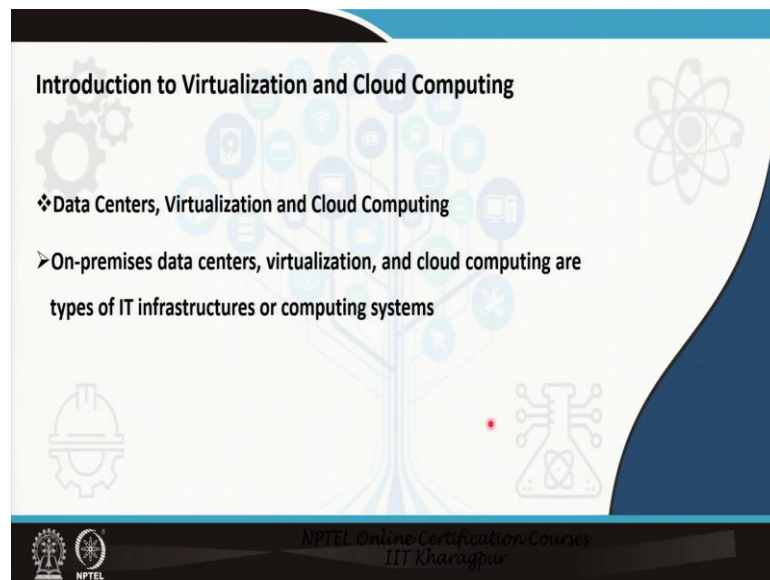


Management Information System
Prof. Kunal Kanti Ghosh
Vinod Gupta School of Management
Indian Institute of Technology, Kharagpur

Week – 07
Module – 04
Lecture – 33
Data Centers, Virtualization and Cloud Computing

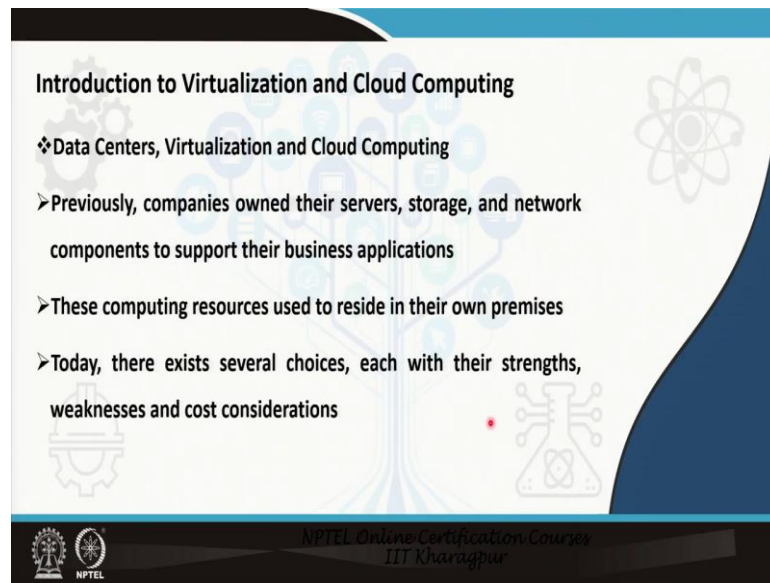
Hi, welcome to the 4th module of week 7 on our course on “Management Information Systems”! Today, the subject topic is ‘data centers, virtualization and cloud computing’.

(Refer Slide Time: 00:43)



Now, on premises, data centers, virtualization and cloud computing are different types of information technology infrastructures or computing systems.

(Refer Slide Time: 01:13)



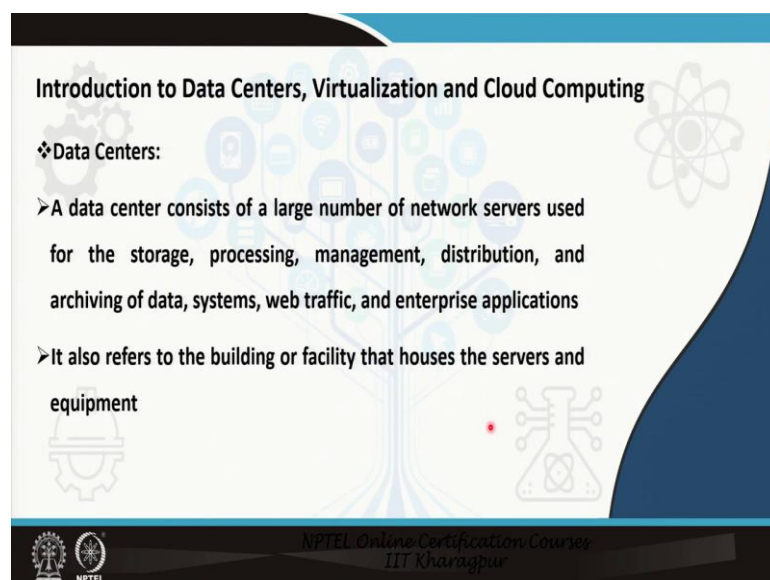
Introduction to Virtualization and Cloud Computing

- ❖ **Data Centers, Virtualization and Cloud Computing**
- Previously, companies owned their servers, storage, and network components to support their business applications
- These computing resources used to reside in their own premises
- Today, there exists several choices, each with their strengths, weaknesses and cost considerations

NPTEL Online Certification Courses
IIT Kharagpur

Previously, companies owned their servers, storage facilities and network components to support their business applications. Those computing resources used to reside in their own premises. Today, there exists several choices, and each of these choice have their own strength and weakness and there are cost considerations related to each of these options.

(Refer Slide Time: 02:19)



Introduction to Data Centers, Virtualization and Cloud Computing

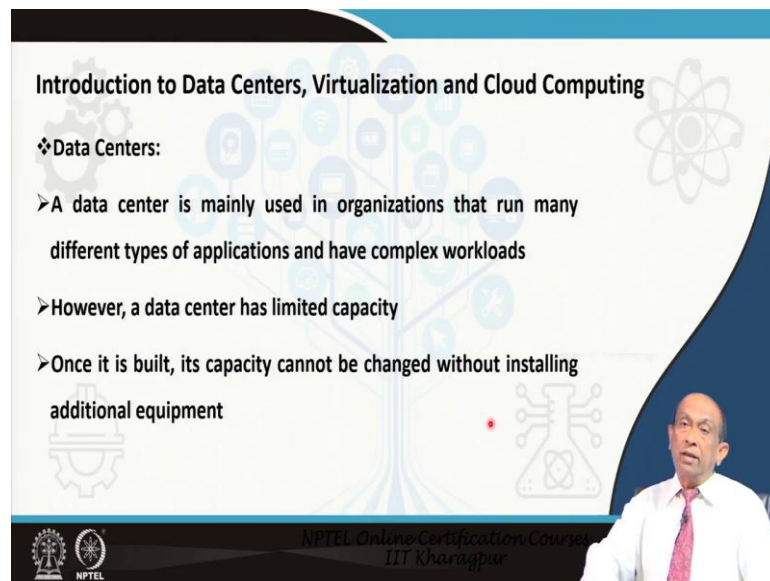
- ❖ **Data Centers:**
- A data center consists of a large number of network servers used for the storage, processing, management, distribution, and archiving of data, systems, web traffic, and enterprise applications
- It also refers to the building or facility that houses the servers and equipment

NPTEL Online Certification Courses
IIT Kharagpur

So, what is a data center? A data center consists of a large number of network servers used for the storage, processing, management, distribution, and archiving of data, systems, web traffic, and enterprise applications.

Data centers also refer to the building or facility that houses the servers and the associated equipments.

(Refer Slide Time: 03:27)



The slide is titled "Introduction to Data Centers, Virtualization and Cloud Computing". It features a background with a blue and white color scheme and various icons representing data, networks, and hardware. The main content is as follows:

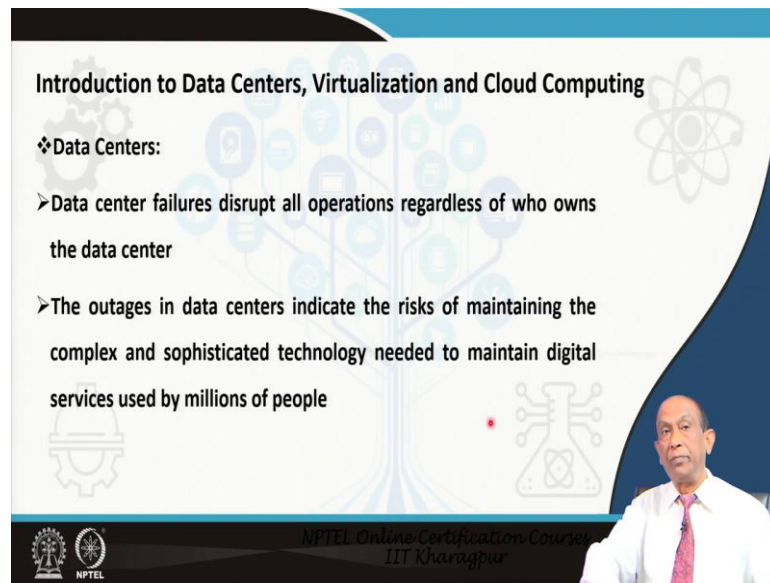
- ❖ **Data Centers:**
 - A data center is mainly used in organizations that run many different types of applications and have complex workloads
 - However, a data center has limited capacity
 - Once it is built, its capacity cannot be changed without installing additional equipment

At the bottom of the slide, there is a logo for NPTEL (National Programme on Technology Enhanced Learning) and the text "NPTEL Online Certification Course IIT Kharagpur". A small inset image of a man in a white shirt and red tie is visible in the bottom right corner of the slide.

A data center is mainly used in organizations that run many different types of applications and have complex workloads. For example, large automotive organizations till very recent times used to maintain their own data centers because they had complex IAS applications.

However, the flexibility associated with a data center is limited, because of its limited capacity. Once a data center is built, its capacity cannot be changed without installing additional equipment.

(Refer Slide Time: 04:45)



Introduction to Data Centers, Virtualization and Cloud Computing

❖ **Data Centers:**

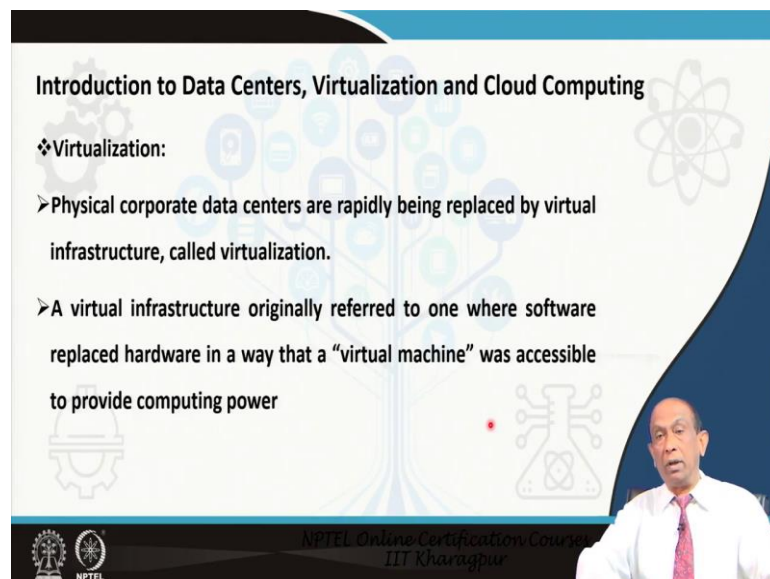
- Data center failures disrupt all operations regardless of who owns the data center
- The outages in data centers indicate the risks of maintaining the complex and sophisticated technology needed to maintain digital services used by millions of people

NPTEL Online Certification Course
IIT Kharagpur

The slide features a background with a blue and white color scheme, including a stylized atom icon and a gear icon. A small inset video of a man in a white shirt and red tie is visible in the bottom right corner.

And the problem is that data center failures, if it once occurs, will disrupt all operations regardless of the fact who owns the data center. The outages in data centers basically indicate the risks of maintaining complex and sophisticated technology which are needed to provide and maintain digital services that are used by millions of people.

(Refer Slide Time: 05:49)



Introduction to Data Centers, Virtualization and Cloud Computing

❖ **Virtualization:**

- Physical corporate data centers are rapidly being replaced by virtual infrastructure, called virtualization.
- A virtual infrastructure originally referred to one where software replaced hardware in a way that a “virtual machine” was accessible to provide computing power

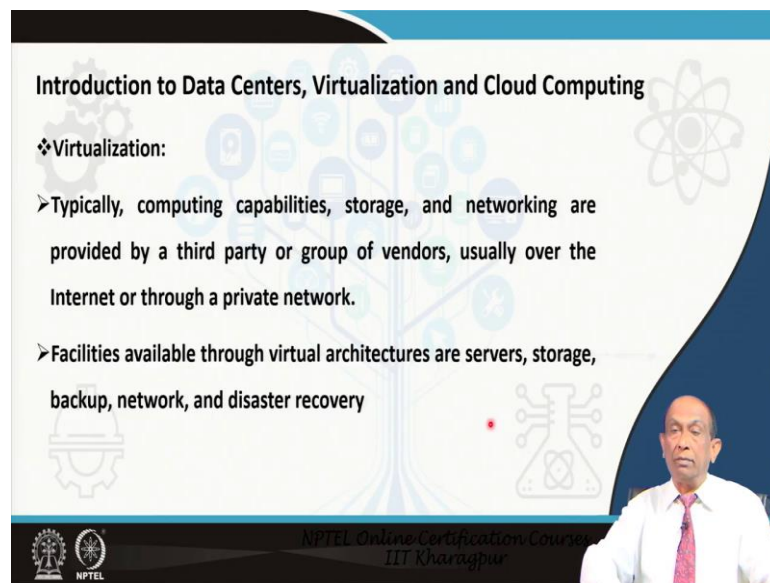
NPTEL Online Certification Course
IIT Kharagpur

The slide features a background with a blue and white color scheme, including a stylized atom icon and a gear icon. A small inset video of a man in a white shirt and red tie is visible in the bottom right corner.

Now, let us talk about virtualization. What is virtualization? Virtualization means, you know software replacing hardware in a way that users, they feel that they are accessing the computing power of a real machine.

Physical corporate data centers, in today's context are rapidly getting replaced by virtual infrastructure, and this is the essence of virtualization. Basically, this concept refers to one where software replaces hardware in a way that a virtual machine is accessible to provide the necessary computing power.

(Refer Slide Time: 07:19)



The slide features a light blue background with a network diagram of nodes and lines. At the top, the title 'Introduction to Data Centers, Virtualization and Cloud Computing' is displayed. Below the title, the word 'Virtualization:' is followed by two bullet points. The first bullet point states that computing capabilities, storage, and networking are typically provided by a third party or group of vendors over the Internet or a private network. The second bullet point lists facilities available through virtual architectures: servers, storage, backup, network, and disaster recovery. In the bottom right corner, there is a small video inset of a man in a white shirt and red tie. The bottom of the slide contains the NPTEL logo and the text 'NPTEL Online Certification Course IIT Kharagpur'.

Introduction to Data Centers, Virtualization and Cloud Computing

❖ **Virtualization:**

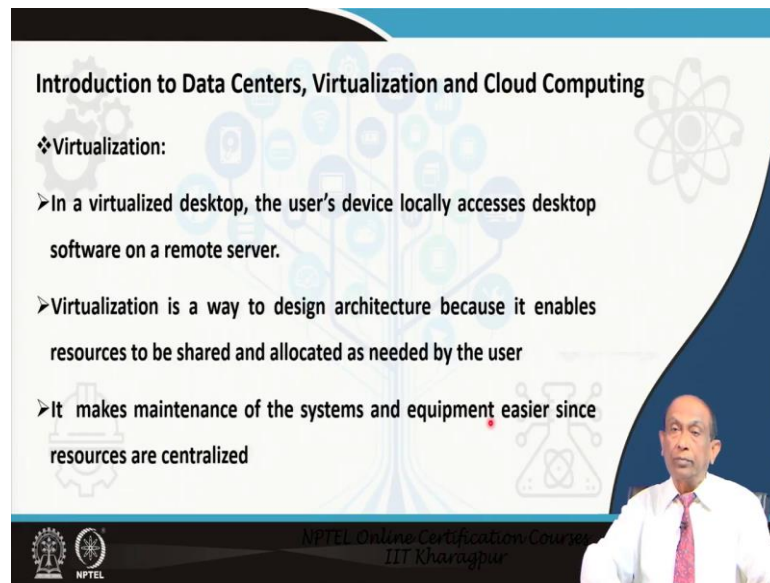
- Typically, computing capabilities, storage, and networking are provided by a third party or group of vendors, usually over the Internet or through a private network.
- Facilities available through virtual architectures are servers, storage, backup, network, and disaster recovery

NPTEL Online Certification Course
IIT Kharagpur

Typically, computing capabilities, storage and networking are provided by a third party, basically the service providers or group of suppliers, usually over the internet or through a private network.

Facilities that are available through this kind of virtual architectures consists of different kinds of servers, storage facilities, backup facilities, network and disaster recovery servers. Even other things that are necessary for disaster recovery.

(Refer Slide Time: 08:37)



Introduction to Data Centers, Virtualization and Cloud Computing

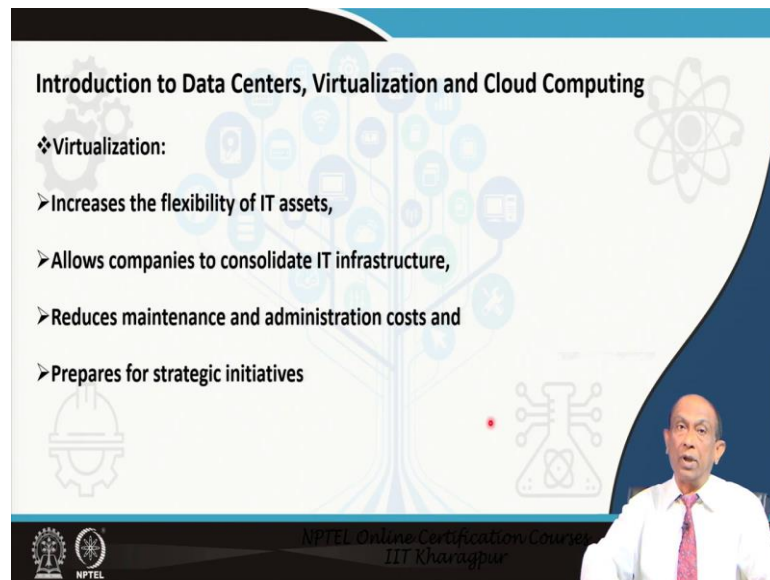
❖ **Virtualization:**

- In a virtualized desktop, the user's device locally accesses desktop software on a remote server.
- Virtualization is a way to design architecture because it enables resources to be shared and allocated as needed by the user
- It makes maintenance of the systems and equipment easier since resources are centralized

NPTEL Online Certification Course
IIT Kharagpur

In a virtualized desktop, the user's device locally accesses the desktop software on a remote server. Virtualization is a way to design architecture because it enables resources to be shared and allocated as needed by the user. Basically, it makes maintenance of the systems and equipment easier, since all the resources are centralized.

(Refer Slide Time: 09:59)



Introduction to Data Centers, Virtualization and Cloud Computing

❖ **Virtualization:**

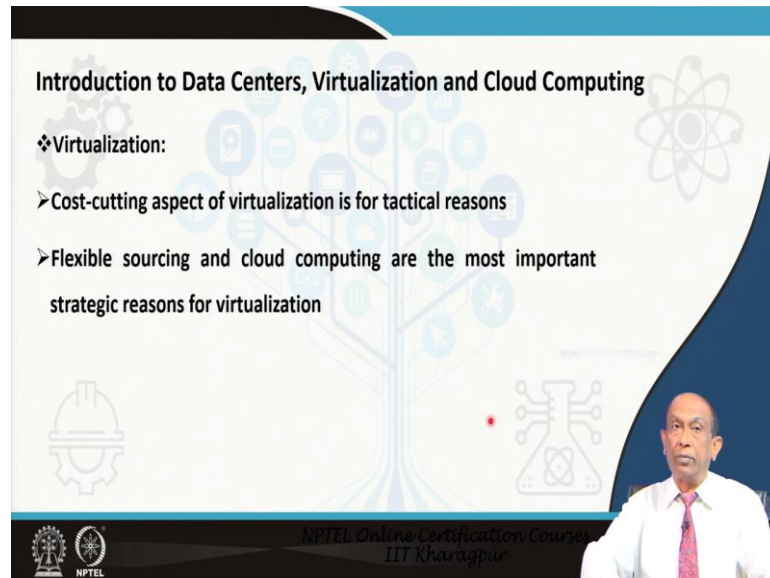
- Increases the flexibility of IT assets,
- Allows companies to consolidate IT infrastructure,
- Reduces maintenance and administration costs and
- Prepares for strategic initiatives

NPTEL Online Certification Course
IIT Kharagpur

So, in effect, virtualization increases the flexibility of information technology assets. It allows companies to consolidate their IT infrastructure; it reduces maintenance and

administration costs; and it helps the company managers to prepare for the strategic initiatives that they would like to undertake.

(Refer Slide Time: 11:03)



Introduction to Data Centers, Virtualization and Cloud Computing

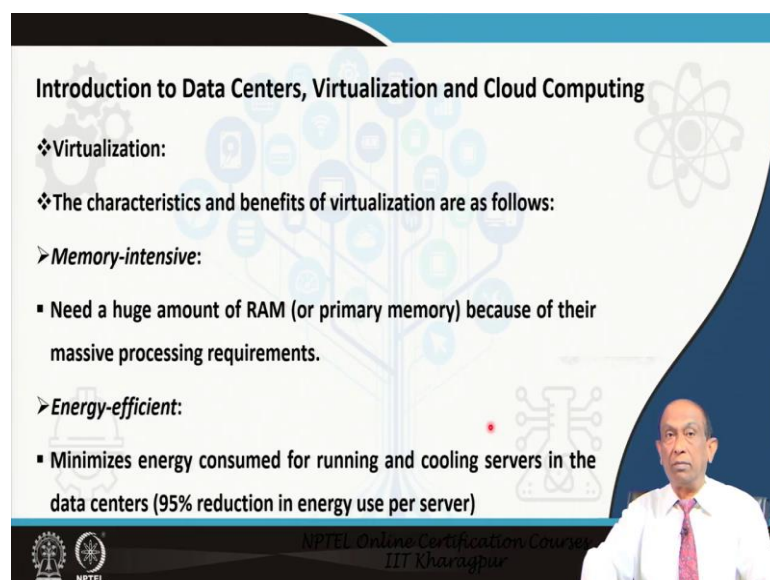
❖ **Virtualization:**

- Cost-cutting aspect of virtualization is for tactical reasons
- Flexible sourcing and cloud computing are the most important strategic reasons for virtualization

NPTEL Online Certification Course
IIT Kharagpur

The cost-cutting aspect of virtualization is basically for tactical reasons. Flexible sourcing and cloud computing are the primary reasons behind this strategy of virtualization.

(Refer Slide Time: 11:41)



Introduction to Data Centers, Virtualization and Cloud Computing

❖ **Virtualization:**

❖ The characteristics and benefits of virtualization are as follows:

- **Memory-intensive:**
 - Need a huge amount of RAM (or primary memory) because of their massive processing requirements.
- **Energy-efficient:**
 - Minimizes energy consumed for running and cooling servers in the data centers (95% reduction in energy use per server)

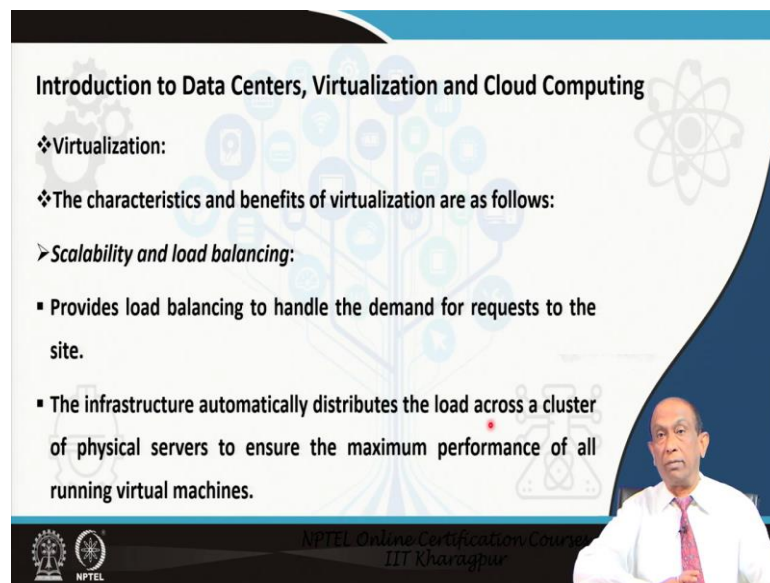
NPTEL Online Certification Course
IIT Kharagpur

So, let us summarize by noting down the characteristics and the associated benefits of virtualization. The first thing that we should note is that virtualization is memory

intensive. Virtualization needs a huge amount of primary memory; that is basically the ram, because in here the processing requirements are massive.

But, the advantage lies in virtualization becoming or being highly energy efficient. This technology minimizes the total energy consumed for running and cooling servers in the data centers. In fact, it has been observed that there is 95 percent reduction in energy use per server if we deploy virtualization.

(Refer Slide Time: 13:41)



The slide is titled "Introduction to Data Centers, Virtualization and Cloud Computing". It contains the following text:

- ❖ Virtualization:
- ❖ The characteristics and benefits of virtualization are as follows:
 - Scalability and load balancing:
 - Provides load balancing to handle the demand for requests to the site.
 - The infrastructure automatically distributes the load across a cluster of physical servers to ensure the maximum performance of all running virtual machines.

The slide also features a speaker overlay in the bottom right corner and logos for NPTEL and IIT Khargapur at the bottom.

The next important thing is, virtualization provides load balancing to handle the demand for requests to the site by so many users. The infrastructure automatically distributes the load across a cluster of physical servers to ensure maximum performance of all running virtual machines. This concept is known as scalability and load balancing is one of the primary characteristics of virtualization.

(Refer Slide Time: 14:51)



Introduction to Data Centers, Virtualization and Cloud Computing

❖ **Cloud Computing:**

➤ **Cloud computing is another term used to describe an architecture based on services provided by a third party over the internet and private network.**

NPTEL Online Certification Course
IIT Kharagpur

The slide features a background with a stylized tree of nodes and various icons like gears, a hard hat, and a network diagram. A speaker is visible in the bottom right corner.

Now, let us come to this concept of cloud computing which has become a very popular concept and widely getting used in various companies across the world. So, what is cloud computing? Basically, cloud computing is a term used to describe an IT architecture based on the services provided by a third party over internet, and maybe along with that the services can be delivered through a private network.

(Refer Slide Time: 15:53)



Introduction to Data Centers, Virtualization and Cloud Computing

❖ **Cloud Computing:**

➤ **Companies offering cloud computing make an entire data center's worth of servers, networking devices, systems management, security, storage, and other infrastructure available to their clients.**

NPTEL Online Certification Course
IIT Kharagpur

The slide features a background with a stylized tree of nodes and various icons like gears, a hard hat, and a network diagram. A speaker is visible in the bottom right corner.

Companies offering cloud computing make an entire data centers worth of servers, networking devices, systems management, security, storage, and other infrastructure available to their clients.

So many companies today, they do not have to maintain any kind of data centers. Cloud company cloud computing give these companies all the facilities that they need and which could have been provided by a data center at a cost which is much much less compared to maintaining own data centers.

(Refer Slide Time: 17:13)

Introduction to Data Centers, Virtualization and Cloud Computing

- ❖ Cloud Computing:
 - Cloud systems are scalable.
 - Clients can buy
 - the exact amount of storage,
 - computing power,
 - security, or other IT functions
 - that they need, when they need it, and pay for what they use.
 - Cloud systems can be adjusted to meet changes in business needs

NPTEL Online Certification Course
IIT Kharagpur

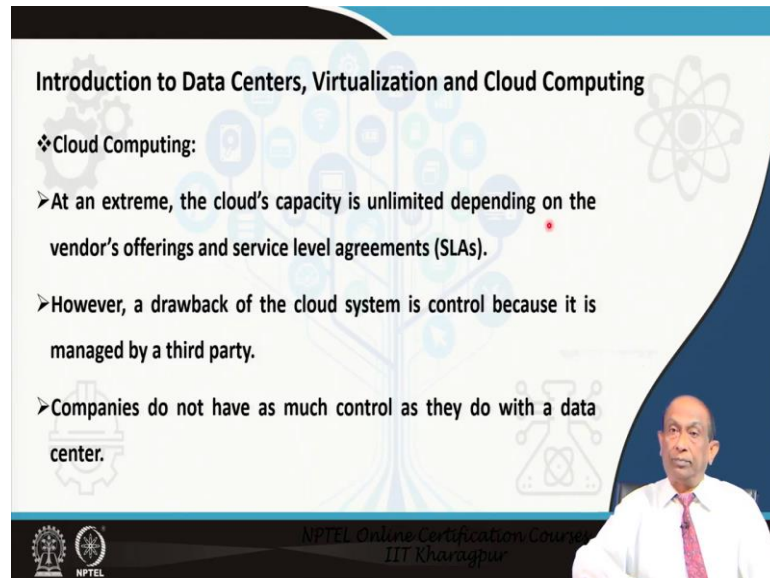
This cloud systems have the advantage that they are scalable; that means, the capacity, the processing power, the storage capacity, everything can be increased or decreased as per the needs of the users.

Clients can buy the exact amount of storage, they can pay for the computing power what they actually need, they get appropriate level of security and other IT functions, and all these things are available when the users need them and the payment is based on actual usage.

So, note this particular points that cloud systems are scalable. Clients can buy the exact amount of storage, computing power, security or other IT functions that they need when they need it and pay for what they use. That means, everything is adaptable, lot of

flexibility is there and cloud systems can be adjusted to meet the changing needs of a business enterprise.

(Refer Slide Time: 19:33)



Introduction to Data Centers, Virtualization and Cloud Computing

❖ Cloud Computing:


- At an extreme, the cloud's capacity is unlimited depending on the vendor's offerings and service level agreements (SLAs).
- However, a drawback of the cloud system is control because it is managed by a third party.
- Companies do not have as much control as they do with a data center.

NPTEL Online Certification Course
IIT Kharagpur

So, at an extreme, the clouds capacity is unlimited depending on what the service provider is offering and the service level agreements that the company or the business enterprise has entered into with this cloud service providers.

But the only drawback of this cloud system is overall control, because the systems are being maintained by a third party service provider. And the companies they really do not have as much control as they can have it with a data center.

(Refer Slide Time: 20:53)



The slide features a light blue background with a network diagram of nodes and lines. The title is 'Introduction to Data Centers, Virtualization and Cloud Computing'. Below it, the text reads: '❖ Cloud Computing: ➤ Service Level Agreements (SLAs):' followed by two bullet points. A speaker, a man in a white shirt and tie, is visible in the bottom right corner. The bottom of the slide has logos for NPTEL and IIT Kharagpur.

Introduction to Data Centers, Virtualization and Cloud Computing

❖ Cloud Computing:

➤ Service Level Agreements (SLAs):

- A negotiated agreement between a company and service provider that can be a legally binding contract or an informal contract.
- The goal is not building the best SLA terms, but getting the terms that are most meaningful to the business.

NPTEL Online Certification Course
IIT Kharagpur

Now, what is this service level agreements? Because this term SLA; service level agreement is widely used in the context of cloud computing. So service level agreement or SLAs refers to a negotiated agreement between a company and the service provider and this agreement can be legally binding contract or in many cases it can be an informal agreement, informal contract.

And when you form this agreement the goal is not to build you know best SLA terms, but getting the terms that are most meaningful to the business in the context of that enterprise.

(Refer Slide Time: 22:15)



Introduction to Data Centers, Virtualization and Cloud Computing

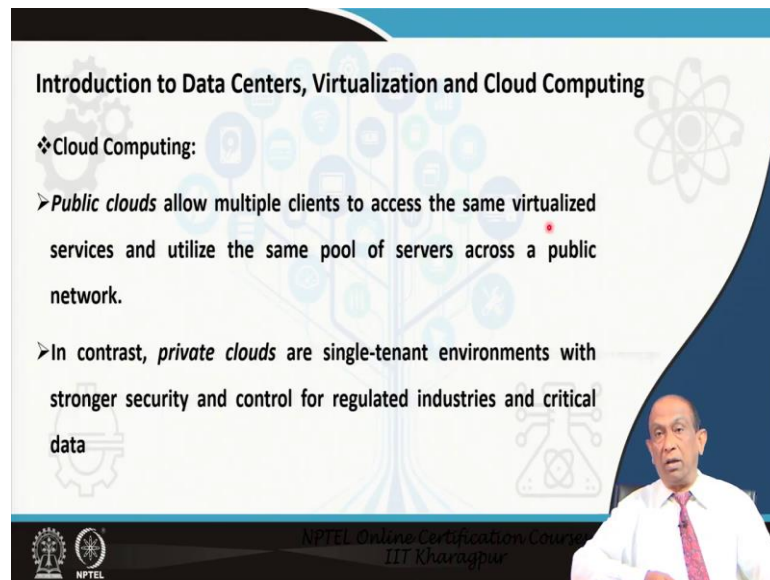
❖ Cloud Computing:

- Unless a client company uses a *private cloud* within its network, it shares computing and storage resources with other cloud users in the vendor's *public cloud*.

NPTEL Online Certification Course
IIT Kharagpur

Another important thing is that, since many a companies they receive this IT services over the internet, unless a client company uses a private cloud within its network, the computing and storage resources are shared with other cloud users in the service providers' public cloud.

(Refer Slide Time: 22:57)



Introduction to Data Centers, Virtualization and Cloud Computing

❖ Cloud Computing:

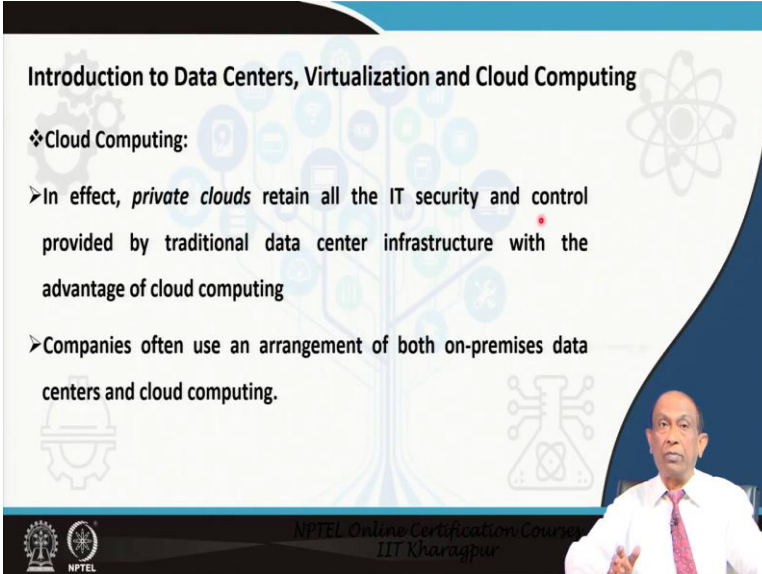
- *Public clouds* allow multiple clients to access the same virtualized services and utilize the same pool of servers across a public network.
- In contrast, *private clouds* are single-tenant environments with stronger security and control for regulated industries and critical data

NPTEL Online Certification Course
IIT Kharagpur

So, public clouds allow multiple clients to access the same virtualized services and utilize the same pool of servers across a public network. So the security question is there.

On the other hand, private clouds are single tenant environments with stronger security and control for regulated industries and where critical data needs to be maintained. Always companies they prefer to have it have the services through a private cloud.

(Refer Slide Time: 24:01)



Introduction to Data Centers, Virtualization and Cloud Computing

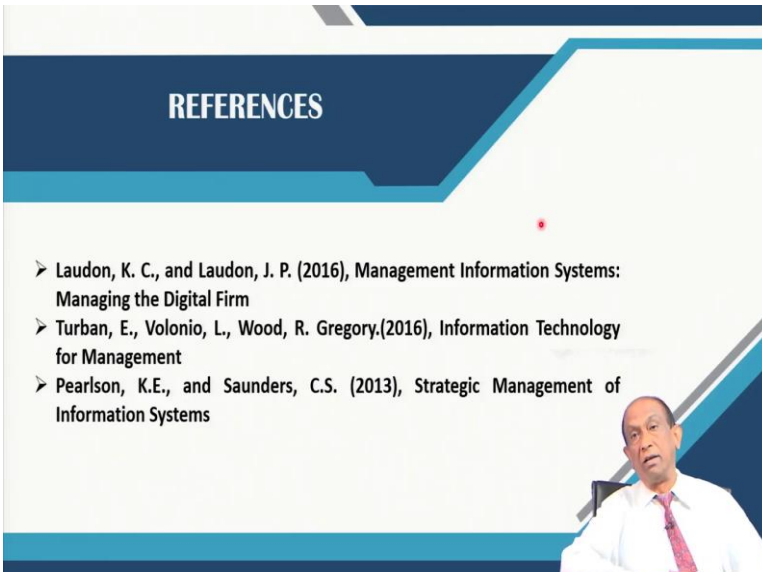
❖ Cloud Computing:

- In effect, *private clouds* retain all the IT security and control provided by traditional data center infrastructure with the advantage of cloud computing
- Companies often use an arrangement of both on-premises data centers and cloud computing.

NPTEL Online Certification Course
IIT Kharagpur

In effect, private clouds retain all the IT security and control that are provided by traditional data center infrastructure with the advantage of cloud computing, at a much lesser cost. Companies often use a combination an arrangement of both on premises data centers and cloud computing to optimize their need for IT infrastructure.

(Refer Slide Time: 24:55)



REFERENCES

- Laudon, K. C., and Laudon, J. P. (2016), Management Information Systems: Managing the Digital Firm
- Turban, E., Volonio, L., Wood, R. Gregory.(2016), Information Technology for Management
- Pearson, K.E., and Saunders, C.S. (2013), Strategic Management of Information Systems

These are the references that have been used in preparing this particular module.

Thank you all for your patience!