

ITU

Unit 4

Q) What is role of Data center in an organization?
Explain in detail.

A) A Data center is designed to handle high volumes of data and traffic with minimum latency, which makes it particularly useful.

① Data Storage, Backup, Recovery and Management.

② Processing : Big Data, Mining Machine Learning and Artificial Intelligence

③ Powering online gaming communities and platforms

④ High Volume E Commerce transactions.

⑤ Private cloud : Hosting house business productivity applications such as CRM, ERP, etc.

(Customer Relationship Management) (Enterprise Resource Planning)

Q) What are different components of Data Center? Explain in detail
A) Following are different components of Data Center :-

① Server :- It is the primary component which handles various tasks such as storing, processing and sending data to user or other system.

② Networking equipment :- It includes routers, switches, firewalls, and load balancers. These devices manage the flow of data between servers within the data center and external network such as internet.

(3)

Storage System : There are need to store data persistently. It includes HDD (Hard Disk Drive), SSD (Solid State Drive), etc.

(4)

Cooling System : Heat generated by servers and other equipment must be removed to maintain optimal operating conditions. Cooling systems such as A/C or liquid cooling solutions regulate the temperature and prevent from overheating.

(5)

Backup and Disaster Recovery :

It should have data backup, offsite storage and failover mechanism which help to protect against data loss.

(Q)

What are different design models of Data Center?

Explain in detail.

(A)

Data centers are essential for business and organizations that need to store, process and manage large amount of data.

A well designed data center can improve the performance, reliability and security of their critical systems.

(1)

Centralized Design Model -

→ It is one of the oldest and most traditional approach.

→ In this all of the computing resources are located in a single physical location, often referred to as mainframe.

→ The main advantage is that it simplifies

Management and maintenance since all resources are located in one place.

- However it can be costly and difficult to scale, since adding more resources requires significant upgrade to the central infrastructure.

(2) Distributed Design model:

- This is more modern approach to Data center design model as it emphasizes decentralization and flexibility.
- In this the computing resources are spread out across multiple physical locations, often connected by high speed network.
- The main advantage of this model is that it allows for greater flexibility and redundancy, since resources can be added or removed as needed without disrupting the entire system.
- However it can also be more complex to manage and maintain since there are multiple points of failure in the network, components.

(3) Hyperconverged design model:

- It is relatively new approach which includes the data center design that combines storage, compute and networking into a single integrated system.
- In this all the software and hardware components are tightly integrated and managed through a

single interface.

The main advantage is that it simplifies management and reduce cost, since there are fewer hardware components to purchase and maintain.

Hence it is more flexible than other models since all resources are tightly integrated and cannot be easily separated.

Cloud Design Model -

It is highly scalable and flexible approach that leverages virtualization and cloud computing techniques.

In this model, computing resources are abstracted from physical hardware and delivered over the internet.

The main advantage is that it allows virtually unlimited scalability and flexibility, since resources can be provisioned or de-provisioned on demand.

It can be more complex to manage and secure since data and applications are stored off-site and accessed over the internet.

Modular Design Model -

It is a flexible and scalable approach to data center design that emphasize standardization and modularity.

In this computing model, resources are divided into standardized modules.

added or removed as per requirement.

→ The main advantage is that it allows rapid deployment, and easy scalability since new modules can be added quickly and easily.

→ However it can be more complex to manage and maintain since there are multiple modules to monitor and secure.

(i) Define multi tier design data model in detail.

A) → The multi tier architecture have been the most commonly designed model of data center architecture used in enterprise of data center consisting of core, aggregation and access layer.

→ Data center core layer: It provides a fabric for high speed packet switching between multiple aggregation modules.

→ Data center aggregation layer: It supports functions like service module integration, layer 2 domain definition, spanning tree processing and default gateway redundancy.

→ Data center access layer:

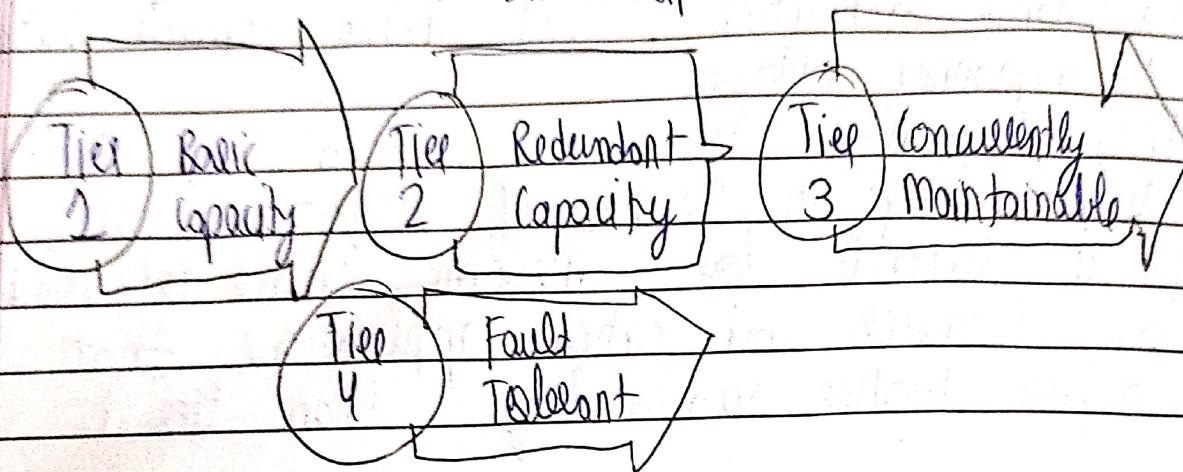
It provides physical level attachment to the server followed and operates in layer 2 or layer 3 mode.

It plays an important role in meeting particular service requirements such as NIC teaming, clustering

and broadcast containment.

fig from pic

- Q) What is tier 1, tier 2 and tier 3 type of data centre (Ans)?
A) The classification of data centres at Tier 1, Tier II and Tier III may be suitable for small business or non-critical applications.



- ① Tier 1 Data centre :-
- It is the most basic level of infrastructure.
 - They have a single path for power and cooling distribution, with no redundant components.
 - Tier 1 data centres are susceptible to disruptions due to power outage, equipment failure and maintenance activities.
 - They typically have an availability of around 99.67% allowing up to 28.8 hours of downtime per year.
 - Tier 1 data centres are suitable for small businesses or non-critical applications where downtime can be tolerated.

② Tie 2 Data Center →

- It offers improved reliability and redundancy compared to Tie 1.
- They have redundant components for power and cooling, providing some level of fault tolerance.
- It may experience planned downtime for maintenance activities but have reduced susceptibility to unplanned outages.
- They typically have an availability of 99.7% allowing up to 22 hours of downtime per year.
- It is suitable for medium-small to medium-sized businesses and critical applications that require higher availability than Tie 1.

③ Tie 3 Data Center →

- It provides a higher level of redundancy and fault tolerance compared to Tie 1 and Tie 2.
- They have multiple paths for power and cooling distribution along with redundant components that allow for maintenance or without disrupting operations.
- They are designed to withstand most equipment failures and planned maintenance activities without impacting availability.
- They typically have an availability of around 99.982%, allowing up to 16 hours of downtime per year.
- It is suitable for medium to large enterprises, cloud service providers and mission critical applications that require high availability and reliability.

(Q5) What is Green Data Center in brief.

A Green Data Center is a repository for the storage, management, and dissemination of data in which the mechanical, lighting, electrical and computer systems are designed to maximize energy efficiency and minimize environmental impact.

Measures such as power usage effectiveness (PUE) are available to help organizations gauge efficiency. PUE is calculated as the power entering the data center divided by the power used in IT infrastructure. This yields a simple ratio that approaches 1.0 as efficiency approaches 100% and the corresponding percentage is expressed as data center infrastructure efficiency. Businesses can improve PUE ratio by reducing the amount of energy in non-IT uses, such as reducing lighting and cooling in non-IT space and implementing other energy efficient building designs. Sustainability is another concern. Power generation creates pollution that is believed to drive climate change and reduce the health of the planet. Creating a sustainable green data center means to strive for net zero carbon emissions for the power that drives data centers. Not zero means that energy is obtained from renewable sources that add zero CO₂ to the atmosphere.

(Q6) What are the different Data Center Recovery Techniques? Explain in detail.

Explain DAS, NAS and SAN in detail.

Data Storage is an essential component of any modern business. The ability to store, access and manage data efficiently is critical for the success of any organization. There are several types of data storage solutions available, including DAS (Direct Attached Storage), NAS (Network Attached Storage) and SAN (Storage Area Network).

DAS (Direct Attached Storage) :-

It is a storage solution where the storage device is directly connected to the host computer or server. This type of storage is typically used for small-scale storage needs such as personal computers or small business.

One of the main advantages of DAS is its simplicity. It is easy to set up and does not require any additional hardware or software. However, it is limited in terms of scalability and can only be accessed by a single host at a time.

Network Attached Storage (NAS) :-

It is a storage solution that connects to a network, allowing multiple users to access the same storage device simultaneously. This type of storage is ideal for small to medium sized business that requires shared storage. One of the main advantage is its flexibility. It can be easily expanded to meet growing storage needs and can be accessed by multiple users from different locations. However, it may require additional hardware and software to set up and maintain.

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SAN (Storage Area Network) :-

- It is a high performance storage solution that connects multiple servers to a centralized storage device.
- This type of storage is ideal for large-scale storage needs such as data centers or enterprise-level businesses.
- One of the main advantages of SAN is its scalability and performance.
- It can support multiple servers and applications simultaneously, providing fast and reliable storage access.
- However, it requires specialized software and hardware, as well as skilled IT professionals to set up and maintain.

- (Q) Discuss the case study on "The Cisco Virtualized Multi-tenant Data Center (VDC)"
- A)
- It is a case study that outlines Cisco's approach to designing and implementing virtualized multi-tenant data centers for enterprise and service providers. This highlights the Cisco experience in network infrastructure, virtualization technologies, and cloud computing solutions.
- Cisco proposed a unified data center architecture that integrates networking, computing, storage, and virtualization techniques into a single, cohesive platform. This architecture enables seamless data resource pooling, dynamic allocation, and centralized management of data center resources.
 - Cisco's solution is designed to support multi-tenancy, enabling multiple customers or business units to share the same physical infrastructure while maintaining isolation and security.

- It emphasizes network virtualization and automation to simplify network provisioning, configuration and management.
- It is designed to scale horizontally and vertically to accommodate increasing workloads and user demands.

Following are outcomes :-

- 1) Cost Saving and Efficiency
- 2) Flexibility and Agility
- 3) Security and Compliance
- 4) High Availability and Reliability