

Answer01:

- **Motivation behind Rack-Mounted Server:**

Conventional servers used in a datacenter for deployment. Designed in a way where servers can be stacked on top of each other on a rack in individual slots called bays. It has low-profile enclosure by installation in a vertical fashion.

- **Motivation behind Blade Server:**

They prefer to share common infrastructure components with the aim to provide solutions to high density computational problems by trying to maximize the number of servers that can be deployed in a physical space.

Individual Customization and Flexibility is compromised to make blade server more compact due to the sharing of common infrastructure components, whereas in Rack-Mounted Servers, each server has its own set of infrastructure components.

Ref:

- <https://www.techtarget.com/whatis/definition/rack-server-rack-mounted-server#:~:text=A%20rack%20server%2C%20also%20called,secured%20in%20place%20with%20screws.>
- [https://en.wikipedia.org/wiki/Blade\\_server](https://en.wikipedia.org/wiki/Blade_server)

Answer02:

Ethernet is widely used in Data Center(s) because:

- Most used networking standard, it can be used to coordinate data communication within the datacenter as well as with the external world.
- Easily scalable with speed ranging from 1Gbps to about 400Gbps and beyond. Such scalability allows datacenters to accommodate increasing traffic and bandwidth ranges.
- It allows the configuration of various network topologies.

Ref:

- <https://www.quora.com/How-is-Ethernet-used-in-data-centers#:~:text=Ethernet%20is%20widely%20used%20in,scalable%20bandwidth%20and%20low%20latency.>
- <https://www.massivenetworks.com/direct-connect/4-ways-ethernet-boosts-data-center-needs/>

Answer03:

The major problem solved by cloud computing is scalability. When scalability comes into play, the demands for increasing/decreasing resources fluctuate heavily, and due to this fluctuation, data storage needs keep on changing very frequently. NAS and SAN allow the change in storage capacity without the disruption of existing services. Moreover, they also provide cloud service providers with centralized management capabilities which is an important aspect due to multiple resources being shared in the cloud.

As DAS services are not subject to network delays, they are more recommended for the management of local data.

Ref:

- <https://blog.purestorage.com/purely-informational/san-vs-nas-vs-das-whats-the-difference/>

Answer04:

In the Serial Attached SCSI (SAS) architecture, the Phy layer enables the communication between SAS devices by converting the logical signal received into electrical and optical signals to be transmitted onto the physical medium.

Ref:

- <https://www.ibm.com/docs/en/power6?topic=overview-sas-architecture>

Answer05:

The generic file-related system calls are:

- Open
- Read
- Close
- Write

There is no RPC invocation for the Close file operation due to the stateless design of the server, and due to this stateless nature, the server does not store any information related to files state.

Under certain circumstances, the file operation does not result in RPC call due to client-side caching of file-data and metadata.

Answer06:

In FC-2M, there are 3 types of topologies:

- Point-to-Point (P2P)
- Arbitrated Loop (FC-AL)
- Switched Fabric (FC-SW)

Amongst these, the most flexible is FC-SW due to:

- scalable nature of accommodating large number of ports, devices, and storage arrays.
- Flexible configuration in designing network layouts, ensure Quality of Service (QoS) policies, and traffic flow control.

Ref:

- <https://www.storageinfra.com/fibre-channel-topologies/>

Answer07:

An ENode chooses a suitable FCF after reviewing advertisements, initiating a delivery solicitation to commence capability negotiation. Upon receiving the solicitation, the FCF replies to the ENode with a solicited discovery advertisement, validating the negotiated capabilities. Once the solicited discovery advertisement is received, the ENode can proceed with establishing a virtual link to the FCF. This process mirrors the fabric login procedure in FC. Successfully completing the login procedure results in the creation of a virtual port on both the ENode and the FCF, along with a virtual link connecting them.

Answer08:

- a. Same TCP connection could be used to provide higher throughput, as multiple iSCSI node can be reached at same address, and one iSCSI node is accessible at many addresses.
- b. Necessary to ensure in-order delivery of network packets, re-transmission in case of missed packet, or to provide congestion control mechanisms.
- c. It was a relatively new protocol at the time of iSCSI standardization.
- d. Because it does not provide a built-in protection against eavesdropping and other active attacks.



Answer09:

Connection allegiance is the technique where the connection initiator device can use any connection to initiate a communication, but to keep the communication session active, it must use the same connection throughout the connection. iSCSI sessions are managed by the login procedure, once a login request is successfully processed, a new connection is added to the list of existing connections.

Answer10:

Credentials as defined in ANSI INCITS 458-2011, serves as an information packet capable of confirming an identity of a user in Fiber Channel (FC). Access Control is not just restricted to verifying identity, but it is also concerned with what that verified user is allowed to do within the system.

Standardized Scheme provides an example of proof based on Capability Key. It involves a quantity being computed over selective request component based on negotiated security method by using the Computed Key.

Answer11:

There are three approaches to block-level virtualization:

- **Host-based Approach:**  
Volume manager is responsible for tasks related to virtualization and is also responsible for logical volume to native block mapping.
- **Array-based Approach:**  
The storage system controller is responsible for virtualization management.
- **Network-based Approach:**  
The special function in storage network is responsible for virtualization management.

#### **In-Band Approach:**

In this mechanism, virtualization operations are performed within the data path of storage network.

#### **Advantages:**

- Simplifies administration and support for advanced storage.
- The snapshot feature helps in capturing the state of virtual machine at any given point.

#### **Disadvantages:**

- Virtualization function creates a bottleneck and single point of failure.
- Tradeoff in performance of virtual machine on the same host if snapshot is being processed.

#### **Out-of-Band Approach:**

In this mechanism, virtualization operations are performed outside the data path of storage network.

#### **Advantages:**

- Better performance, since the traffic can go straight into the destination without any processing delay caused by the virtualization function.

#### **Disadvantages:**

- No support for advance storage function.
- Per-host caching

I personally think that Cloud Computing environments may benefit from the scalability and performance advantages of out-of-band virtualization, provided that the additional complexity can be effectively managed.

Answer12:

**NOR Flash:**

- Organized in parallel architecture in which individual memory cells are connected in parallel to memory bus.
- Well-suited for applications requiring fast read access.
- Storage density is limited.

**NAND Flash:**

- Random access only to units that are larger than a byte.
- Storage density is not limited.

Ref:

- <https://www.baeldung.com/cs/flash-memory-nor-vs-nand#:~:text=NOR%20flash%20memory%20typically%20has,memory%20cells%20between%20multiple%20pages>.

Answer13:

For deploying NAND flash solid state drive, the limitations which needs to be overcome are:

- Perform erase operation on block basis, whereas page basis is reserved for write operations.
- After certain Write-erase cycles, memory cells erase out.
- Erasing current content before performing an overwrite operation.

Answer14:

The basic operation of consistent hashing involves three major functionalities:

- Mapping range of hash function to a circle, where in a clockwise fashion would make the largest value wrapping around the smallest value.
- A point in a circle act as an identifier to each server in a pool.
- To cache a data item having key “K”, select the server with an identifier value greater than or equal to  $H(k)$

The server selected for K is called K’s successor and is responsible for creating an arc between the identifier of previous server and K.

The consequence of a server entering or leaving a pool is restricted to its immediate neighbors. When a new server joins the pool, then certain keys which were assigned to the server “P” successor are now reassigned to the server, while others remain unaffected. Similarly, if a server “P” decides to leave at any point, only the keys assigned to the server “P” will now be reassigned to its successor.