# نظم معلومات موزعة
Distributed Information Systems

Lecture 8: Cloud Computing and Virtualization

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Introduction

- Cloud computing is a service, which offers customers to work over the internet.

- It simply states that *cloud computing means storing and accessing the data and programs over the internet rather than the computer's hard disk*.

- The data can be anything such as music, files, images, documents, and many more.

- To access cloud computing, the user should register and provide with ID and password for security reasons.

- The speed of transfer depends on various factors such as internet speed, the capacity of the server, and many more.

- Cloud computing means on demand delivery of IT resources via the internet with pay-as-you-go pricing.

- It provides a solution of IT infrastructure in low cost.

- for any IT company, we need a Server Room that is the basic need of IT companies. In that server room, there should be a *database server*, *mail server*, *networking*, *firewalls*, *routers*, *modem*, *switches*, *high net speed* and the *maintenance engineers*.

- To establish such IT infrastructure, we need to spend lots of money. To overcome all these problems and to reduce the IT infrastructure cost, Cloud Computing comes into existence.
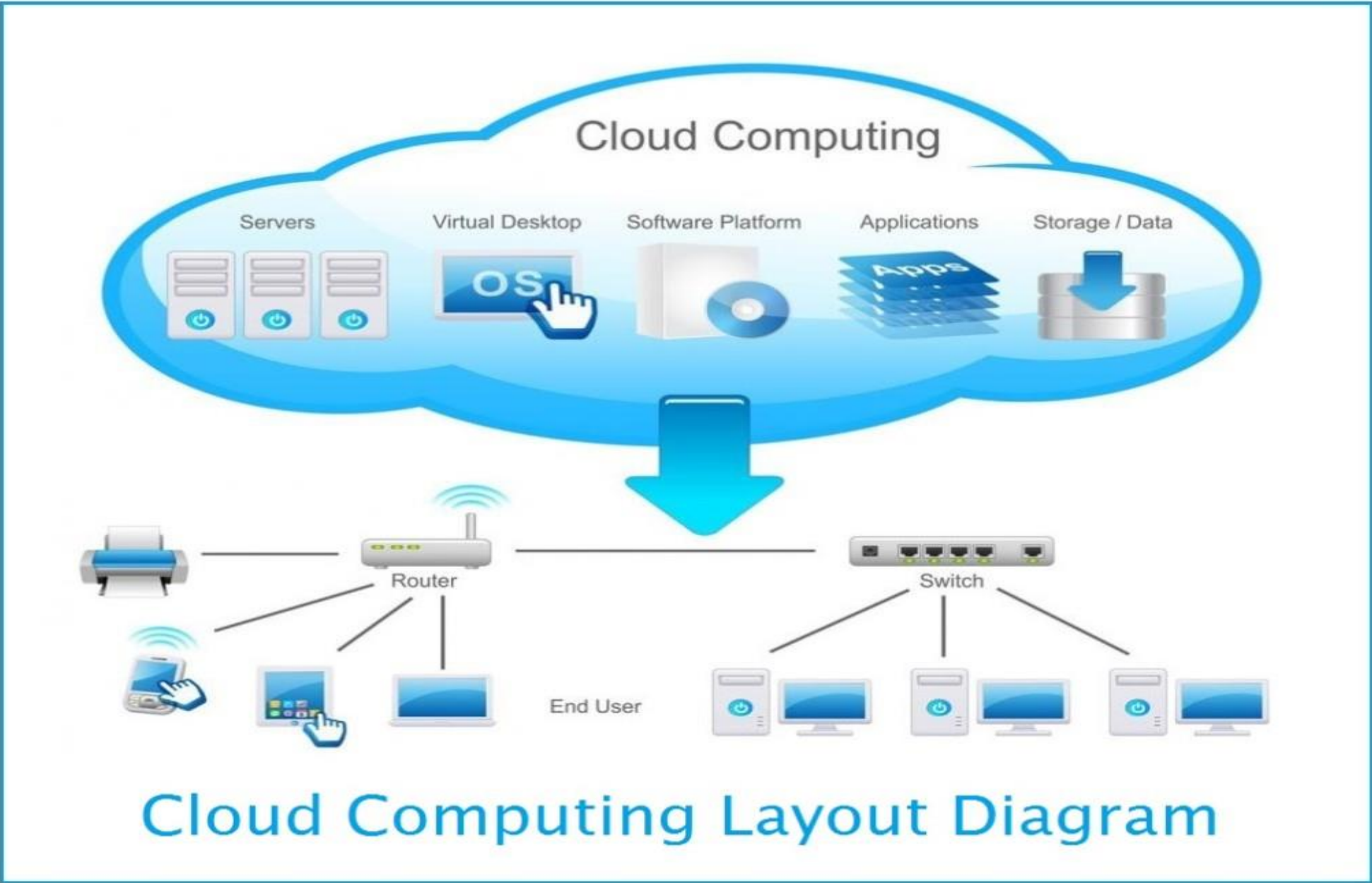
Characteristics of Cloud Computing

- The cloud **works in the distributed computing environment**. It shares resources among users and works very fast.

- Availability of servers is high and more reliable, because **chances of infrastructure failure are minimal**.

- **"on-demand" provisioning of resources on a large scale**, without having engineers for peak loads.

- **multiple users and applications can work more efficiently** with cost reductions by sharing common infrastructure.

- Enables the users to access systems using a web browser regardless of their location or what device they use e.g. PC, mobile phone etc. **As infrastructure is off-site** (typically provided by a third-party) **and accessed via the Internet, users can connect from anywhere**.

- Maintenance of cloud computing applications is easier, since they **do not need to be installed on each user's computer and can be accessed from different places**. So, it reduces the cost also.

- By using cloud computing, the cost will be reduced because to take the services of cloud computing, **IT company need not to set its own infrastructure** and pay-as-per usage of resources.

- Application Programming Interfaces **(APIs) are provided to the users so that they can access services on the cloud** by using these APIs **and pay the charges as per the usage of services**.

- Users don't need to face with the choice between obsolete software and high upgrade costs. If the app is web-based, **updates happen automatically** and are available next time when the user logs in to the cloud.
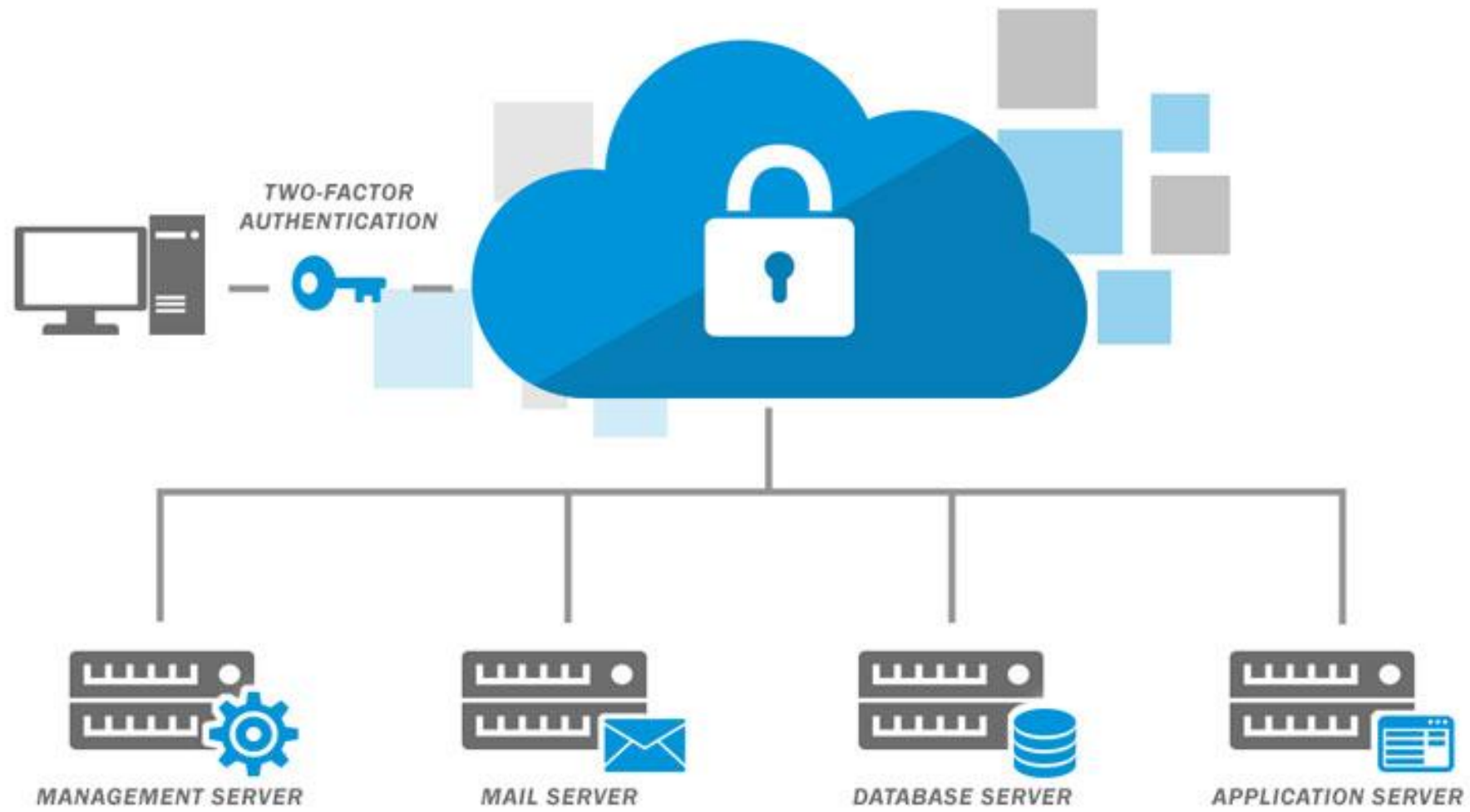
Types of Cloud

❑ Public Cloud

- Public cloud allows the accessibility of systems and services easily to general public. Eg: Amazon, IBM, Microsoft, Google, Rackspace etc.

- Public cloud is having low cost as compared to private or hybrid cloud, because it shares same resources with large number of consumer.

- Provides large number of resources from different locations, if any of the resource fail, public cloud can employ another one.

- It ensures the independency of location, because public cloud services are delivered through Internet.
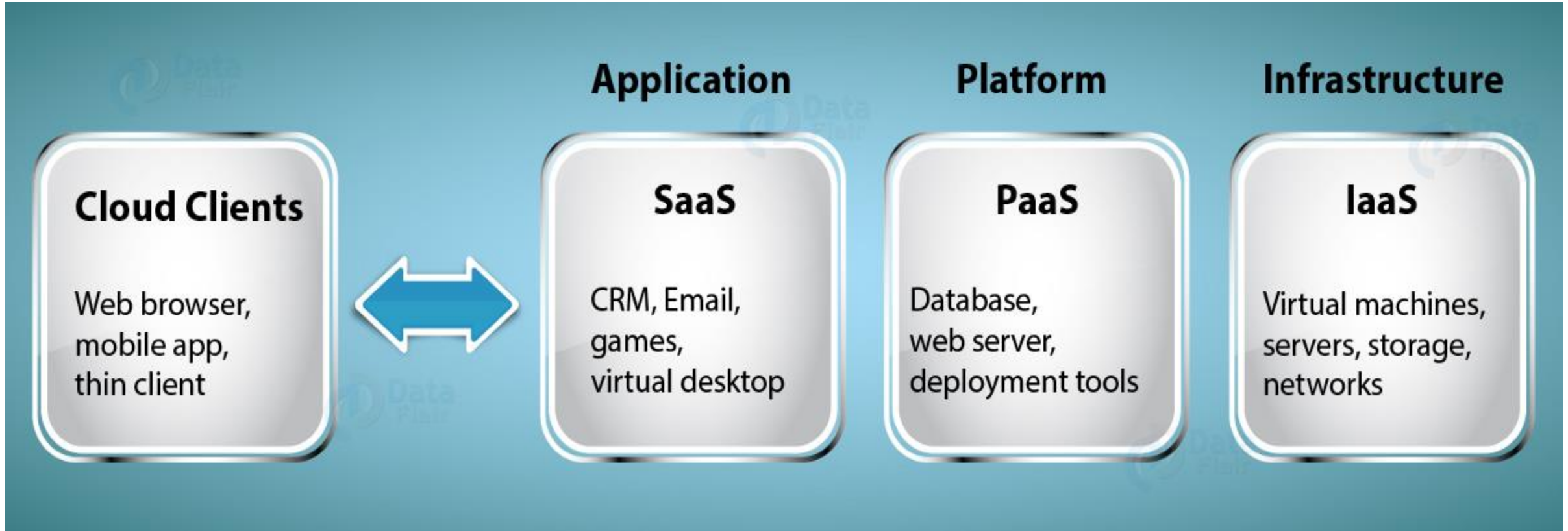
❑ Private Cloud

- The Private cloud allows the accessibility of systems and services within the organization.

- Is operated only within a particular organization. But it will be managed internally or by third party.

- Private cloud resources are shared from distinct pool of resources and hence highly secured.

- have more control on its resources and hardware than public cloud because it is accessed only within the boundary of an organization.

- have more cost than public clouds.

TWO-FACTOR AUTHENTICATION

MANAGEMENT SERVER

MAIL SERVER

DATABASE SERVER

APPLICATION SERVER

Cloud Service Models

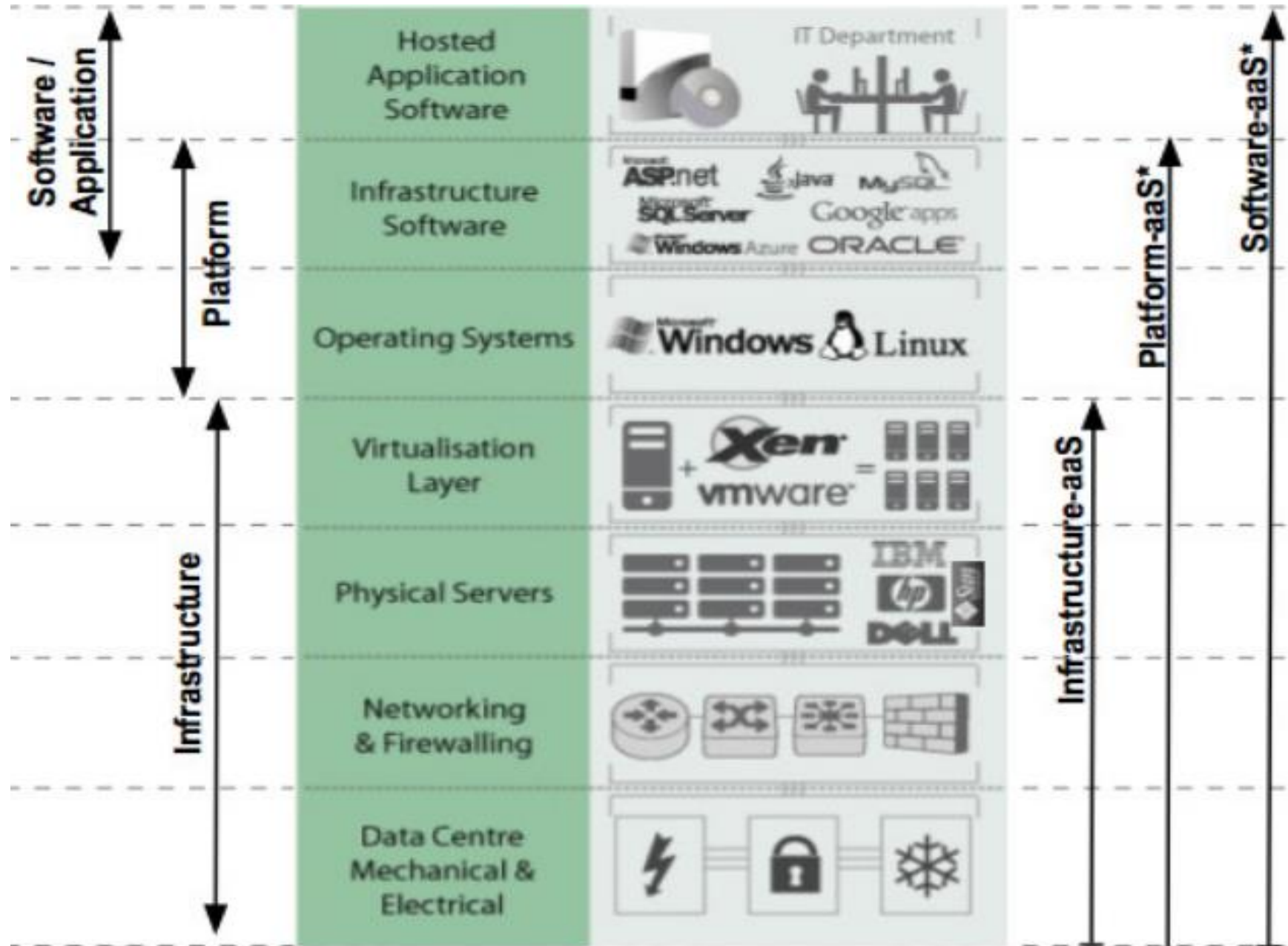| **Cloud Clients**		**Application** **SaaS**	**Platform** **PaaS**	**Infrastructure** **IaaS**
Web browser, mobile app, thin client	⟷	CRM, Email, games, virtual desktop	Database, web server, deployment tools	Virtual machines, servers, storage, networks

❖ Software as a Service | **SaaS**

- SaaS is a software distribution model in which applications are hosted by a cloud service provider and made available to customers over internet. SaaS is also known as **"On-Demand Software"**.

- In SaaS, software and associated data are centrally hosted on the cloud server. SaaS is accessed by users using a thin client via a web browser.

- SaaS pricing is based on a monthly fee or annual fee, SaaS allows organizations to access business functionality at a low cost which is less than licensed applications.

- The software is hosted remotely, so organizations don't need to invest in additional hardware.
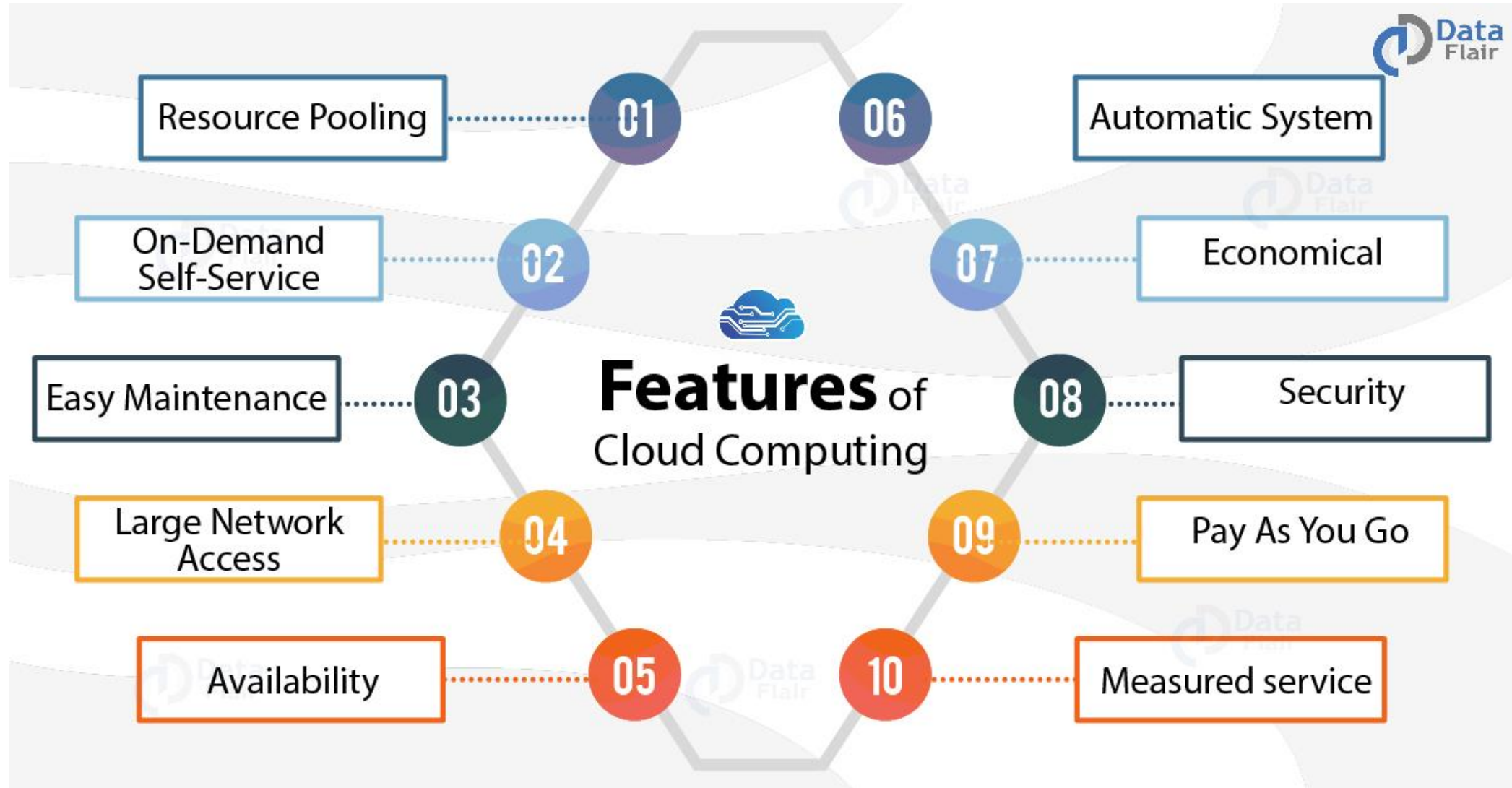
❖ Infrastructure as a Service | **IaaS**

• the customer organization outsources its IT infrastructure such as servers, networking, processing, storage, virtual machines and other resources. Customers access these resources over internet i.e. cloud computing platform, on a pay-per-use model.

• With the help of IaaS cloud computing platform layer, clients can dynamically scale the configuration to meet changing requires, and are billed only for the services actually used.

• You can dynamically choose a CPU, memory and storage configuration as per your needs.

❖ Platform as a Service | **PaaS**

- **PaaS cloud computing platform** is a developer programming platform which *is created for the programmer to develop, test, run and manage the applications*.

- A developer is able to write the application as well as deploy it directly into this layer easily.

- Developers can focus on development and innovation without worrying about the infrastructure.

- Applications deployed can scale from one to thousands of users without any changes to the applications.

Features of Cloud Computing

Resource Pooling — 01

06 — Automatic System

On-Demand Self-Service — 02

07 — Economical

Easy Maintenance — 03

08 — Security

Large Network Access — 04

09 — Pay As You Go

Availability — 05

10 — Measured service

Features of Cloud Computing

- Resources Pooling: It means that the Cloud provider pulled the computing resources to provide services to multiple customers with the help of a **multi-tenant** model: allows customers to share computing resources in a public or private cloud. Each tenant's data is isolated and remains invisible to other tenants..

- On-Demand Self-Service: the user can continuously monitor the server uptime, capabilities, and allotted network storage.

- Easy Maintenance: comes up with an update every time by gradually making it better.

- Large Network Access: The user can access the data of the cloud or upload the data to the cloud from anywhere just with the help of a device and an internet connection.

- Availability: The capabilities of the Cloud can be modified as per the use and can be extended a lot. It analyzes the storage usage and allows the user to buy extra Cloud storage if needed for a very small amount.

- Automatic System: automatically analyzes the data needed and supports a metering capability at some level of services. We can monitor, control, and report the usage.

- Economical: It is the one-time investment as the company (host) has to buy the storage and a small part of it can be provided to the many companies which save the host from monthly or yearly costs.

- Security: is one of the best features of cloud computing. It creates a snapshot of the data stored so that the data may not get lost even if one of the servers gets damaged. The data is stored within the storage devices, which cannot be hacked and utilized by any other person. The storage service is quick and reliable.

- Pay as you go: the user has to pay only for the service or the space they have utilized. There is no hidden or extra charge which is to be paid.

- Measured Service: Cloud Computing resources used to monitor and the company uses it for recording. This resource utilization is analyzed by supporting charge-per-use capabilities.

Virtualization in Cloud Computing

- **Virtualization** is the "creation of a virtual (rather than actual) version of something, such as a server, a desktop, a storage device, an operating system or network resources".

- is a technique, which allows to share a single physical instance of a resource or an application among multiple customers and organizations.

- It does by assigning a logical name to a physical storage and providing a pointer to that physical resource when demanded.

- Creation of a virtual machine over existing operating system and hardware is known as Hardware Virtualization. A Virtual machine provides an environment that is logically separated from the underlying hardware.

Types of Virtualization

➤ Hardware Virtualization

- When the virtual machine software or virtual machine manager *(VMM) is directly installed on the hardware system* is known as hardware virtualization.

- The main job of **hypervisor** is to control and monitoring the processor, memory and other hardware resources.

- After virtualization of hardware system we can install different operating system on it and run different applications on those OS.

- **Usage**: Hardware virtualization is mainly done for the server platforms, because controlling virtual machines is much easier than controlling a physical server.

➢Operating System Virtualization

- When the virtual machine software or virtual machine manager *(VMM) is installed on the Host operating system* instead of directly on the hardware system is known as operating system virtualization.

- **Usage:** Operating System Virtualization is mainly used for testing the applications on different platforms of OS.

➢Server Virtualization

- When the virtual machine software or virtual machine manager *(VMM) is directly installed on the Server system* is known as server virtualization.

- **Usage:** Server virtualization is done because a single physical server can be divided into multiple servers on the demand basis and for balancing the load.

➢Storage Virtualization

- Storage virtualization is the *process of grouping the physical storage from multiple network storage devices so that it looks like a single storage device*.

- Storage virtualization is also implemented by using software applications.

- **Usage:** Storage virtualization is mainly done for back-up and recovery purposes.

How does virtualization work in cloud computing?

- The **main usage of Virtualization Technology** is to provide the applications with the standard versions to their cloud users, suppose if the next version of that application is released, then cloud provider has to provide the latest version to their cloud users and practically it is possible because it is more expensive.

- To overcome this problem we use basically virtualization technology, By using virtualization, all severs and the software application which are required by other cloud providers are maintained by the third party people, and the cloud providers has to pay the money on monthly or annual basis.

Case study: Linux OS Virtualization

- Vmware workstation software is used to do the virtualization of Operating System.

- For installing any Operating System virtually, you need to install VMware software.

- Before installing linux OS, you need to have iso image file of linux OS (.iso), we will install Ubuntu.

- You can find images in the following url:

https://ubuntu.com/download/alternative-downloads

End of Lecture 8