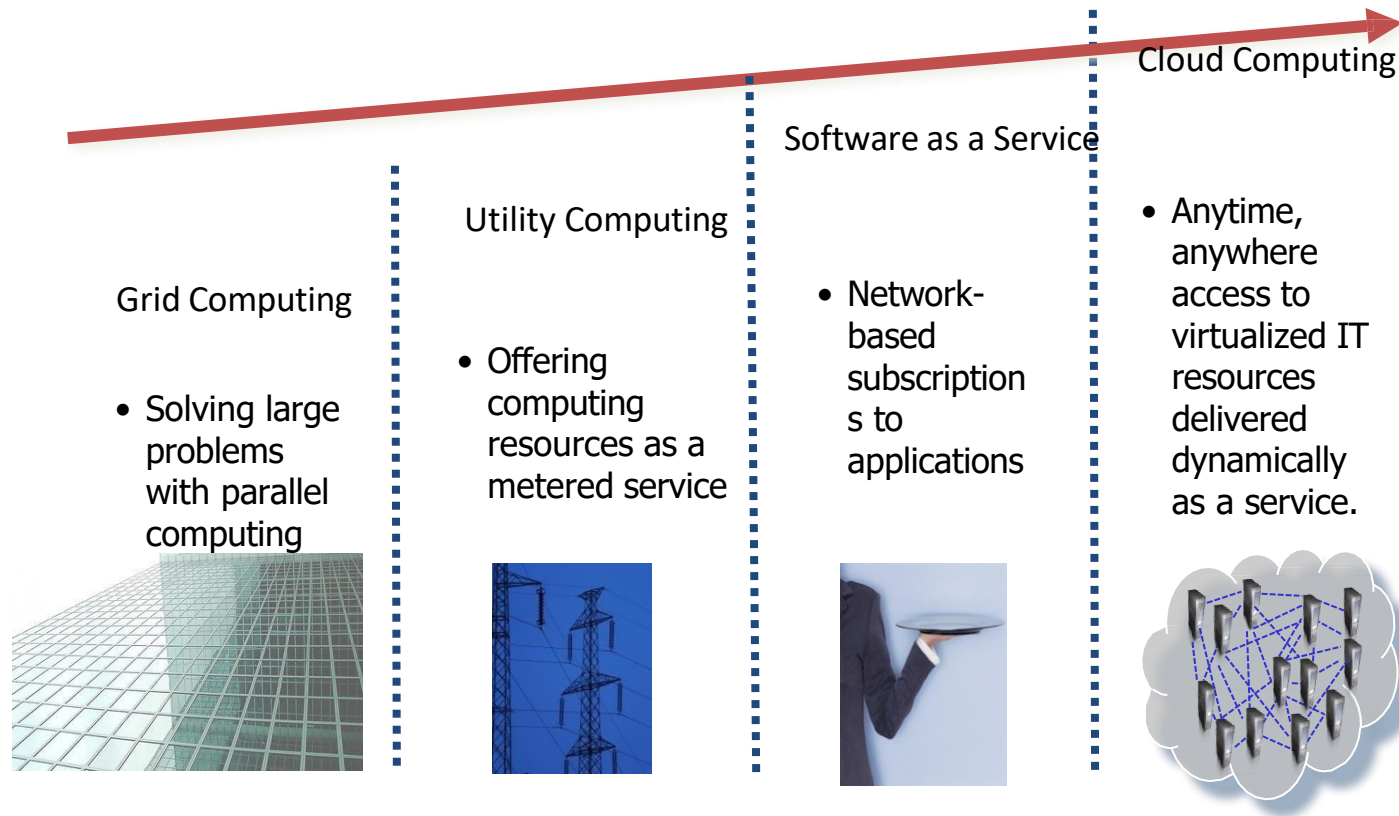iii) Security [more Secure than public but less than private]

Disadvantages:

↳ i) We need to be careful in storing data [data Seggregation]

Responsibilities

Resources
× ☐ ('x')

Community.

org. A   org. B

Difference	Private	Public	Hybrid
Tenancy	Single tenancy: there's only the data of a single organization stored in the cloud.	Multi-tenancy: the data of multiple organizations in stored in a shared environment.	The data stored in the public cloud is usually multi-tenant, which means the data from multiple organizations is stored in a shared environment. The data stored in private cloud is kept private by the organization.
Exposed to the Public	No: only the organization itself can use the private cloud services.	Yes: anyone can use the public cloud services.	The services running on a private cloud can be accessed only the organization's users, while the services running on public cloud can be accessed by anyone.
Data Center Location	Inside the organization's network.	Anywhere on the Internet where the cloud service provider's services are located.	Inside the organization's network for private cloud services as well as anywhere on the Internet for public cloud services.
Cloud Service Management	The organization must have their own administrators managing their private cloud services.	The cloud service provider manages the services, where the organization merely uses them.	The organization itself must manage the private cloud, while the public cloud is managed by the CSP.
Hardware Components	Must be provided by the organization itself, which has to buy physical servers to build the private cloud on.	The CSP provides all the hardware and ensures it's working at all times.	The organization must provide hardware for the private cloud, while the hardware of CSP is used for public cloud services.
Expenses	Can be quite expensive, since the hardware, applications and network have to be provided and managed by the organization itself.	The CSP has to provide the hardware, set-up the application and provide the network accessibility according to the SLA.	The private cloud services must be provided by the organization, including the hardware, applications and network, while the CSP manages the public cloud services.

Evolution of Cloud Computing

Cloud Computing

Software as a Service

Utility Computing

Grid Computing

- Solving large problems with parallel computing

- Offering computing resources as a metered service

- Network-based subscriptions to applications

- Anytime, anywhere access to virtualized IT resources delivered dynamically as a service.

Cloud Computing Characteristics

On Demand Self-Service

Broad Network Access

Resource Pooling

Rapid Elasticity

Measured Service

Cloud Computing

- Cloud computing has five:

  1. On-demand self-service, the services are available on demand, the user can get the services at any time, all it takes is an Internet connection.

  2. Broad network access, the cloud is accessed remotely over the network, while the access to the cloud is through the internet; it means that it is accessible to its computing capabilities, software, and hardware from anywhere.

  3. Resources pooling in an independent location and resources serve a large number of users with all their different devices and their required resources.

  4. Rapid elasticity, dealing with the cloud is very easy, the user can simply reduce or increase the capacity, and also it's faster than the regular computing types.

  5. Measured Service, the cloud systems control and reuse the resources by using measurement capabilities and according to the type of service, these services also have financial return, depending on usage.

Applications

- Email
  - Gmail, Yahoo mail
- Online Collaboration tools
  - Google docs for collaboration on documents
  - Google Hangouts for video conferencing
- Big Data Analytics
  - Provides a cost effective and scalable infrastructure to support **big data and business analytics**.
- Test and Development
  - now readily available environments tailored for your needs at your fingertips.
- Storage

Cloud Storage

- Several large Web companies (such as Amazon and Google) are now exploiting the fact that they have data storage capacity that can be hired out to others.

- This approach, known as cloud storage allows data stored remotely to be temporarily cached on desktop computers, mobile phones or other Internet-linked devices.

- Amazon's Simple Storage Solution (S3) is a well known example.

Amazon S3

- Provides secure, durable, highly-scalable cloud storage.

- Amazon S3 Standard for general-purpose storage of frequently accessed data

- Amazon Glacier for long-term archive.

Advantages of Cloud Computing

- Lower computer costs
- Instant software updates
- Unlimited storage capacity
- Increased data reliability
- Universal document access
- Device independence
- Lowers the outlay expense for start up companies
- Easier group collaboration

Disadvantages of Cloud Computing

- Requires a constant Internet connection
- Does not work well with low-speed connections
- Governance and Regulatory compliance
  - Not all service providers have well-defined service-level agreements.
- Stored data might not be secure:
  - Limited knowledge of the physical location of stored data
  - Multi-tenant platform
  - Limited capabilities for monitoring access to applications hosted on cloud.

Examples of Cloud

- **Google Drive**: This is a pure cloud computing service, with all the storage found online so it can work with the cloud apps: Google Docs, Google Sheets, and Google Slides.

- **Apple icloud**: Apple's cloud service is primarily used for online storage, backup, and synchronization of your mail, contacts, calendar, and more. All the data you need is available to you on your iOS, Mac OS, or Windows device (Windows users have to install the iCloud control panel)

- **Amazon Cloud Drive**: Storage at the big retailer is mainly for music, preferably MP3s that you purchase from Amazon, and images—if you have Amazon Prime, you get unlimited image storage.

Examples of Cloud

- **Facebook and instaghram** —which are definitely cloud services— regarding what they get to do with your photos

- **Chromebook:** The primary example of a device that is completely cloud-centric is the chromebook. These are laptops that have just enough local storage and power to run the Chrome OS, which essentially turns the Googlechrome Web browser into an operating system. With a Chromebook, most everything you do is online: apps, media, and storage are all in the cloud.

Contents

- Why Cloud Computing?
- What is Cloud Computing?
- Enabling Technologies
- Advantages of Cloud Computing
- Disadvantages of Cloud Computing
- Service Models
- Deployment Models

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Enabling Technologies

- Grid Computing
- Utility Computing
- Autonomic Computing
- Service Oriented Architecture
- Virtualization

Enabling Technologies

- Grid Computing: Cluster of loosely coupled computers for a common cause.

- Utility Computing: Packaging of computer resources as metered service.

- Autonomic Computing: Capable of self- management.

Service Oriented Architecture

- Service-Oriented Architecture (SOA) is a technique of designing software which supports development of components as services.

- A component is a well-defined and independent module that offers required business functionality.

- Cloud Computing follows service-oriented architecture so that infrastructure, platform and software can be provided as modular services with well-defined interfaces to be used by anyone.

- Consumer need not bother about the details of the service and can consume it like a black box service.

Virtualization

- Virtualization allows the creation of multiple virtual instances on a single server.

- Each virtual instance acts similar to a physical server having its own operating system (OS) known as guest OS and a software stack.

- A software layer called hypervisor enables the coordination between guest OS and physical hardware.

Virtualization

- Virtualization addresses IT's most pressing challenge: the infrastructure sprawl that compels IT departments to channel 70 percent of their budget into maintenance, leaving few resources for business-building innovation.

- Virtualization software solves the problem by enabling several operating systems and applications to run on one physical server or "host."

Benefits of ServerVirtualization

- Better utilization of everyserver

- Robust, affordable high availability

- VM Isolation

- VM Migration

Service Models

Service Models

- Service Models describe the type of service that the service provider is offering.

- Three types of Service Models are there:
  - Software as s Service(SaaS)
  - Platform as a Service(PaaS)   **SPI Model**
  - Infrastructure as a Service(IaaS)
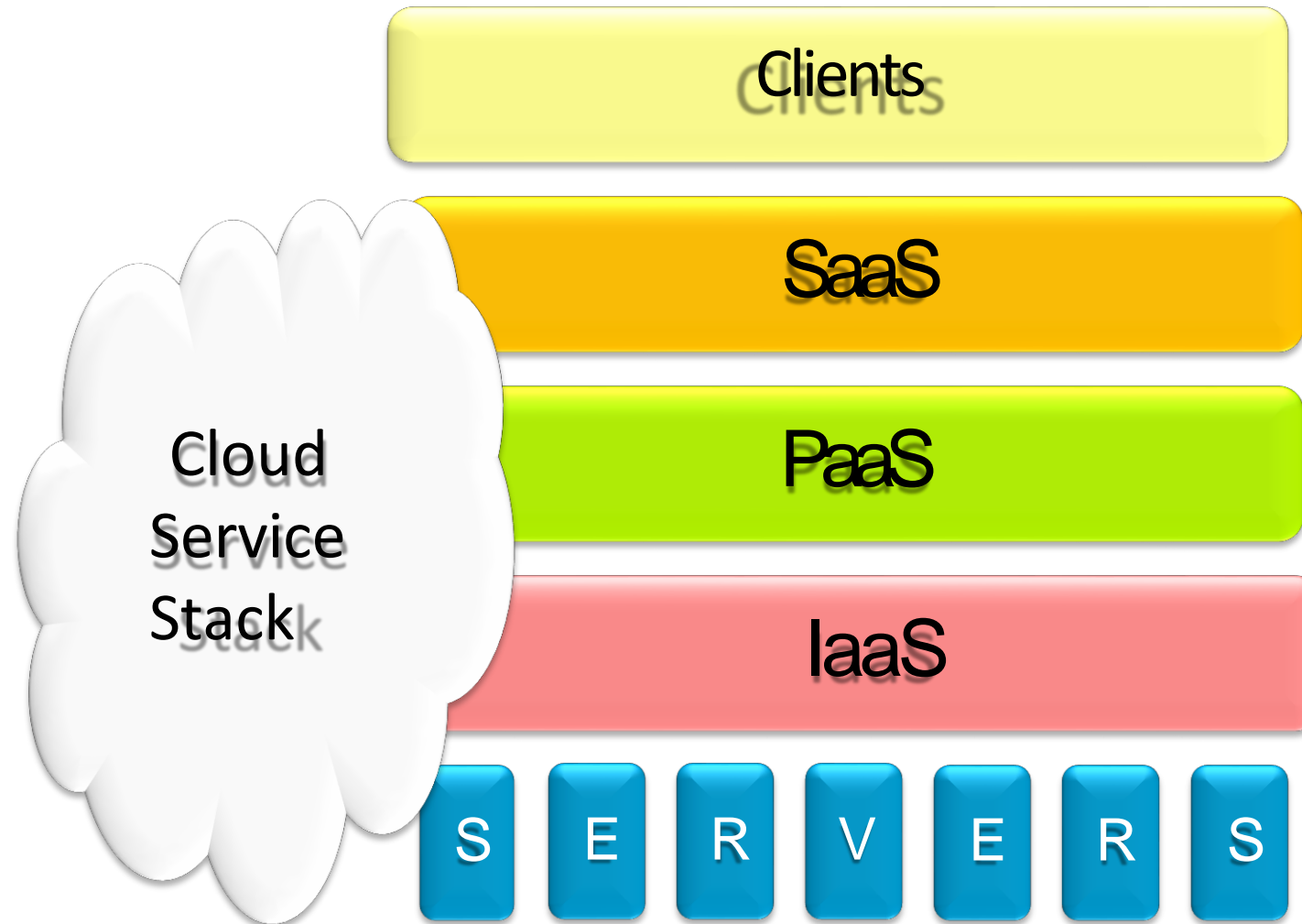
IaaS

- Infrastructure as a Service (IaaS) is a form of cloud computing where hardware is provided and managed by an external provider. This hardware is provided in the cloud environment and can include anything from virtual servers to network connections and load balancers.

- Because this hardware is virtualised, it gives businesses the ability to easily scale their IT solutions. This makes it particularly popular with growing businesses and when working on temporary projects.

Benefits of IaaS:

- **Scalability** —one of the main benefits of IaaS is the scalability it offers. Through a subscription service, you access the IT system you require when you need it. Due to its virtualisation, scaling up your systems can be done quickly and efficiently, minimising downtime.
- **Minimised hardware maintenance** — the hardware behind your IaaS system is managed externally, minimising the time and money your business spends on this type of maintenance.
- **Flexibility** — many IaaS systems can be accessed remotely, although this will vary from system to system.
- **Reduced downtime** — if your hardware fails, you'll usually need to wait for a repair, impacting the productivity of both your staff and business overall. An IaaS system relies on a multitude of servers and data centres; if one area fails, other hardware resources are available to pick up the slack.
- **On–demand access** — an IaaS system can be accessed on-demand and you'll only pay for the resources you use, keeping costs down.

IaaS Providers

- Amazon
- Rackspace
- Gogrid
- GoDaddy
- Joyent
- Microsoft Sql Services

PaaS

- Platform as a Service (PaaS) is a form of cloud computing that allows a dedicated space to build and test applications. It's predominantly used by software and web developers, although it can also be utilised by businesses who want to create and test their own internal software. It's usually available on a subscription basis.

Benefits of PaaS

- **Reduced costs** — in the past, developing software was costly, as a result of the hardware, skills and experience needed. Instead, PaaS allows users to effectively rent the required infrastructure, paid for through their subscription fee.

- **Eliminates skills barrier** — PaaS systems are often simple to use, meaning businesses don't need to employ specialists to develop their apps. Rather, an app can be developed in-house through only a web browser.

- **Increased collaboration** — in larger businesses, multiple parties may be working on the same app development project. Via cloud connectivity, multiple developers across different locations can collaborate on the same project.

PaaS Providers

- Google App Engine

- Windows Azure

- Microsoft .Net Services

- Cisco Webex Connect

- Longjump

- Force.com

SaaS

- Software as a Service (SaaS) is a way for software applications to be delivered over the internet through the cloud. Because of this, SaaS is often referred to as cloud software.

- Different from previous methods of purchasing software outright and installing it onto a device, SaaS is usually subscription-based. The software isn't localised on a specific PC — rather, it's accessed via an internet connection.

- Example : Office 365 or streaming your favourite films via Netflix.

Benefits of SaaS

- **Eradicates initial costs** — because SaaS is usually delivered on a subscription basis, it eliminates the initial costs that were traditionally associated with implementing software. With cost a barrier for many, this approach makes accessing more sophisticated systems easier and more affordable.

- **Stop using, stop paying —** another benefit of a subscription SaaS system is that it means you can often terminate your contract when you no longer require the software.

- **Keep your data safer —** through using cloud-connected software systems, you eliminate the vulnerability of storing files to a local device. PCs, laptops and tablets can fail, but you'll always have a digital back-up to hand.

- **Flexibility** —one of the main benefits of SaaS is the flexibility it offers. You're no longer tethered to specific devices that have the software capability; rather, you can access the applications you need wherever you are using a simple internet connection.

SaaS Examples

THANK YOU

Presented By Veepin Kumar

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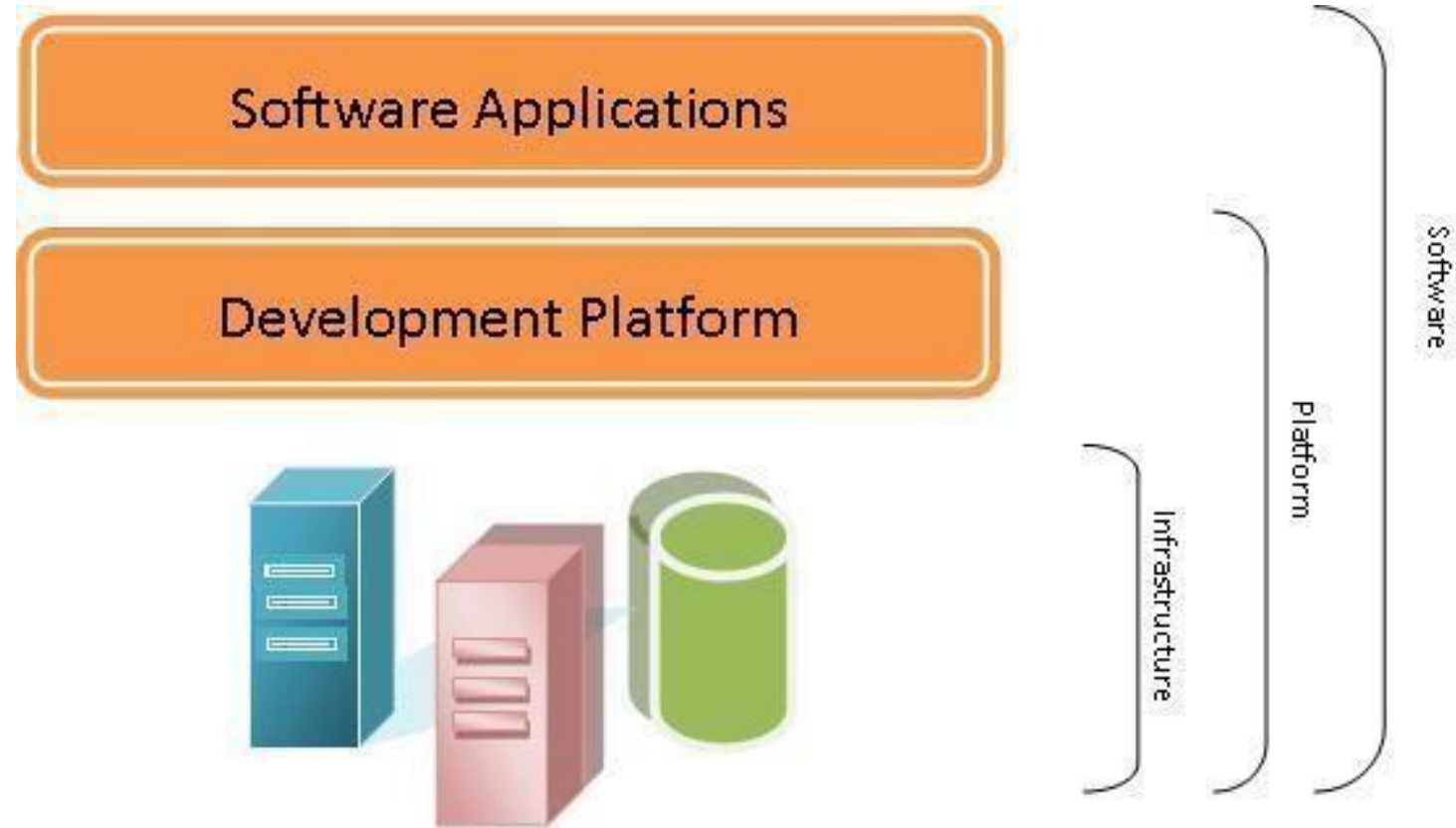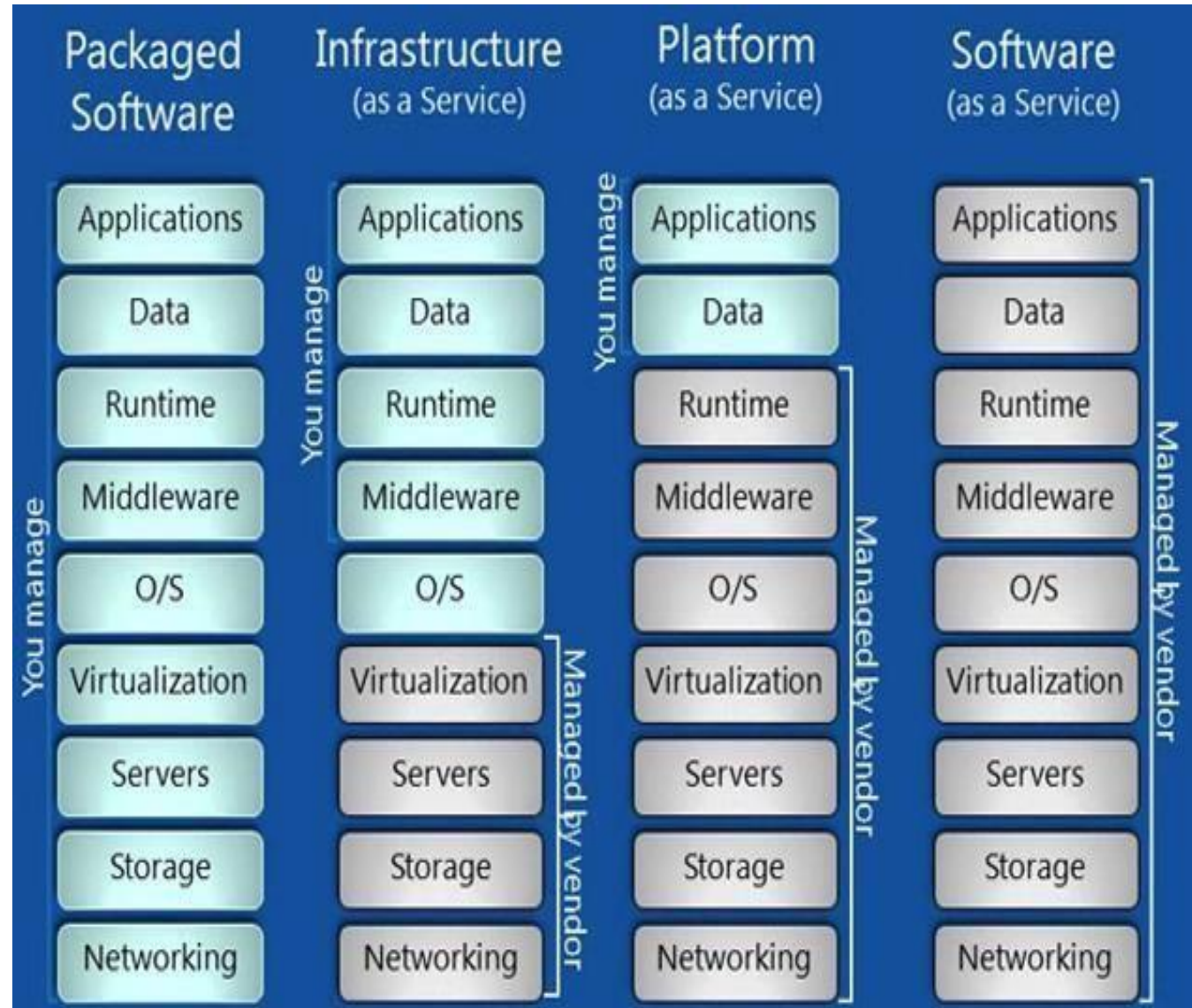
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