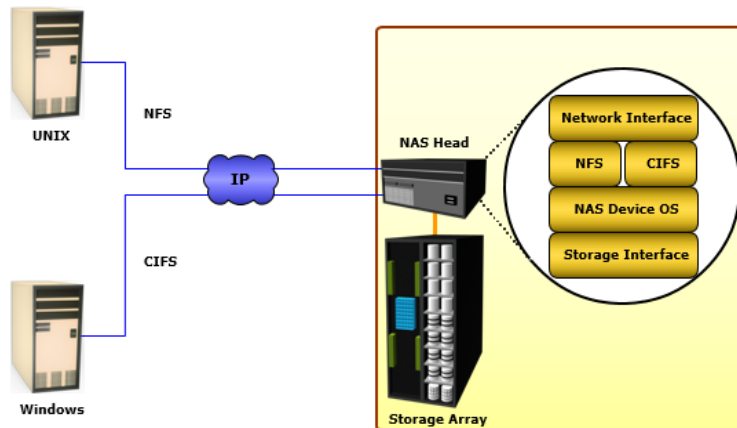


Components of NAS



- Two common NAS file sharing protocols are:
 - CIFS – Common Internet File System protocol
 - Traditional Microsoft environment file sharing protocol, based upon the Server Message Block protocol
 - NFS – Network File System protocol
 - Traditional UNIX environment file sharing protocol

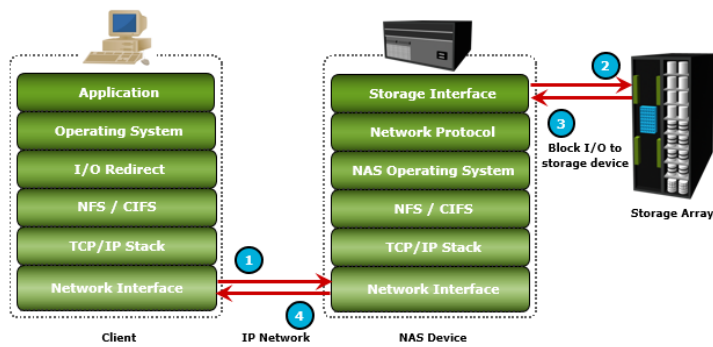
Network File System (NFS)

- Client/server application
- Uses RPC mechanisms over TCP protocol
- Mount points grant access to remote hierarchical file structures for local file system structures
- Access to the mount can be controlled by permissions

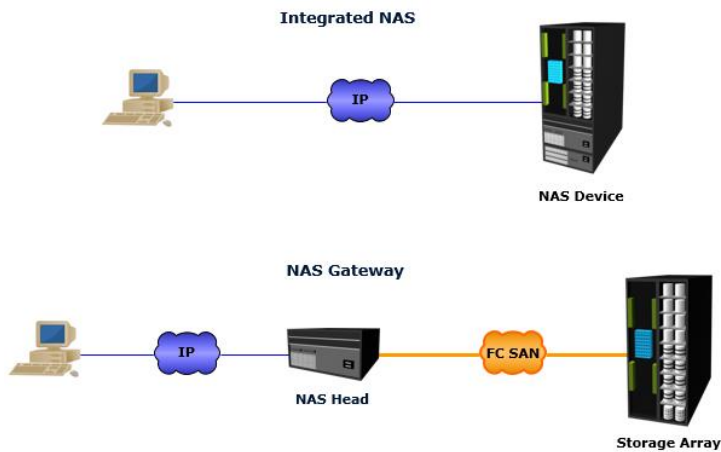
NAS File Sharing - CIFS

- Common Internet File System
 - Developed by Microsoft in 1996
 - An enhanced version of the Server Message Block (SMB) protocol
 - Stateful Protocol
 - Can automatically restore connections and reopen files that were open prior to interruption
 - Operates at the Application/Presentation layer of the OSI model
 - Most commonly used with Microsoft operating systems, but is platform-independent
 - CIFS runs over TCP/IP and uses DNS (Domain Naming Service) for name resolution

NAS I/O



NAS Implementations



2. **What is iSCSI? Explain the protocol stack with a neat diagram.**

[10]

CO2 L1

IP based protocol used to connect host and storage
 Carries block-level data over IP-based network
 Encapsulate SCSI commands and transport as TCP/IP packet

Components of iSCSI

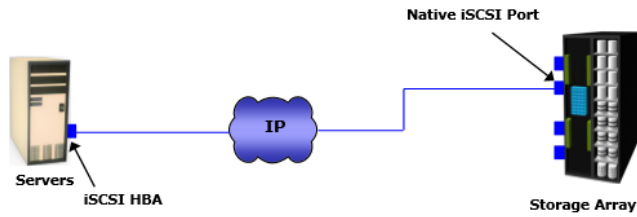
- iSCSI host initiators
 - Host computer using a NIC or iSCSI HBA to connect to storage
 - iSCSI initiator software may need to be installed
- iSCSI targets
 - Storage array with embedded iSCSI capable network port
 - FC-iSCSI bridge
- LAN for IP storage network – Interconnected Ethernet switches and/or routers

• Three options for iSCSI configuration:

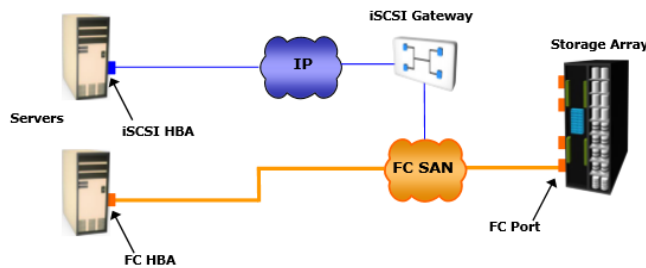
- **Software Initiators**
 - Code that can be loaded onto a host to provide the translation between the storage I/O calls and the network interface
- **TCP Offload Engine (TOE)**
 - Moves the TCP processing load off the host CPU onto the NIC card, to free up processing cycles for application execution
- **iSCSI HBA**
 - A network interface adapter with an integrated ASIC (application-specific integrated circuit)
 - Simplest option for boot from SAN



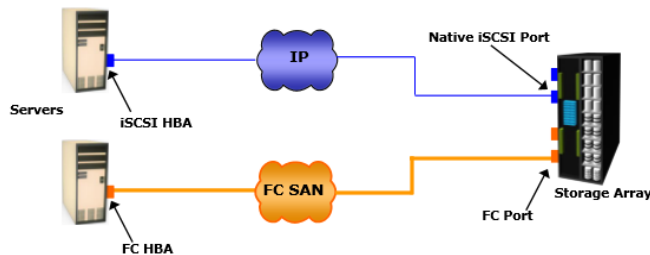
Native iSCSI Connectivity



Bridged iSCSI Connectivity



Combining FCP and Native iSCSI Connectivity



3. What is Storage Virtualization? Discuss its types and challenges.

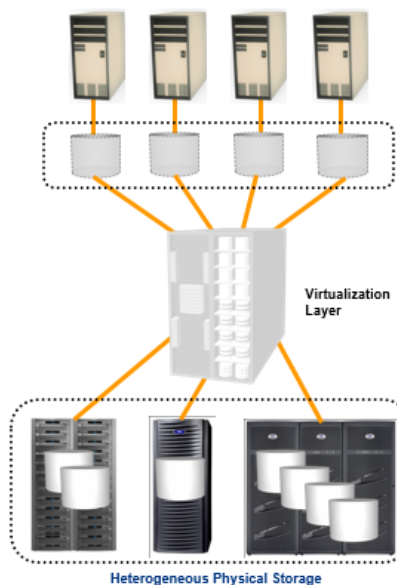
[10]

CO2 L2

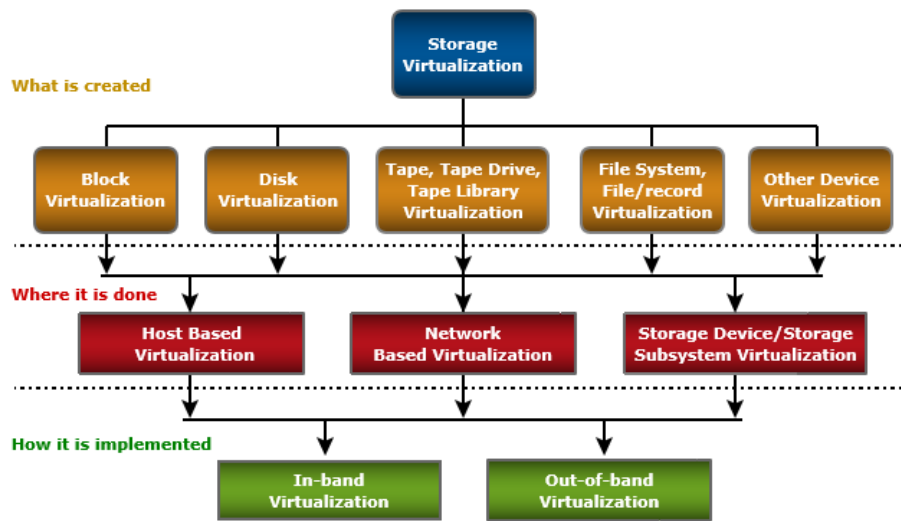
- Virtualization is a technique of abstracting physical resources in to logical view
- Increases utilization and capability of IT resource
- Simplifies resource management by pooling and sharing resources
- Significantly reduce downtime
 - Planned and unplanned
- Improved performance of IT resources

Storage Virtualization

- Process of presenting a logical view of physical storage resources to hosts
- Logical storage appears and behaves as physical storage directly connected to host
- Examples of storage virtualization are:
 - Host-based volume management
 - LUN creation
 - Tape virtualization
- Benefits of storage virtualization:
 - Increased storage utilization
 - Adding or deleting storage without affecting application's availability
 - Non-disruptive data migration



SNIA Storage Virtualization Taxonomy



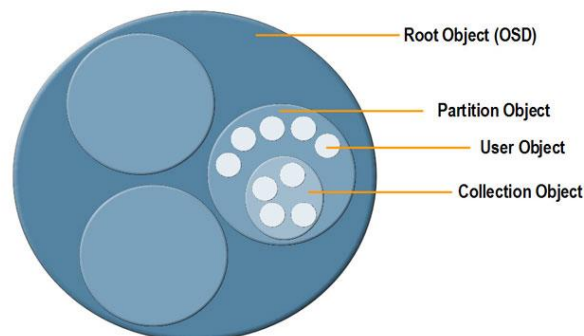
4. Explain the concept of Object Based Storage with a neat diagram

[10]

CO6 L2

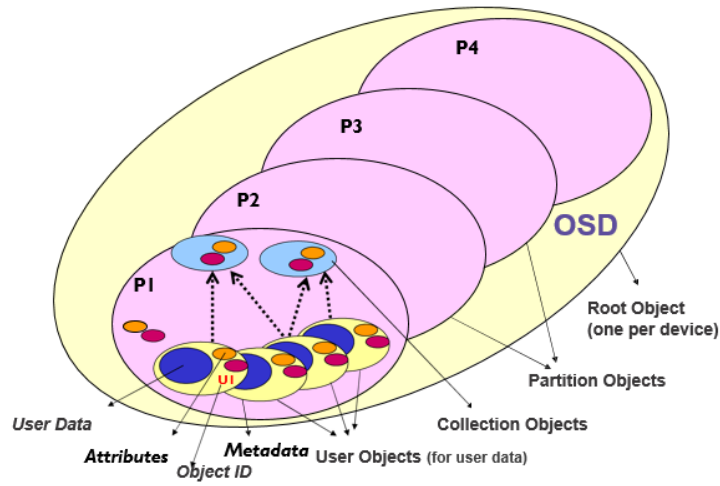
- An object is a logical unit of storage
 - ID (Identification)
 - Application data
 - Metadata which includes block allocation and length
 - Attributes that is accessible by users
- Objects have file-like methods
 - open, close, read, write

Object Types



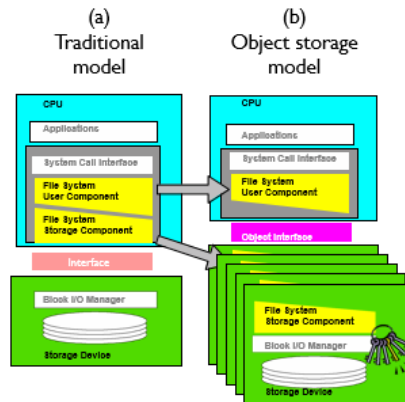
- **The root object** -- The OSD itself
- **User object** -- Created by SCSI commands from the application or client
- **Collection object** -- A group of user objects, such as all .mp3
- **Partition object** -- Containers that share common security and space management characteristics

Object

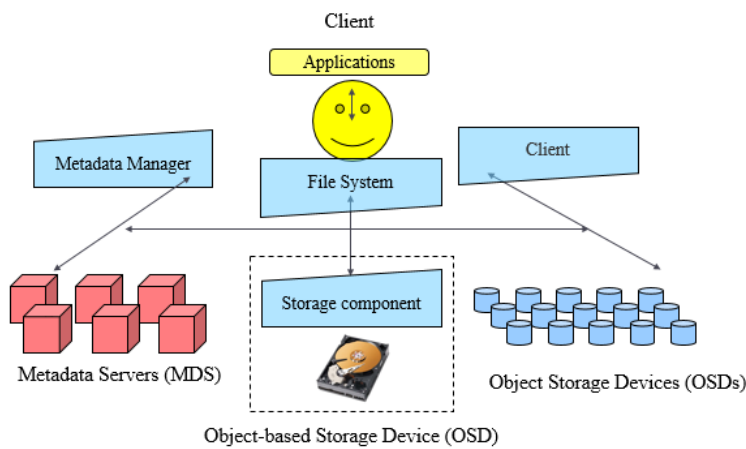


Object Storage Devices

- Two changes :
- Object-based storage offloads the storage component to the storage device
 - The device interface changes from blocks to objects



Dataflow of Metadata



OSD Commands(Interface)

• Basic Protocol

- READ } very basic
- WRITE } very basic
- CREATE } space mgmt
- REMOVE } space mgmt
- GET ATTR } attributes
- SET ATTR } attributes
 - opaque
 - internal
 - shared

• Specialized

- APPEND
- CREATE & WRITE
- FLUSH
- LIST

• Security

- Authorization
- Integrity
- SET KEY } shared secrets
- SET MASTER KEY } shared secrets

• Groups

- CREATE COLLECTION
- REMOVE COLLECTION
- LIST COLLECTION

• Management

- CREATE PARTITION
- REMOVE PARTITION
- FLUSH PARTITION
- PERFORM SCSI COMMAND
- PERFORM TASK MGMT

5. **What is Information Availability? Explain how information availability is defined and measured?** [10]

CO6 L1

What is Business Continuity?

Business Continuity

Processes and/or procedures for ensuring continued business operations

- BC entails preparing for, responding to, and recovering from a system outage that adversely affects business operations
- BC is an integrated and enterprise wide process that includes set of activities to ensure “information availability”
- BC involves proactive measures and reactive countermeasures
- In a virtualized environment, BC solutions need to protect both physical and virtualized resources

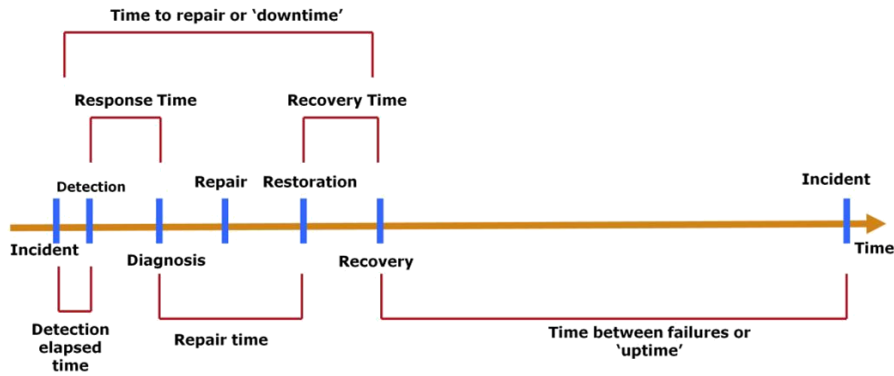
Information Availability

Information Availability

Ability of an IT infrastructure to function according to business expectations during its specified time of operation

- Information Availability can be defined with the help of
 - ▶ Accessibility
 - ▶▶ Information should be accessible to the right user when required
 - ▶ Reliability
 - ▶▶ Information should be reliable and correct in all aspects
 - ▶ Timeliness
 - ▶▶ Defines the time window during which information must be accessible

Measuring Information Availability



- MTBF: Average time available for a system or component to perform its normal operations between failures
($MTBF = \text{Total operational time} / \text{Number of failures}$)
- MTTR: Average time required to repair a failed component
($MTTR = \text{Total downtime} / \text{Number of failures}$)

$$IA = MTBF / (MTBF + MTTR) \text{ or } IA = \text{uptime} / (\text{uptime} + \text{downtime})$$

6. What is Business Continuity? Explain the BC Planning Life Cycle with a neat diagram. [10]

BC Planning Lifecycle

- Establishing objectives
 - ▶ Determine BC requirements
 - ▶ Select BC team and create BC policies
- Analyzing
 - ▶ Collect information on business processes
 - ▶ Conduct business impact analysis
 - ▶ Identify critical business processes
 - ▶ Perform risk analysis for critical functions
 - ▶ Perform cost benefit analysis for available solutions



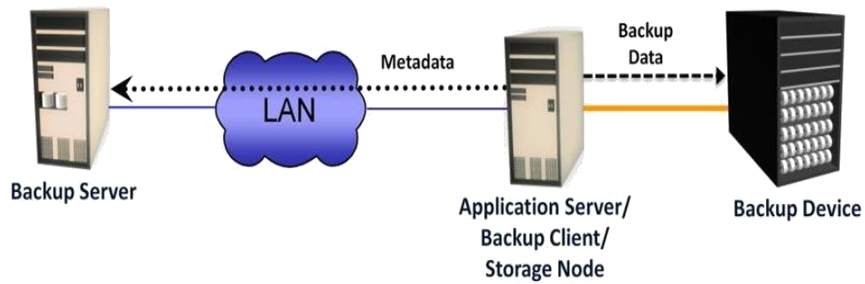
CO3 L1

CO2	L2

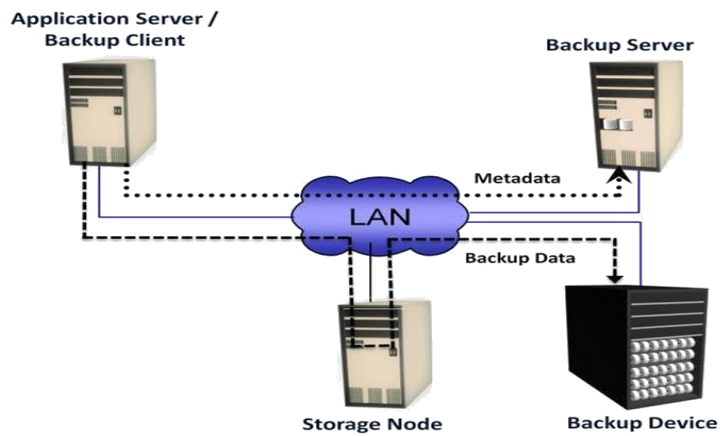
7. Explain the various Backup Topologies with neat diagram

[10]

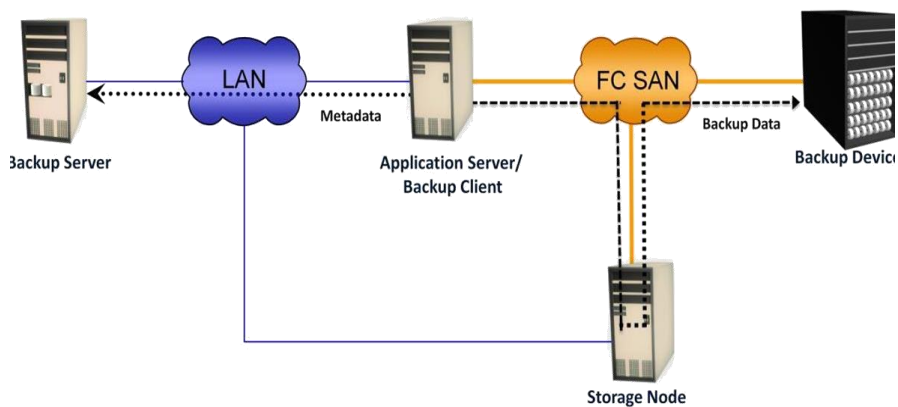
Direct-Attached Backup



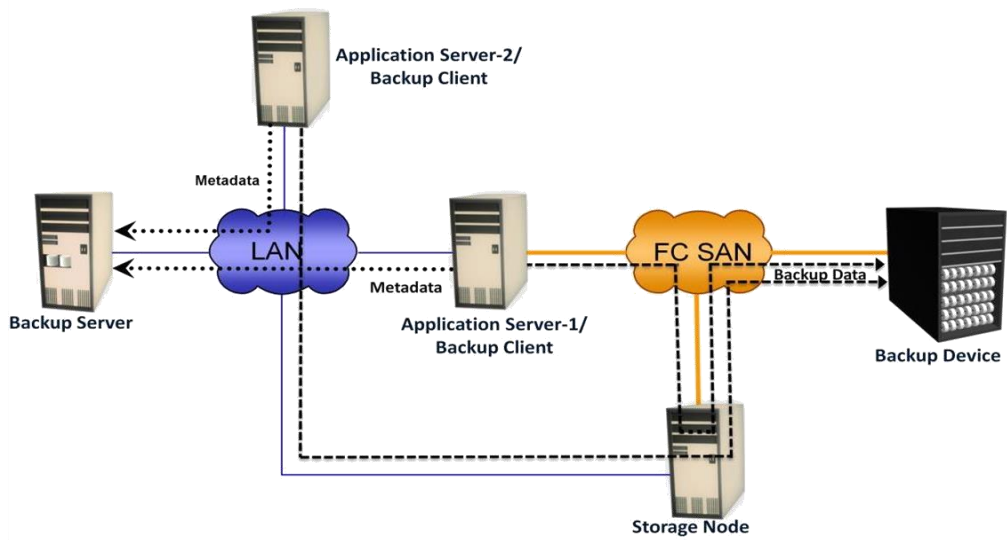
LAN-Based Backup



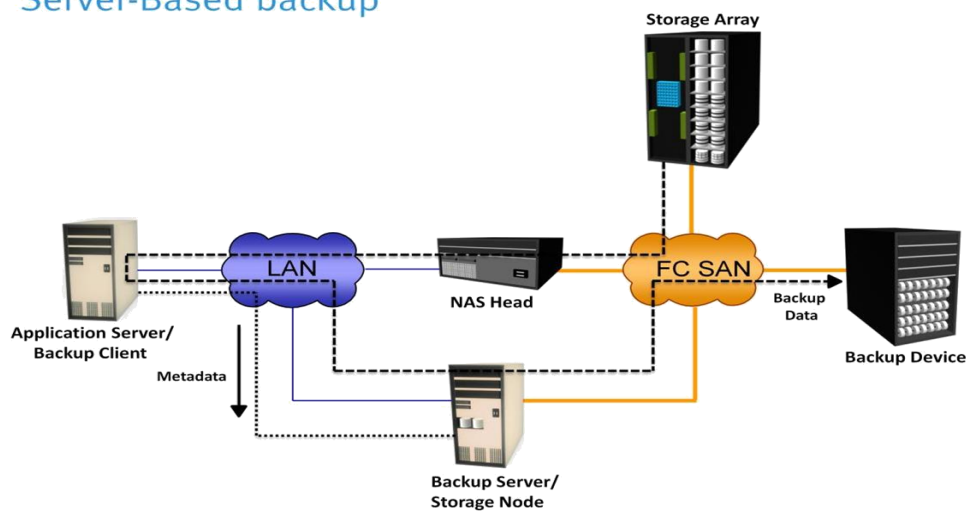
SAN-Based Backup



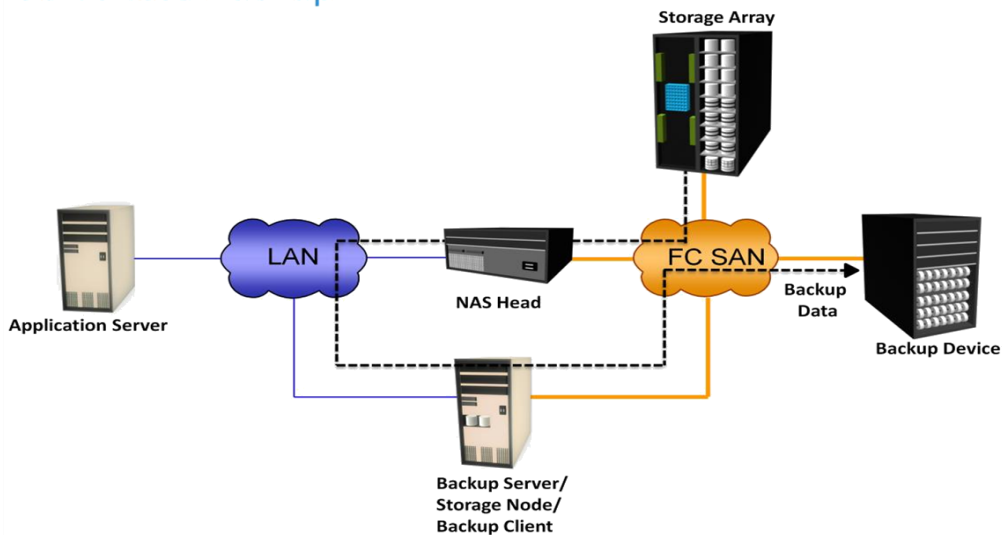
Mixed Backup Topology



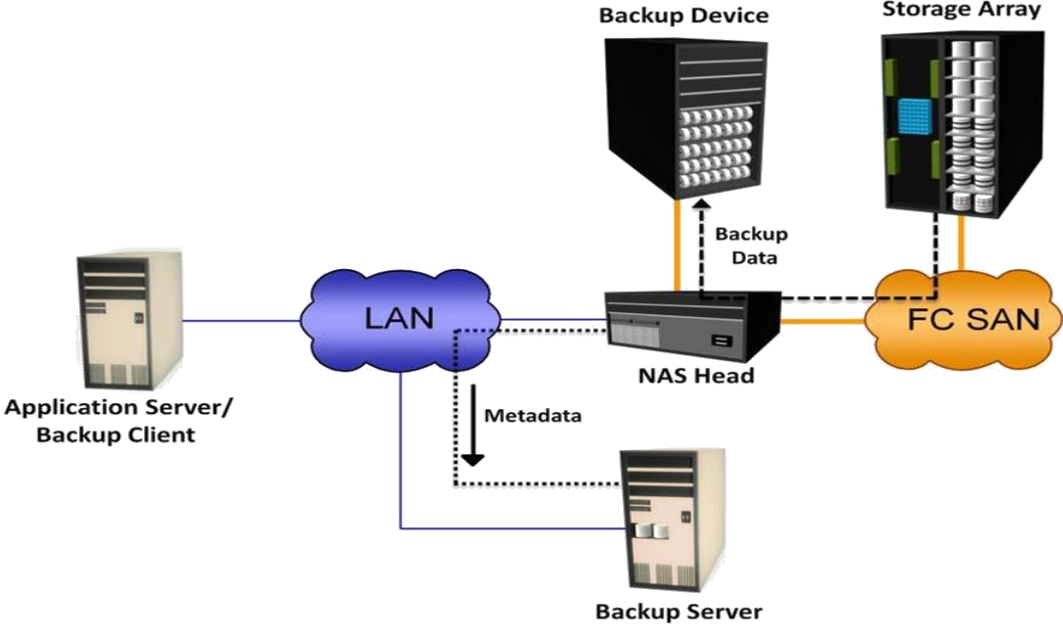
Server-Based backup



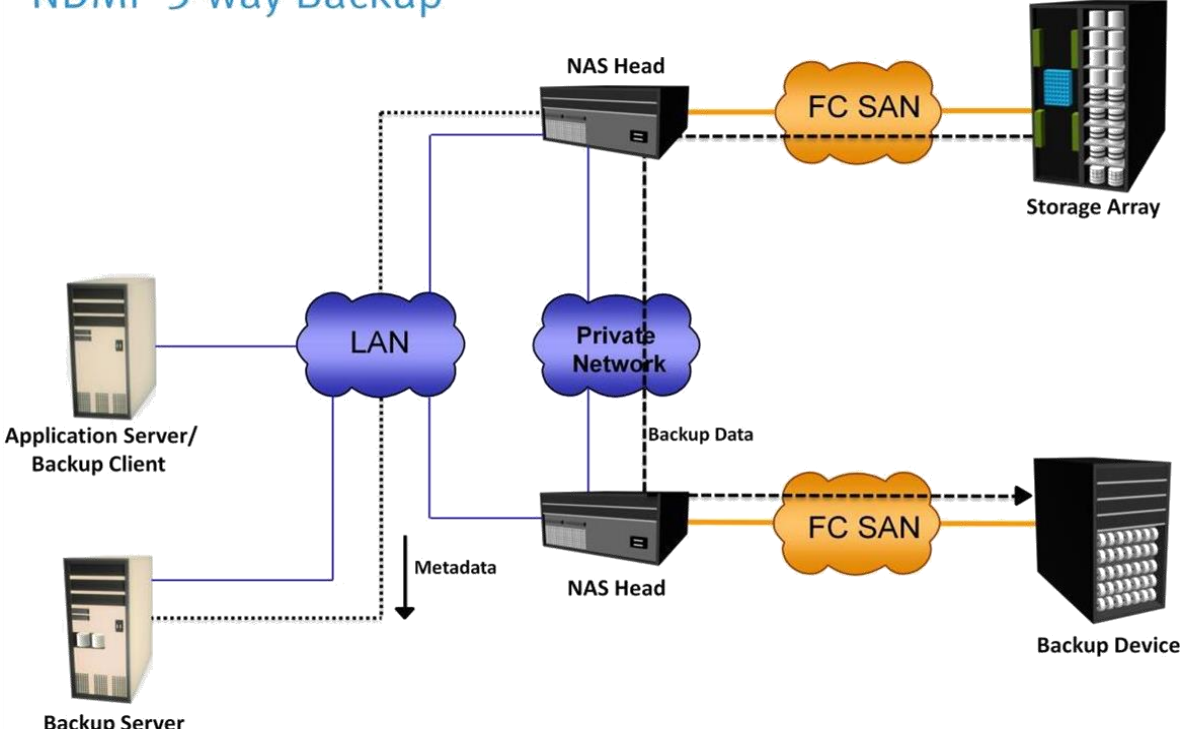
Serverless Backup



NDMP 2-way Backup



NDMP 3-way Backup



☺ ~ ~ END ~ ~ ☺