Course: Cloud Computing

Week 1: Introduction to cloud computing

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Course Description

- This course is concerned with developing an understanding of core principles and techniques of cloud computing.
- Focus will be on understanding the different cloud types, Cloud infrastructure and architecture and uses of the cloud.
- Emphasis will be placed on Cloud deployment and services.

Course Description

- Further discussion of Cloud based storage and Cloud based backup systems, the concept of Virtualization in cloud computing, management, security, cloud Networking, managing the cloud, common components of cloud migration, Mobile cloud ecosystem, the different pillars or trends in cloud computing.

Course Goal

- The Course aims at helping learners understand what cloud computing is.
- Its platforms, how to utilize Storage facilities in the cloud, understanding the architecture of the cloud and securely deploying and migrating to the cloud

The Lecture Learning Outcome

- At the End of the lecture you will be able to:

i. Grasp the concept of Cloud Computing

ii. Understand application of Cloud computing

iii. Explain the cloud architecture

iv. Understand the models for deploying and accessing Cloud computing environment

The Lecture Learning Outcome

i. Understand the different cloud services

ii. Appreciate the benefits and challenges of Cloud Computing

1.1 Introduction to cloud computing

1.2 On-Premise Computing

- To understand cloud computing; we first need to comprehend;
- **On-Premise computing;** Organizations resolve to deploy, manage and own their Hardware and software infrastructure, the data centers are within the organization's building.

On-Premise computing;

- The load of managing the Data center is solely the responsibility of the organization;
- **Why do some businesses continue to maintain on-site IT infrastructure**

❖ Security fears

❖ Tailored to meet organizational needs, goals and objectives

❖ Fear of replacing existing infrastructure to transaction to the unknown.

On-Premise Computing

- Connectivity- Does not depend on external variables like internet
- No monthly subscriptions to the cloud provider
- Absolute control over their own infrastructure

Challenges of on- premise Computing

- High implementation costs
- High maintenance cost
- Limited scalability
- Need for highly skilled and dedicated IT personnel

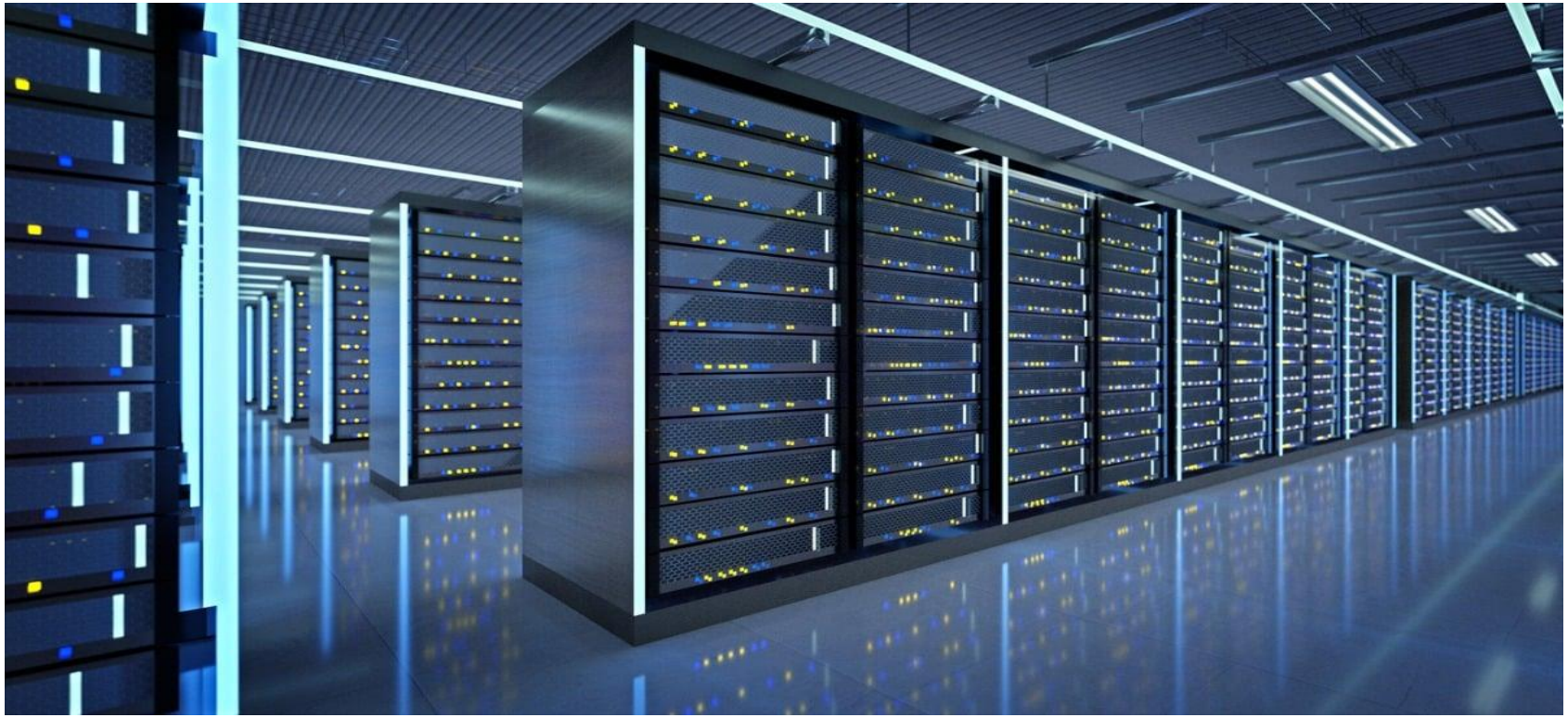
Challenges of on- premise Computing

- Limited resource sharing for offices in different locations-hindering collaboration.
- So much spaces required to house the servers
- Poor security due to costs involved in procuring security hardware and software
- Data recovery and backup is costly

1.3 The Cloud

- **Cloud;** this is a very big building that houses millions of servers/ giant data center that run Several applications, host mails, network services, store big data, host websites etc.
- The cloud is accessed over the internet by clients across the globe.

Defining the Cloud-Room



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Defining the Cloud

- **Cloud Provider;** is an IT firm that seeks to provide its customers with Computing services and they get paid for their services e.g
- Amazon web services (AWS) provides cloud IaaS services varying from virtual compute, storage, and networking and storage-on-demand services like Elastic Compute Cloud (EC2) and Simple Storage Service (S3).

Cloud computing Providers

2. Google Cloud; devoted to executing Web applications, the languages currently supported are Python, Java, and Go

3. Microsoft Azure

4. Force.com and Salesforce.com are cloud computing platform for developing social enterprise applications.

Cloud computing Providers

5. Aneka; It supports a collection of programming abstractions for developing applications and a distributed runtime environment

5. IBM

6. Alibaba

7. Oracle

8. Red Hat

9. Digital Ocean

10. Rackspace

Defining the Cloud

- In cloud computing another company takes the responsibility of hosting your applications.

This means that they handle the costs of servers, they manage the data backup, software updates and other services at an affordable rate.

cloud computing

- Cloud computing is designed to enable global, convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) (Buyya, 2013)

1.4 History of cloud computing

- **First Age**
- Centered around mainframes, big point-to-point networks, centralized databases, and big batch jobs, terminals evolved into personal computers, networks went from hierarchical (with the mainframes at the center of each network) to decentralized, generally more numerous collections of servers and storage scattered throughout an organization (marks, 2010).

History of cloud computing

- Databases where developed with specialized storage infrastructure upon which those databases were built.

History of cloud computing

- **Limitation**
- Despite huge IT Budgets, application backlog remained a challenge, the cost of computing was extremely high.
- **Second Age**
- Second Age experienced the rise of easy-to-use, visually attractive devices that could be used by nearly everyone and rise of the Internet—Sun, Cisco, Mosaic (which became Netscape), web 1.0, eBay, Yahoo, baby.com, and the first Internet Bubble where so significant in this age

History of cloud computing

- **Third Age**
- Data storage needed to be done in a simple, yet fairly reliable manner to facilitate scaling (the Google File System came in so handy
- New architecture(s) immerged like map-reduce family (which inspired open source descendants such as Hadoop) among others (marks, 2010).

History of cloud computing

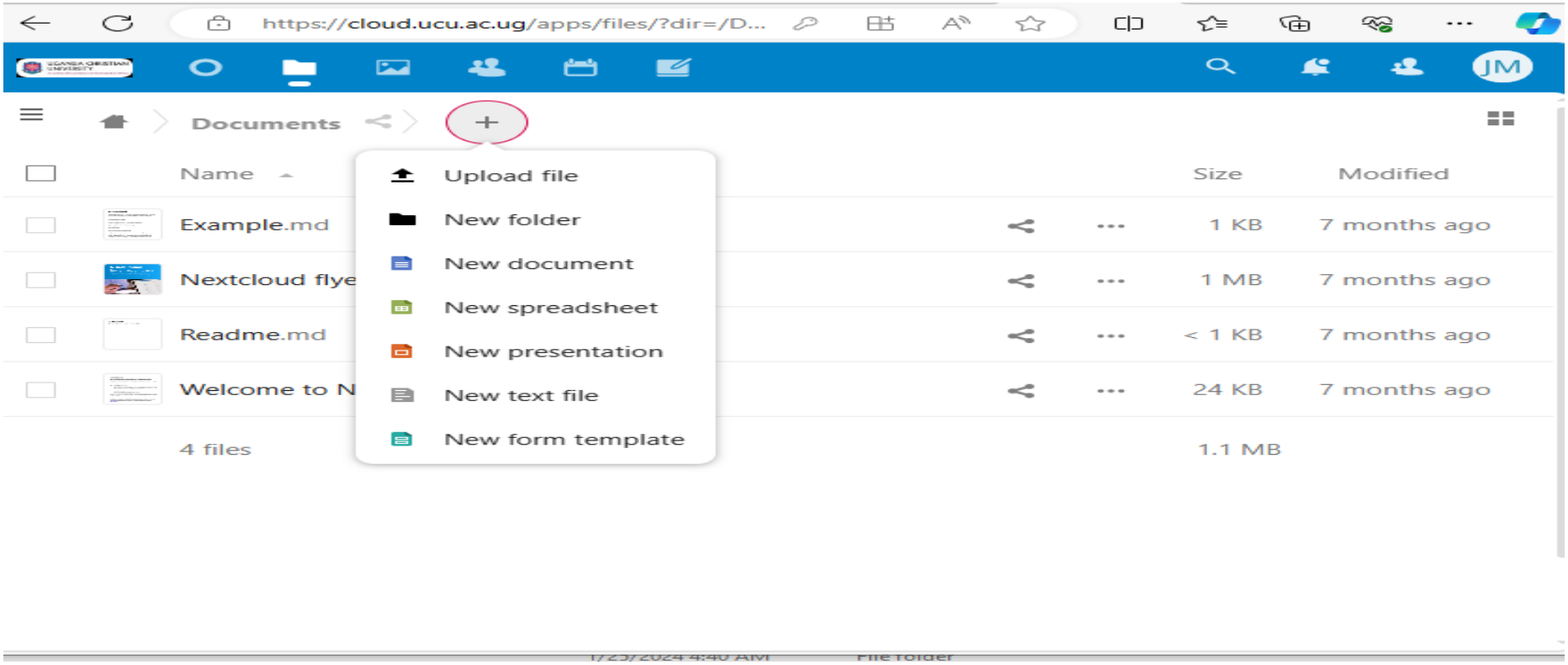
- Amazon began to offer basic computing resources
- Public cloud services and Pay as you go CRM (customer relationship management) implementation led to the rise of Salesforce.com and a number of competitors joined the cloud space market (marks, 2010).

1.5 Application of cloud computing

- Access and integration of, cloud computing resources and systems are now as easy as performing a credit card transaction over the Internet.
- End users can have their documents accessible from everywhere and by any device
- **A simple Demonstration**

You can utilize Own Cloud server to add files, remove files and make changes based on the privileges you have.

Application of cloud computing- Users own cloud interface



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Application of cloud computing

- Large enterprises can offload some of their activities to cloud-based systems.

Companies do not have to buy huge servers

to manage their emails, mail servers like Gmail, yahoo can do the job (Buyya, 2013).

- Small enterprises and start-ups can concentrate on growing their core business, without excessive up-front costs on IT infrastructures

Application of cloud computing

For example Animoto application allows users to create videos out of images, music, and video fragments with the help of Amazon Web Services .

Application of cloud computing

In R. Buyya, *Mastering Cloud Computing* (p. 1-469).

1.6 Cloud Architecture

- Cloud computing Architecture can be divided into two parts
- **Front End** and **Back End**
- **Front End**
- Entails Client part of the cloud computing system

Cloud Architecture

- **Consisting of;**

- Interfaces, Applications Like web browsers that provide access to the cloud computing platforms.
- Virtual sessions.
- Local Area Networks with devices like desktops, laptops, tablet computers, mobile phones, or PDAs.(All devices used to connect to the internet)

Clients

- Three categories of Clients:
- ➢ **Mobile:**
- Mobile devices include PDAs or smartphones, like a Blackberry, Windows Mobile Smartphone, or an

iPhone.

- ➢ **Thin:**
- Clients are computers that do not have internal hard drives, but rather let the server do all the work, but then display the information.
- ➢ **Thick:** This type of client is a regular computer, using a web browser like Firefox or Internet Explorer to connect to the cloud.

Cloud Architecture

- **Back End**

Resources Like Servers and Datacenters extending cloud computing services

Datacenter

- The datacenter is the collection of servers where applications reside. It could be a large room in the basement of your building
- or a room full of servers on the other side of the world that you access via the Internet.

Cloud Architecture

- **Distributed Servers**
- Servers spread across different locations
- For instance, Amazon has their cloud solution servers all over the world.
- If something were to happen at one site, causing a failure, the service would still be accessed through another site.
- Note: Back-end ensures adequate security and traffic control
- The server delivers middleware used to connect devices & enable them communicate to each other.

Cloud Architecture

- **Other components at the back-end**
- Virtual Machines
- Security system
- Backup mechanisms
- Deployment models etc

1.7 Models for deploying cloud computing environment

Public/Internet Clouds

*Third-party, multitenant cloud infrastructure and services

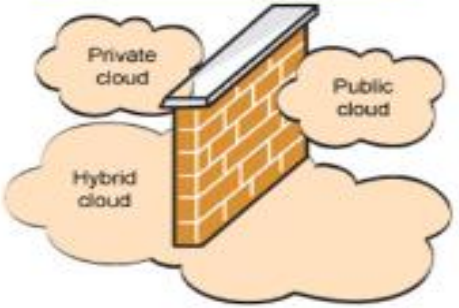
*Available on a subscription basis to all

Private/Enterprise Clouds

*A public cloud model within a company's own datacenter/infrastructure for internal and/or partners' use

Hybrid/Inter Clouds

* Mixed use of private and public clouds; leasing public cloud services when private cloud capacity is insufficient



- Source: Buyya, R. (2013). Mastering Cloud Computing

Models for deploying cloud computing environment

•Public:

- Services and resources are extended to the public by using the internet. Some of the benefits include;
- The user is able to utilize and pay for only the resources needed
- Operational simplicity and Scalability since systems are organized and hosted by a third party
- Set back; security Vulnerability since this environment is accessible to the public and user data is hosted by a third party.

Models for deploying cloud computing environment

•Private:

- Services and resources are reachable within a private institute.

- Benefits; Integration, optimization of hardware deals and scalability.
- More secure than Public Model since their services are availed through private and internal networks
- Setback: Complexity.

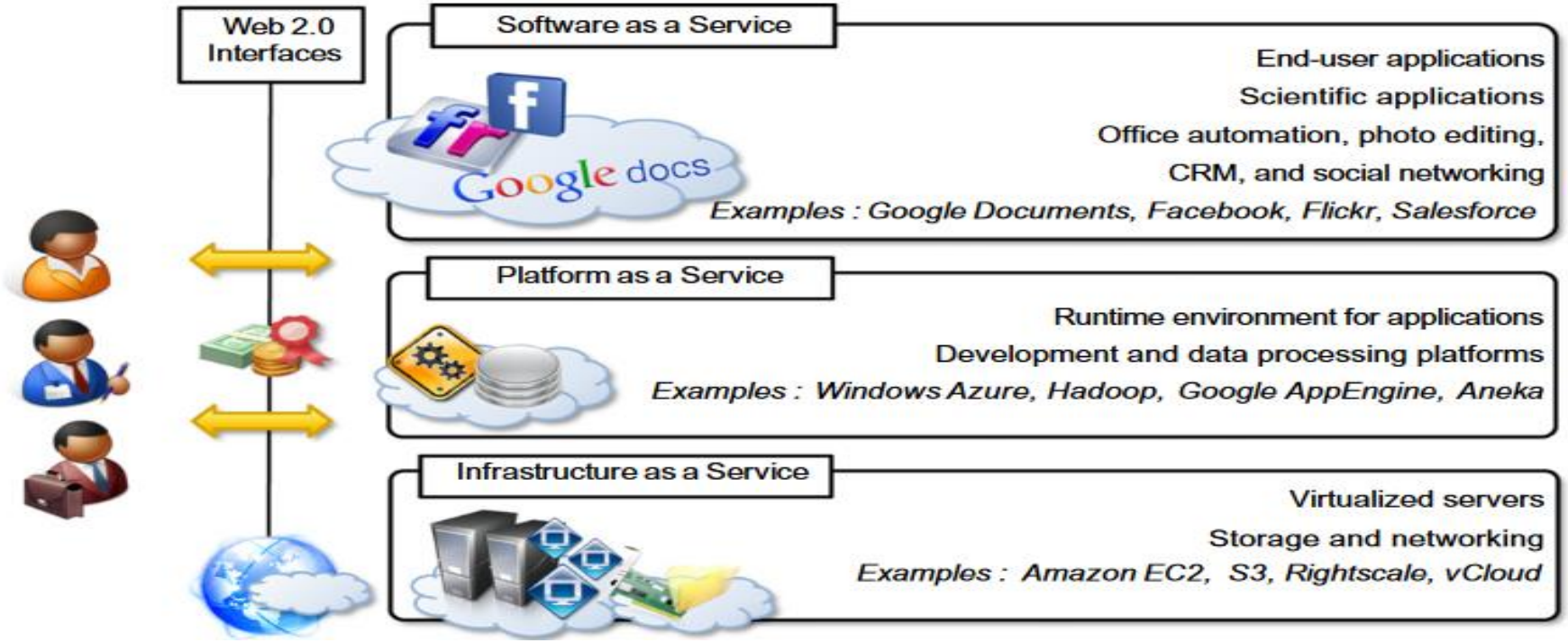
Models for deploying cloud computing environment

- **Hybrid:**
- Is an integration of both private and public clouds, where resources can be used either in a public or a private cloud environment, hence adopting both benefits and challenges of the Private and Public

1.8 Cloud Computing Services

- Cloud computing services are majorly categorized into three:
- Infrastructure-as-a-Service (IaaS),
- Platform-as-a-Service (PaaS),
- Software-as-a-Service (SaaS).

Cloud Computing Services



- Source: Buyya, R. (2013). Mastering Cloud Computing

1.9 Benefits of Cloud Computing

- Resource Pooling: The cloud providers put all the IT resources together like storage, processing, memory, network bandwidth, and virtual machines to server their consumers (Linthicum, 2009).
- On-Demand Self-Service: cloud computing allows user to track server uptimes, capability and network storage on an ongoing basis.

Benefits of Cloud Computing

- 3. Easy Maintenance: By renting the infrastructure and the application services, organizations are no longer responsible for their maintenance. This task is the responsibility of the cloud service provider.
- 4. Large Network Access, Through web based interfaces and numerous desktop and portable devices enabling cloud services to be accessed any where any time.

Benefits of Cloud Computing

- 5. Availability: The cloud capabilities can be changed and expanded according to the usage, the consumer can buy additional cloud storage any time
- 6. Automatic System: Cloud computing analyzes the data required automatically and supports a certain service level of measuring capabilities. It provides both the host and the customer with accountability.

Benefits of Cloud Computing

- 7. Economical: the host incurs a one-off investment that is made available to many companies, which save the host from monthly or annual costs.

- 8. Security: Cloud providers have adequate security mechanism to protect and back up user data.

Benefits of Cloud Computing

9. Pay as you go Users only have to pay for the service or the space in cloud computing, there are no hidden costs meet by the customer (Linthicum, 2009).

10. Measured Service: Cloud computing resources that the company uses can be monitored and record.

1.9.1 Limitations of cloud computing

1. Security and privacy concerns; many organizations still find it hard to entirely entrust sensitive data to a cloud provider.

2. Cloud computing Depends a lot on internet connectivity; cloud resources are often accessed over the internet, where there is no or poor connectivity these resources will not be availed to the customers

Limitations of cloud computing

3. Its quit hard harmonizing laws- there is a possibility that data hosted by a cloud provider will be subjected to the laws of his country.

4. Customization of services to suit individual organizational needs is limited while on premise systems are built as custom data systems

Limitations of cloud computing

5. Losing Control; Handing over all IT infrastructure to a cloud provider, can imply giving up control of your IT infrastructure.

6. Compliance- In instances where the cloud provider can not provide logging and auditing features, compliance with the laws and audit processes become hard.

2.0 summary

- **On-Premise computing**;
- This is a traditional computing system where organizations choose to own and manage their Hardware and software infrastructure
- **In cloud computing** data and all applications reside on the cloud and not on a local computer
- **Cloud Types**; Deployment model: Public cloud, Private cloud, Hybrid Cloud
- Cloud Services: Infrastructure-as-a-Service (IaaS),Platform-as-a-Service (PaaS), Software-as-a-Service (SaaS).
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Next Lecture

- Cloud computing Types
- Cloud Service Model
- Infrastructure-as-a-Service (IaaS),
- Platform-as-a-Service (PaaS),
- Software-as-a-Service (SaaS).
- Deployment Model
- Public
- Private
- Hybrid

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