

Lecture 4

Data Center Technology Cloud Storage



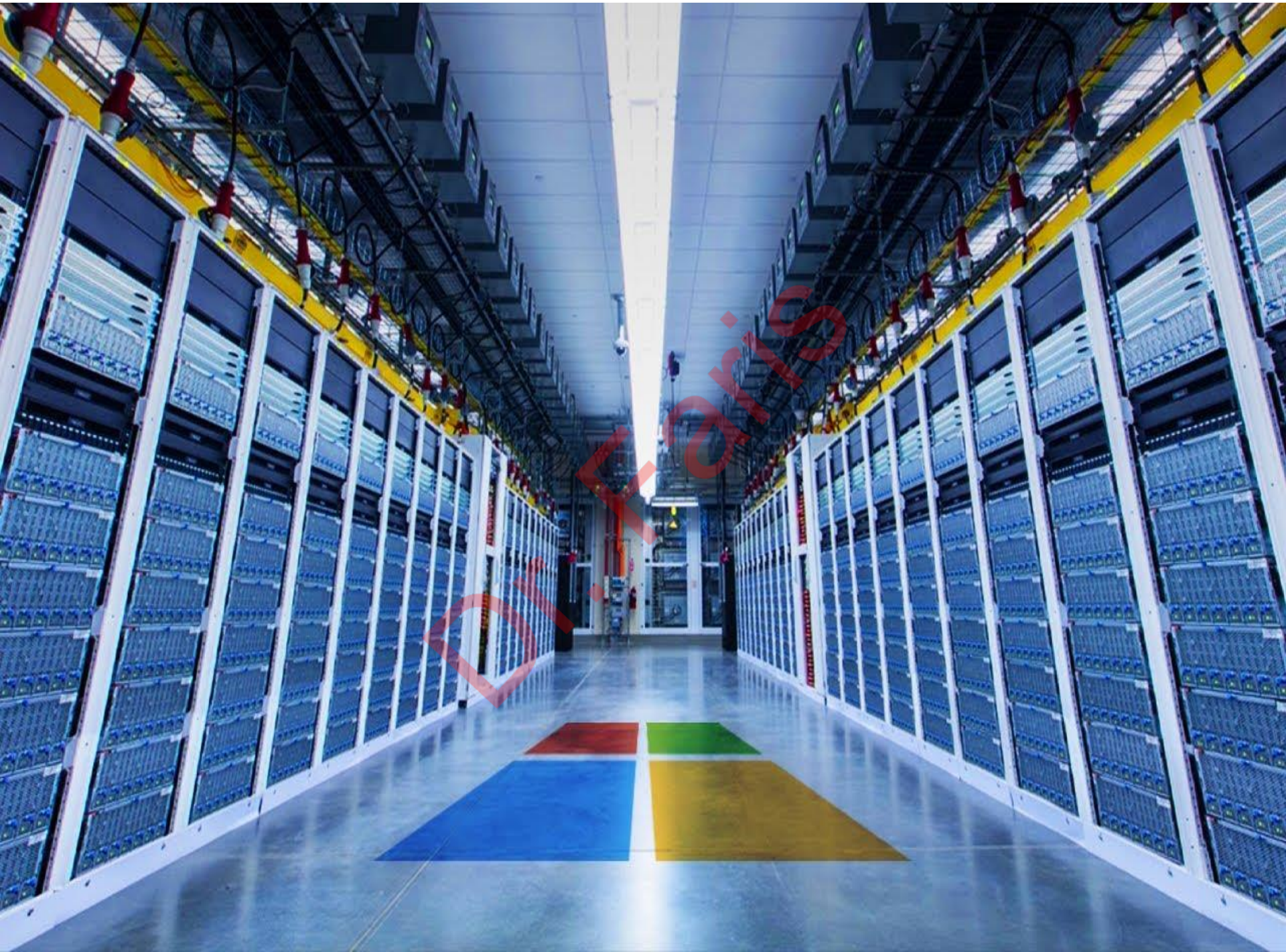
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What is Data Center in Cloud Computing?

The cloud computing backbone (العمود الفقري) is Data centers in the cloud computing ecosystem that support range diverse of services such as applications, platforms as well as infrastructure thereby serving as a critical enabler for digital transformation and development.





What is a Data Center?

A data center is a centralized facility equipped with computing resources such as servers, storage systems, networking equipment, and cooling infrastructure that is used for the delivery of cloud services over the Internet. Data centers in [cloud computing](#) require high levels of reliability, availability, and scalability. To achieve continuous operation and reduce the possibility of service disruptions, they are built with redundancy and failover mechanisms, when need be. These mechanisms include security measures such as access controls, encryption, and monitoring which protect from unauthorized access and cyber threats only.

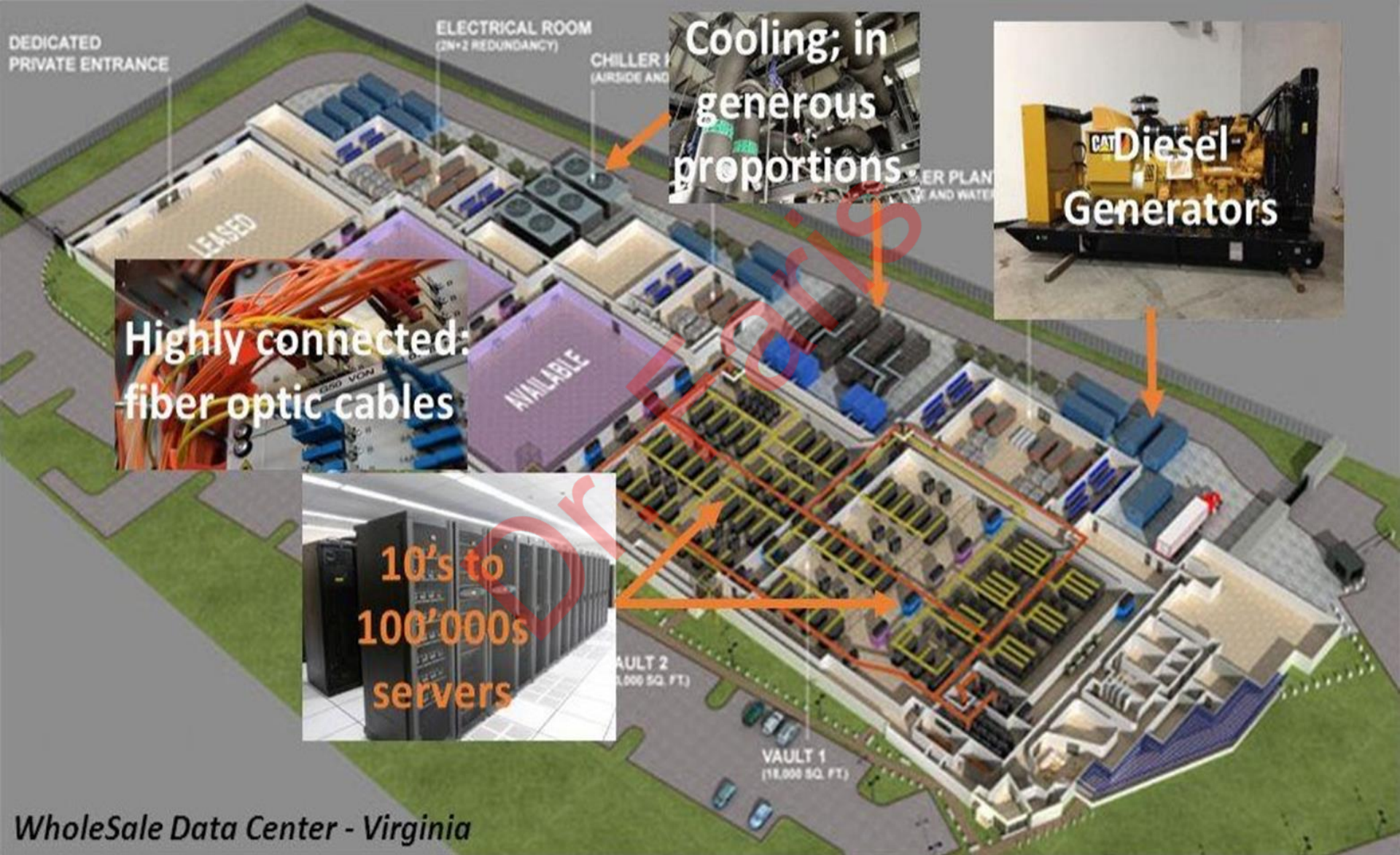
What is a Data Center?

"A facility used to house computer systems and associated components."
(Wikipedia)

"It is the brain of a company and the place where the most critical processes are run."
(SAP)

"It is a factory that transforms and stores bits."
(Albert Greenberg - Microsoft)

The Data Center



Why are Data Centers Important?

Data centers are important in cloud computing for many reasons:

- **Infrastructure Hosting:**

Data centers are buildings or spaces where there is equipment needed in order for it to function and maintain virtualized computer resources supporting cloud computing. These hardware units have servers (computers), disks or tapes with information on them (storage), connections between different parts within businesses (networking), and air conditioners among other things that cool them down.

•**Scalability:**

Based on demand, cloud providers have the capacity to increase or reduce computing resources due to Datacenter **cost-effectiveness**. This way, it enables cloud services to cater to, changing workloads while at the same time maintaining their performance at an optimal level in terms of cost-effectiveness.

•**Reliability and High Availability:**

Data centers have been made redundant and failover mechanisms have been used to less to and data centers and hardware components.

•Security:

Things, like access controls, encryption or intrusion detection systems, and, physical security protocols among other measures, are done by data centers as part of robust security measures to protect against cyber threats as well as prevent unauthorized access.

•Efficiency and Sustainability:

In order to cut down on running expenses and environmental footprints, data centers try to optimize their resource use and be more energy-effective. Technologies, like virtualization, automation,, and cooling systems that save energy, are employed in order to get the most out of available resources while using the least amount of electricity possible.

Role of Data Centers in Cloud Computing

Data centers serve as the foundation of cloud computing, enabling the delivery of a vast array of services to users worldwide. They host the infrastructure that powers popular applications and platforms, including social media networks, e-commerce websites, and enterprise software solutions. Without the underlying infrastructure provided by data centers, the seamless experience of accessing data and applications from any device, anywhere, would not be possible.

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How does a data center work in cloud computing?

Infrastructure and resources are made available through data centers to offer computing services over the internet in cloud computing. The following is a simplified explanation of how data centers function with respect to cloud computing:

•Resource Provisioning:

Cloud providers own and operate massive data center facilities equipped with thousands of servers, storage systems, networking equipment, and other hardware. These resources are pooled together and virtualized to create virtual instances that can be allocated to customers on-demand.

How does a data center work in cloud computing?

•**Virtualization:**

The abstraction of physical hardware, allowing multiple virtual instances (virtual machines or VMs) to run on a single physical server, is made possible by virtualization technology. This in return causes maximization of resource utilization by enabling efficient allocation of computing resources in meeting different workload demands.

•**Service Management:**

The services are provided, managed, maintained by these providers so that customers have no longer to worry about handling the underlying infrastructure in addition to concentrating on developing and running applications.

How does a data center work in cloud computing?

•Data Storage:

data centers have massive storage systems that can store petabytes worth of information, quite a significant amount of information can be stored in Data centers. The durability and availability of data is usually maintained through using multiple servers as well as disks which ensure back-up copies are created every time some changes are made to this information. This minimizes risk associated with data loss particularly due power failures because there will always be power backups at least. Storage schemes vary in terms of performance; some employ advanced techniques like solid-state storage or distributed file system while others still use traditional storage ideas based on HDDs.

How does a data center work in cloud computing?

- Networking:** Data centers contain the very advanced infrastructure of networking so as to make communication among servers, storage systems and external networks easier enabling smooth connectivity of cloud services with low latency and high throughput of transferring data.

- Security:** Data centers are especially characterized by elevated levels of security that help protect sensitive information and also stop any unauthorized persons from accessing it. A range of measures such as encryption, access controls, firewalls, intrusion detection systems and physical security protocols are in place to protect both the infrastructure and the information contained therein from cyber threats and breaches.

The Evolution of Data Centers in Cloud Computing

- Recently, there has been significant advancement in data centers. They have grown from mere server rooms located within an organization to sophisticated computer installations that house a wide range of computing resources comprising servers, storage, networking equipment amongst others. Specifically, they are designed for the needs of cloud computing in which several services are provided over the internet. The ability to scale up or down, and the high level of protection and dependability are therefore ensured, along with a big range of options in terms of applications being provided through the internet.

Types of Data Centers in Cloud Computing

- Public Cloud Data Centers:** Cloud service providers like Amazon Web Services (AWS), Microsoft Azure, and Google Cloud Platform (GCP) own and operate these. They provide computing resources, storage as well as other services to various customers through the internet
- Private Cloud Data Centers:** Individual organizations own and operate these in order to fulfil their particular computing requirements. They may be on the premises or hosted by third-party providers and they give an increased level of control as well as customization possibilities.

Types of Data Centers in Cloud Computing

- Hybrid Cloud Data Centers:** They employ qualities from both public cloud as well as private clouds, thereby fostering round the clock sharing of information and programs across them. Public clouds offer firms with elasticity in computing capacity, while private clouds are used to cater for confidential data or individual jobs, as it fosters a high-quality environment.

- Edge Data Centers:** These are smaller facilities to reduce latency and improve performance for applications that require real-time data processing. They are positioned closer to end-users. For IoT (Internet of Things) applications, content delivery and other services which are sensitive of latency, edge data centers are gaining more attention.

Types of Data Centers in Cloud Computing

- **Enterprise Data Centers:** Large organizations typically retain data centers to help internal IT systems and software. Such centers can be very diverse in terms of their size and details based on what a given organization wants and has at its disposal.

Questions & Answers

- Q) What role does a data center play in cloud computing?

The backbone of cloud computing is dependent on data centers that provide physical infrastructure support for cloud services, store/process data and host applications, deliver computing resources using the internet.

Questions & Answers

Q) How are data centers different from traditional server rooms?

Data centers are generally larger and more complex than the traditional server rooms. They are engineered to accommodate a huge number of servers coupled with networking equipment, often featuring redundant power sources, cooling systems and security systems to guarantee uninterrupted operation.

Questions & Answers

Q) What are the key components of a data center in cloud computing?

Servers (either physical or virtual), storage systems, networking equipment – routers, switches; cooling systems; power distribution units (PDUs), backup generators; security systems like firewalls from where some people may gain access while others cannot.

Questions & Answers

Q) What are the different types of data centers used in cloud computing?

Different kinds of data centers exist, these are; public cloud data centers owned and operated by cloud service providers like AWS, Azure and Google Cloud, private cloud data centers for exclusive use by individual organizations and hybrid cloud data centers combining elements of both public and private clouds.

Cloud Storage

- 1- Introduction
- 2- What is cloud storage?
- 3- How does cloud storage work?
- 4- Cloud Storage - Business Benefits
 - What does it cost to users?
- 5- Advantages of Cloud Storage
- 6- Disadvantages of Cloud Storage

Introduction

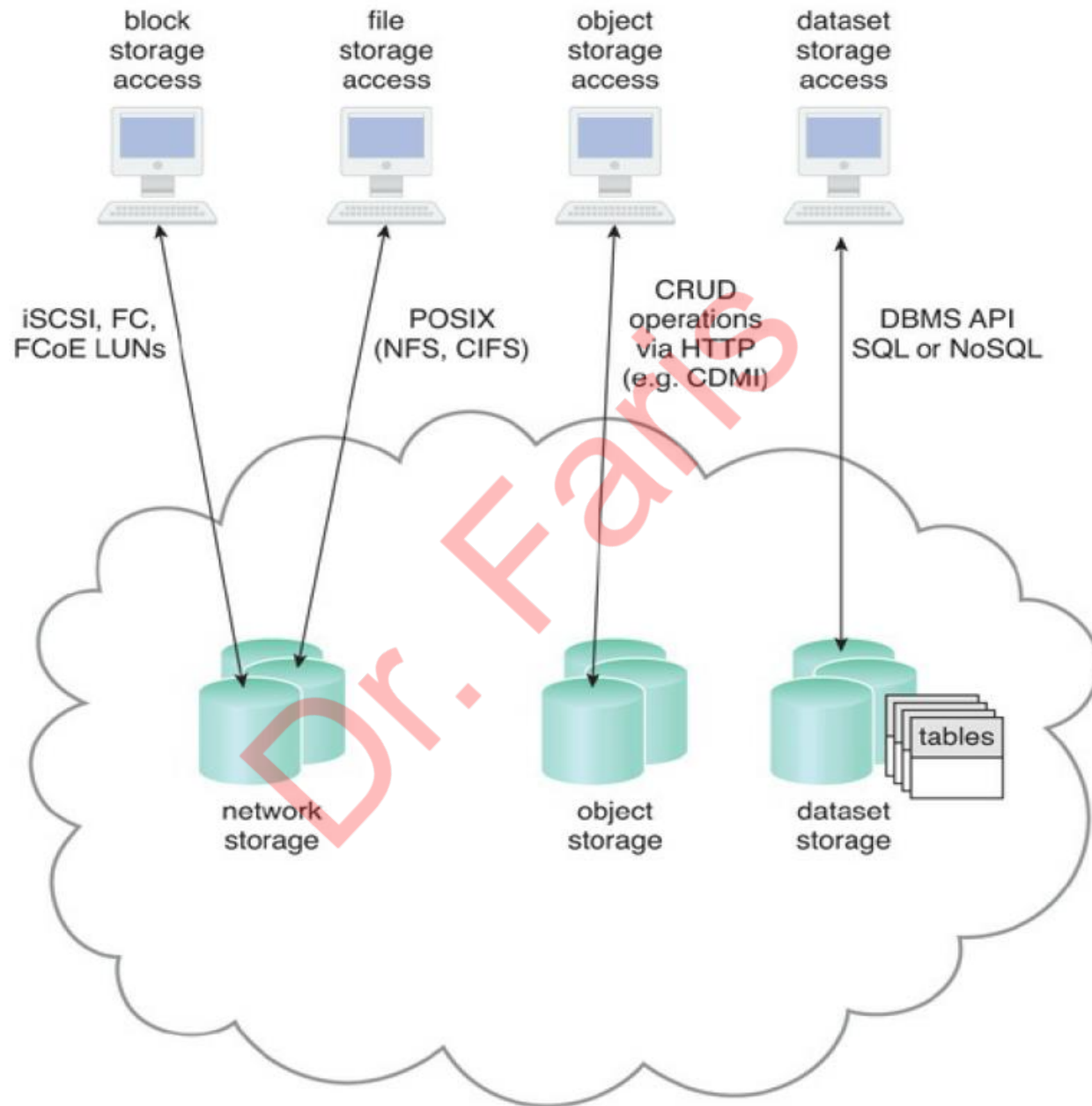
Cloud storage is a model of data storage in which the digital data is stored in logical pools, the physical storage spans multiple servers (and often locations), and the physical environment is typically owned and managed by a hosting company.

Cloud Storage Level

Cloud Storage Levels

Cloud storage device mechanisms provide common logical units of data storage, such as:

- **Files** – Collections of data are grouped into files that are located in folders.
- **Blocks** – The lowest level of storage and the closest to the hardware, a block is the smallest unit of data that is still individually accessible.
- **Datasets** – Sets of data are organized into a table-based, delimited, or record format.
- **Objects** – Data and its associated metadata are organized as Web-based resources.



Features of Cloud Storage :

Cloud storage offers a variety of data security options.

- These storage options are easily accessible with every internet-connected device.
- Faults are easily traceable in cloud-based storage.
- Setting up and cloud storage is way more effective and easier than traditional ones.

Parameters	Cloud Storage	Traditional Storage
Performance	Cloud storage perform better due to using NoSQL.	Traditional storage perform a bit slow as compared to cloud.
Maintenance	This type of storage options are easy to maintain as you use and service provider takes care of maintenance.	This storage are heavy to manage as you need to manually run through maintenance tools.
Reliability	Cloud storage are highly reliable as it takes less time to get under functioning.	Traditional storage requires high initial effort and is less reliable.
File Sharing	Cloud storage supports file sharing dynamically as it can be shared anywhere with network access.	Traditional storage requires physical drives to share data and network is to established between both.
File access time	In this system file access time is dependent on the network speed.	This system has fast access time as compared to cloud storage.
Security	Cloud storage are more secure as it integrates with many security tools.	Traditional storage are secure with they can get attacked easily through virus and malwares.
Applications	Amazon Drive, Dropbox, AutoSync are some applications of cloud storage.	HHD, SSD and Pen drives are some applications of traditional storage.

Cloud Storage - Personal Use Benefits

iCloud



My photo
Download photo from
iCloud to my device.

iCloud syncs it
Your photo is stored
in iCloud.

And pushes it to your devices.
Your photo is available on your
iPhone, iPad, Mac, and PC.



- iCloud is a service provided by Apple

- 5GB storage space is free of cost

- Once the iCloud is used you can share your stored data on any of your different Apple devices

- Access to all files, music, calendar, email

Microsoft OneDrive

Microsoft OneDrive is one of the best cloud services by Microsoft. It allows the users to store, share, and sync their files. The stored files, photos, and documents can be accessed from any device anywhere with OneDrive. It also makes collaborations easier, that is the users can work together on the office files from different locations. The files are safely backed up and protected.

Pricing:

- Free plan: 5GB storage
- Standalone OneDrive: \$1.99/month for 100GB
- Microsoft 365 Personal: \$69.99/year for 1TB

Google Drive

Among all of them, Google is one of the finest, easiest & the best cloud storage services. With over 2 billion monthly active users that include Gmail, Docs, Sheets, and other productivity tools, Google provides file storage and synchronization services through Google Drive. It provides encrypted and secured access to the file.

Pricing:

- Free plan: 15GB storage
- Google One: \$1.99/month for 100GB
- Google One: \$9.99/month for 2TB

Dropbox

Dropbox Inc. is an American company that hosts file services & upholds over 15 million active premium users worldwide. The services provided by Dropbox include cloud storage, personal cloud, file synchronization, etc. The files are safe and secure with Dropbox. It lets the users store up to 5TB of data with standard plans and up to 2 GB of data with basic plans.

Pricing:

- Free plan: 2GB storage
- Plus plan: \$9.99/month for 2TB
- Professional plan: \$16.58/month for 3TB

Cloud Storage - Business Benefits

- With cloud storage, there's no need for CDs, external hard drives, or localized servers.
- Data is quickly and automatically updated in the cloud and available for your retrieval whenever you need it.
- Should your office become the victim of a burglary, fire, or natural disaster, your data is safe and secure in the cloud, even if your physical assets are destroyed.
- One of the greatest benefits of cloud storage is its ability to grow with its users.
- With no need for physical, on-site storage space, you can have a smaller workspace, less equipment to buy, and fewer IT employees to maintain your equipment and manage your data.



What are the negatives to cloud computing?

- ▶ **Security**: Many companies may not want to hand over their data to an external organization to store, fearing that they may not have the right security software to protect the company's data.
- **Performance**: There were several incidents that some cloud-service providers temporarily went down or lost customer's data.



Advantages of Cloud Storage

- ▶ Usability
- ▶ Bandwidth
- ▶ Accessibility
- ▶ Disaster Recovery
- ▶ Cost Savings

Dr. Faris