# Data Science

## Data Life Cycle

## Network Storage Devices


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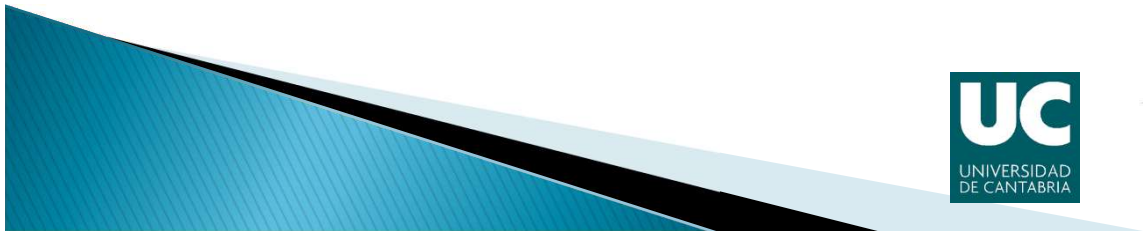
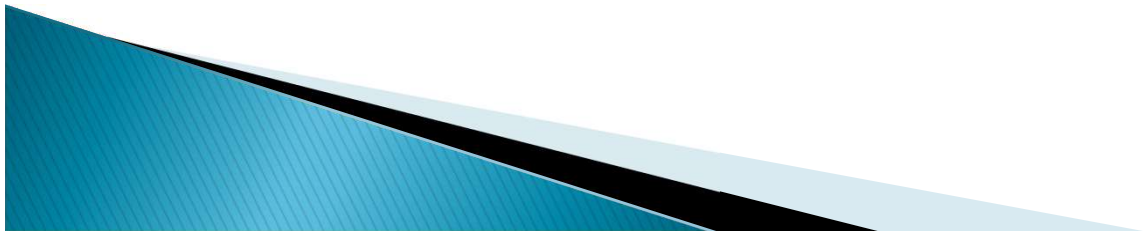


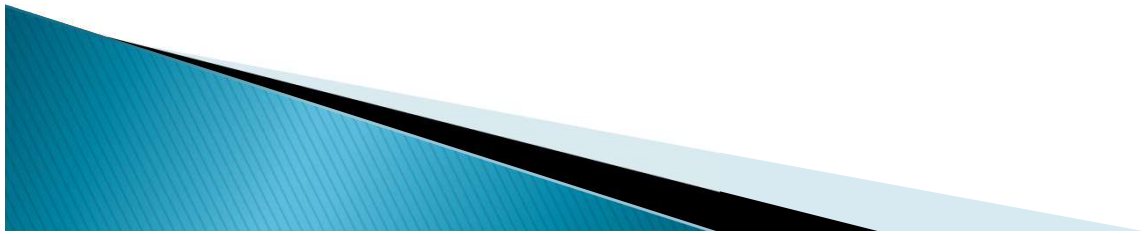
# Summary

- Physical Storage Devices
- Network Storage Devices
- Data Storage
- Data Management
- Backup



# Schema II

- Network Storage
  - Direct Attached Storage (DAS)
  - Storage Area network (SAN)
  - Network Attached Storage (NAS)
  - Mixed Environments
  - FC/SAS SANs
  - Convergence Networks
    - iSCSI
    - Ata over Ethernet (AoE)
    - Fibre Channel over Ethernet (FCoE)

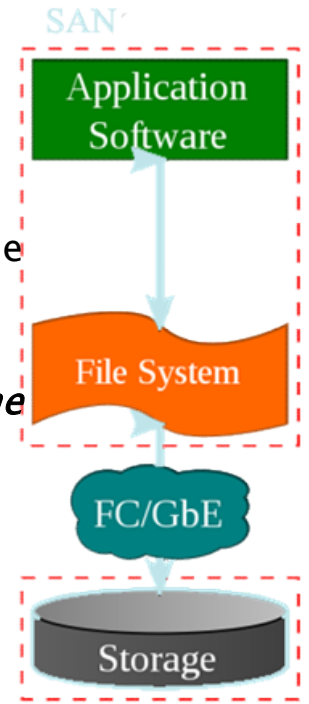


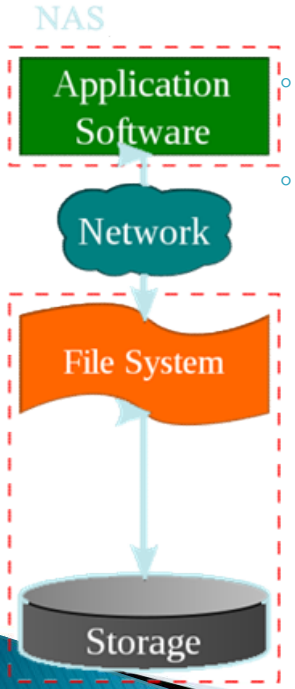
# Network Storage I

- Direct Attached Sorage (DAS)
  - The storage device is directly connected to the server via a data bus
    - An external USB, FIREWIRE, SAS or SATA disk connected to a server
    - A direct FC HBA connection to a server
  - Applications and user programs make their data *requests to the file system directly*
  - *We access to block level, we can access to the physical device*
  - DAS is simply an extension to an existing server and is not necessarily networked

# Network Storage II

- Storage Area Network (SAN)
  - Autonomous storage system connected to a network and only accessible through it by the rest of the systems that are part of the infrastructure
  - As in DAS
    - Applications and user programs make their data *requests to the file system directly*
    - *We access to block level, we can access to the physical device*
  - The storage Device can be accesible by all the storage network servers
  - Usually High performance networks (FC, iSCSI, FCoE, AoE)

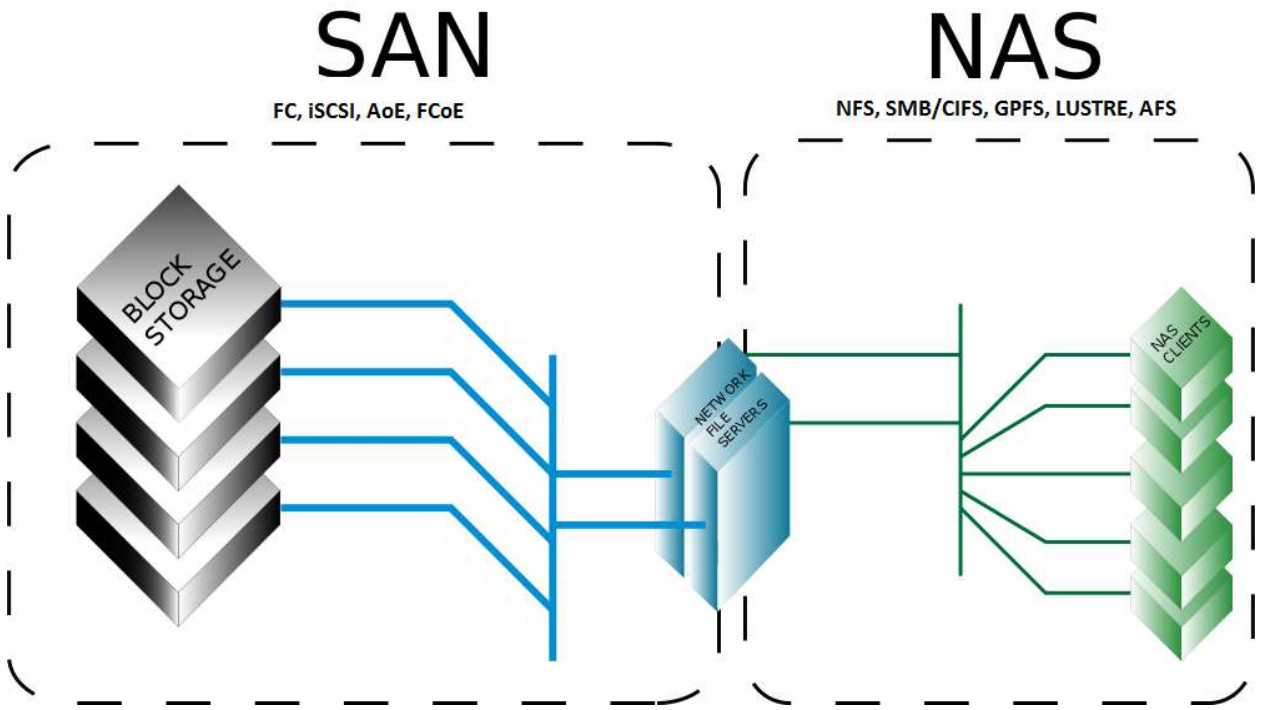



- Network Attached Storage (NAS)
  - Provides storage access to a file system level using a Network
  - providing data access to a heterogeneous group of clients
  - Is not limited to an espeficic LAN
  - No data replication
  - provide access to files using network file sharing protocols such as NFS, SMB/CIFS, LUSTRE, GPFS, AFS

# Network Storage III

- Mixed Environments (SAN & NAS)
  - SAN and NAS are not mutually exclusive



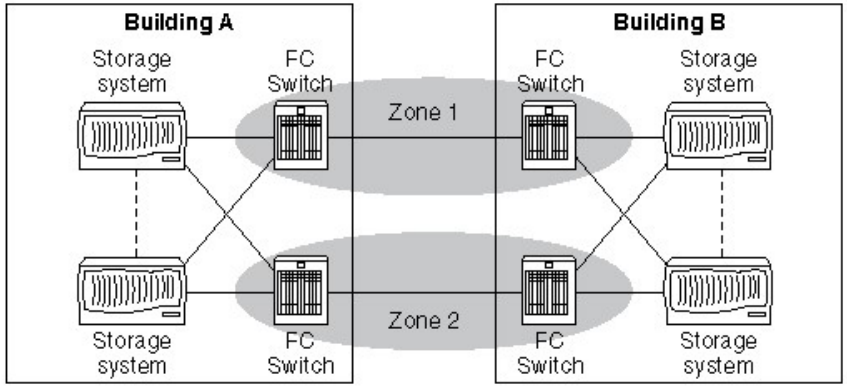
# SAN (FC) I

- Fiber Channel SAN
  - Best Practise
    - For failures
      - Connect the host and storage ports in such a way as to prevent a single point of failure from affecting redundant paths
      - Use two power sources
    - Host and Storage
      - To reduce the possibility of congestion, and maximize ease of management, connect hosts and storage port pairs to the same switch where possible
      - Hosts that have more than one connection to more than one storage port, always connect the HBAs and, if possible, the storage ports that it accesses to different FC switches. If a completely separate fabric is available, connect each HBA and storage port pair to different fabrics
    - Cabling (be careful with distances that can be supported for Fibre Channel )

| Form fac | Speed | Mutimode Maximun distances | | |
|---|---|---|---|---|
| | | 62.5um/200MHz | 50um/500MHz | 50um/2000MHz |
| SFP/SFP+ | 2 Gbps | 150 m | 300 m | 500 m |
| SFP/SFP+ | 4 Gbps | 70 m | 150 m | 380 m |
| SFP+ | 8 Gbps | 21 m | 50 m | 150 m |
| XFP | 10 Gbps | 33 m | 82 m | 300 m |

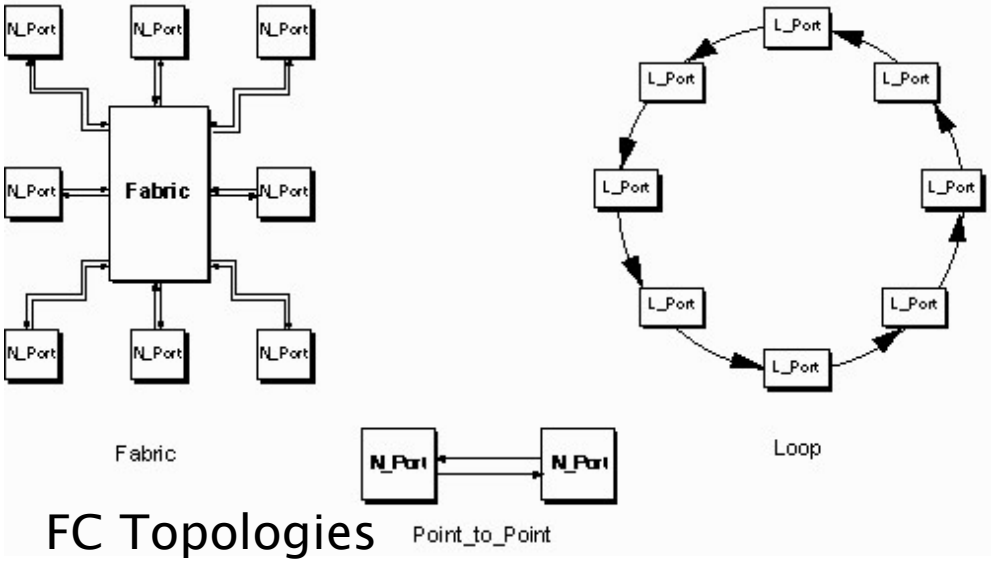
# SAN (FC) II

- Zoning
  - **Fibre Channel zoning** is the partitioning of a Fibre Channel fabric into smaller subsets to restrict interference.
    - add security
    - Simplify management.
  - Soft Zoning
    - The fabric name service allows each device to query the addresses of all other devices
    - Soft zoning restricts only the fabric name service, to show only an allowed subset of devices
  - Hard Zoning
    - Zoning can be applied to either the switch port a device is connected to OR the WWN on the host being connected
      - Port based zoning restricts traffic flow based on the specific switch port that a device is connected to, if the device is moved, it will lose access
        - different device is connected to the port in question, it will gain access to any resources the previous host had access too
      - WWN zoning restricts access by a device's WWN
        - Connecting a new device into a port previously used by a WWN zone device will not convey any access the previous devices resources



# SAN (FC) III

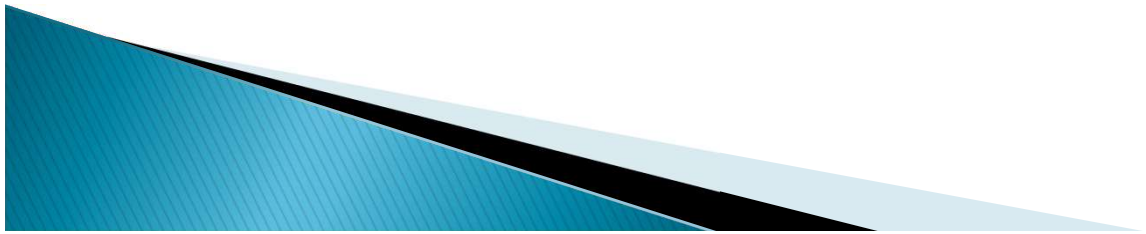
- Security Consideration
  - Change Default passwd!!!
  - Use zoning (If it is possible)
  - Disable not used interfaces access
  - Limit physical access to FC switches
  - Use SSL or SSH connection (If it is possible)
- Multipathing
  - **multipath I/O** is a fault-tolerance and performance enhancement technique whereby there is more than one physical path between the CPU in a computer system and its mass storage devices
    - Dynamic load balancing
    - Traffic shaping
    - Automatic path management
    - Dynamic reconfiguration
  - Linux multipath deamon
  - RDAC LSI
  - Emuex LPFCdriver
  - Qlogic fibreutils
  - EMC powerpath
  - Fijitsu  ETERNUSmpd
  - etc




FC Topologies

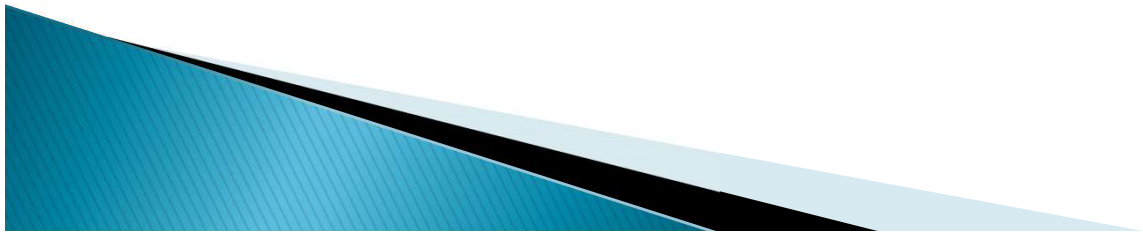
# Convergence Networks I

- Convergence Networks
  - **Internet Small Computer System Interface (ISCSI)**, an Internet Protocol (IP) based storage networking standard for linking data storage facilities.
    - iSCSI simply allows two hosts to negotiate and then exchange SCSI commands using IP networks
    - high-performance local storage bus
    - iSCSI requires no dedicated cabling; it can be run over existing IP infrastructure
    - iSCSI is often seen as a low-cost alternative to Fibre Channel
    - iSCSI SAN deployment can be severely degraded if not operated on a dedicated network or subnet
    - iSCSI initiator sends SCSI commands over an IP network
      - Software, use code to implement iSCSI
      - Dedicated Hardware, mitigates the overhead of iSCSI and TCP processing and Ethernet interrupts, and therefore may improve the performance of servers that use iSCSI.
        - iSCSI HBA
        - TOE cards



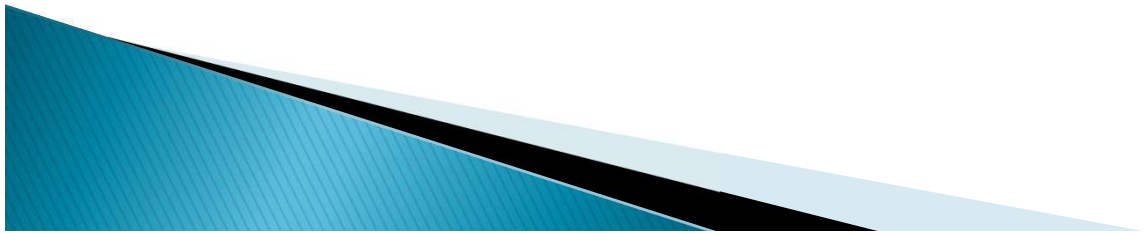
# Convergence Networks II (iSCSI)

- iSCSI Target, specification refers to a storage resource located on an iSCSI server
- Addresing
  - iSCSI Qualified Name (IQN) (iqn.2013-01.com.StorageSample:storage.hdd01)
  - Extended Unique Identifier (EUI) (eui.02004567A425678D)
  - T11 Network Address Authority (NAA) (naa.52004567BA64678D)
- Is routable because works at IP layer
  - Security issues!!
  - Network cuts provoke read-ony file systems
- Server (target)
  - Install tgt pakage
  - tgtadm --lld iscsi --op show --mode target (show the targets)
  - tgtadm --lld iscsi --op new --mode target --tid 1 -T iqn.2013-ifca.example.com.:disk
  - tgt-admin --update ALL
- Client (initiator)
  - Install open-iscsi
  - iscsiadm -m discovery -t sendtargets -p “target_host” (discover de device)
  - iscsiadm --mode node --targetname iqn.2013-ifca.example.com:disk --portal “target_host” -login (login de target)



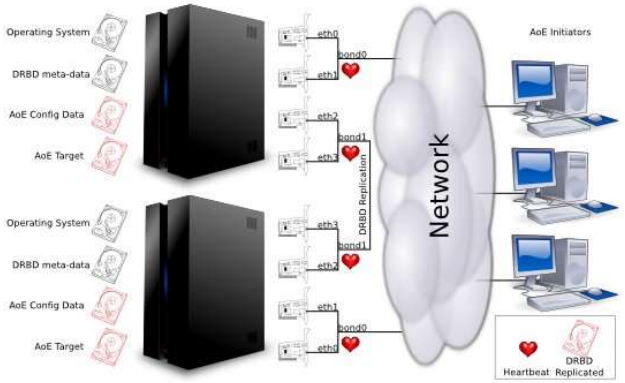
# Convergence Networks III (AoE)

- Ata over Ethernet (AoE)
  - Is a network protocol developed by Brantley Coile Company, designed for high-performance access od SATA device over Ethernet Networks to build low cost SANs
  - Runs on Layer Ethernet
  - Non-routable
  - Less extended than iSCSI
  - AoE is in theory the fastest with least overhead and also because caching occures on the client side
  - Benefits
    - Significantly reduce initial capital and implementation costs.
    - Reduce power and cooling requirements.
    - Accelerate deployments, upgrades, and server repurposing.
    - Reduce complexity and risk.
    - Improve critical system availability.
    - Implement enhanced Disaster Recovery solutions.
  - Drivers for Windows and Linux



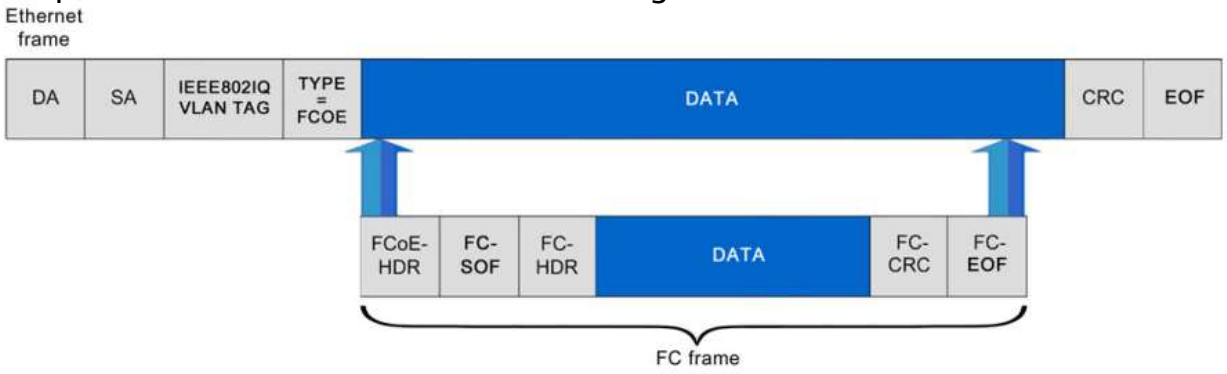
# Convergence Networks IV (AoE)

- The storage server (target)
  - open source vblade package installed (vblade is the daemon that allows exporting partitions or hard drives )
    - *vbladed 0 0 eth0 /dev/sda1*
- The client side
  - On linux clients Install the aoe module (#*modprobe aoe*) and aoetools .
    - *aoe-discover;aoe-stat* add the entry /dev/etherd/e0.0 on the client machine.
  - On Windows clients
    - Instal winaoe driver
      - ( http://www.winaoe.org aoe.inf)



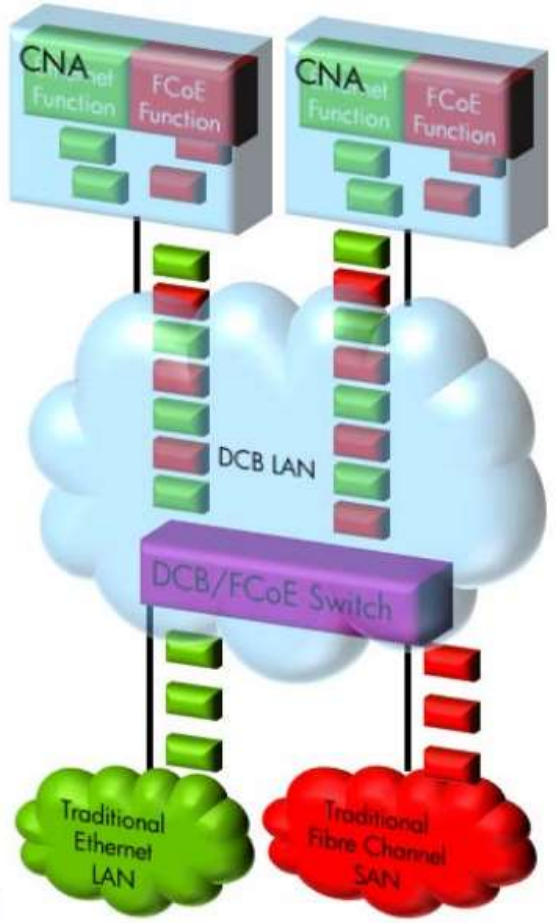
# Convergence Networks V (FCoE)

- Fibre Channel over Ethernet (FCoE)
  - Is an encapsulation of fibre channel frames over ethernet networks (Similar to AoE)
  - Replace the FC0 and FC1 layers with Ethernet
  - Non-routable (Ethernet Layer)
  - Goals
    - Prepares a converged infrastructure and provisioning servers and storage networks later.
    - Reduce the physical space occupied by teams. Fewer adapters, switches that support fewer hosts, less power, less cooling, less wiring and more streamlined.
    - Simplifies administration.
  - Requirements
    - Loosless Network
      - FCoE is a lightweight encapsulation protocol and lacks the reliable data transport of the TCP layer. Therefore, FCoE must operate on DCB-enabled Ethernet and use lossless traffic classes to prevent Ethernet frame loss under congested network conditions.

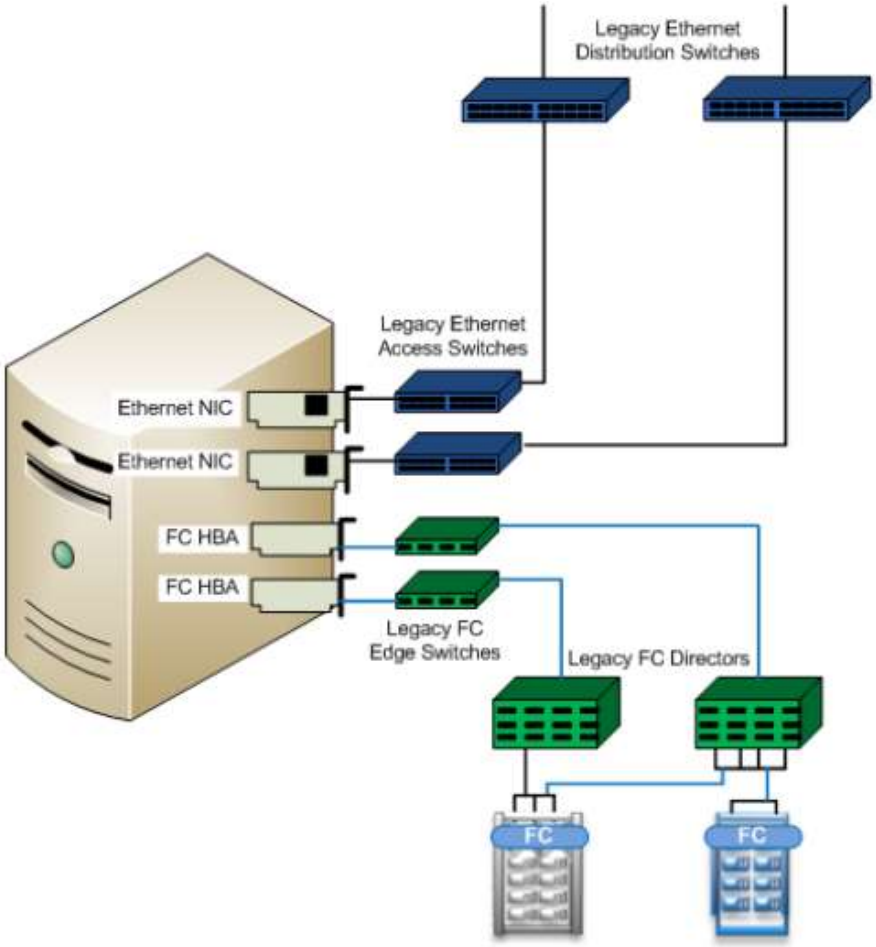


# Convergence Networks VI (FCoE)

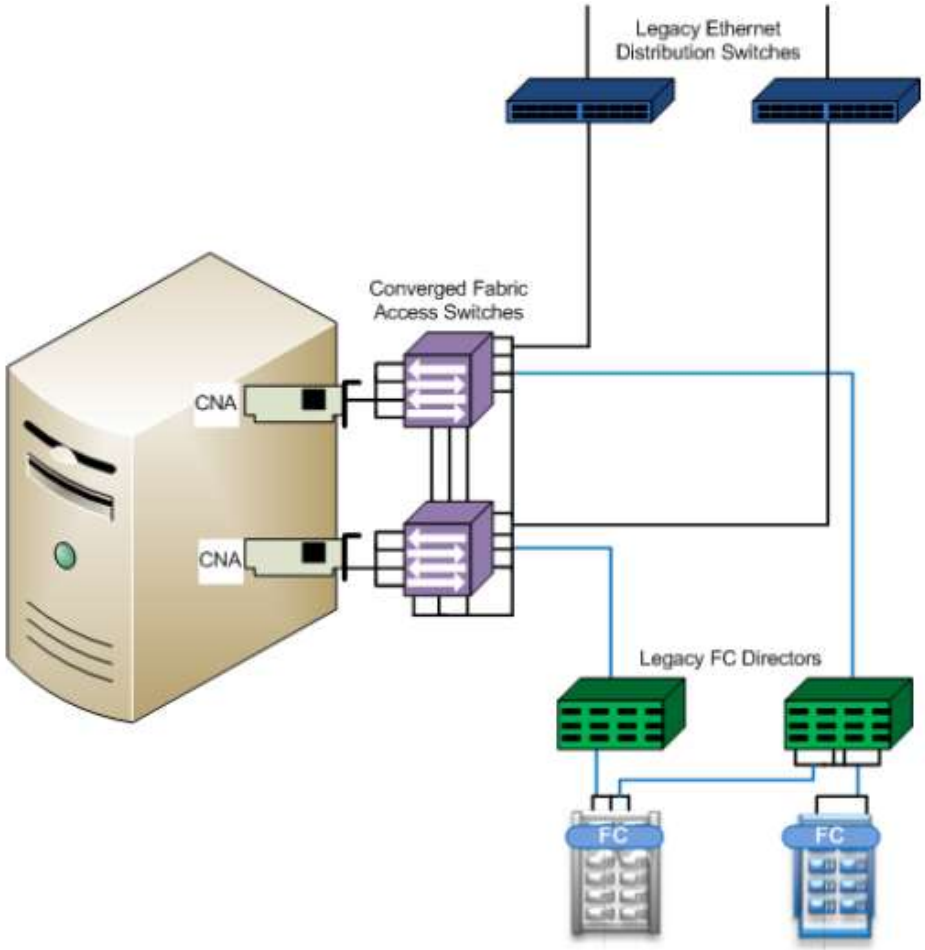
- CNAs
  - In a converged network, CNAs in servers can handle both FC and traditional LAN-based communication traffic That significantly reduces the amount of NIC, HBA, and cable infrastructure.



# Convergence Networks VII (FCoE)

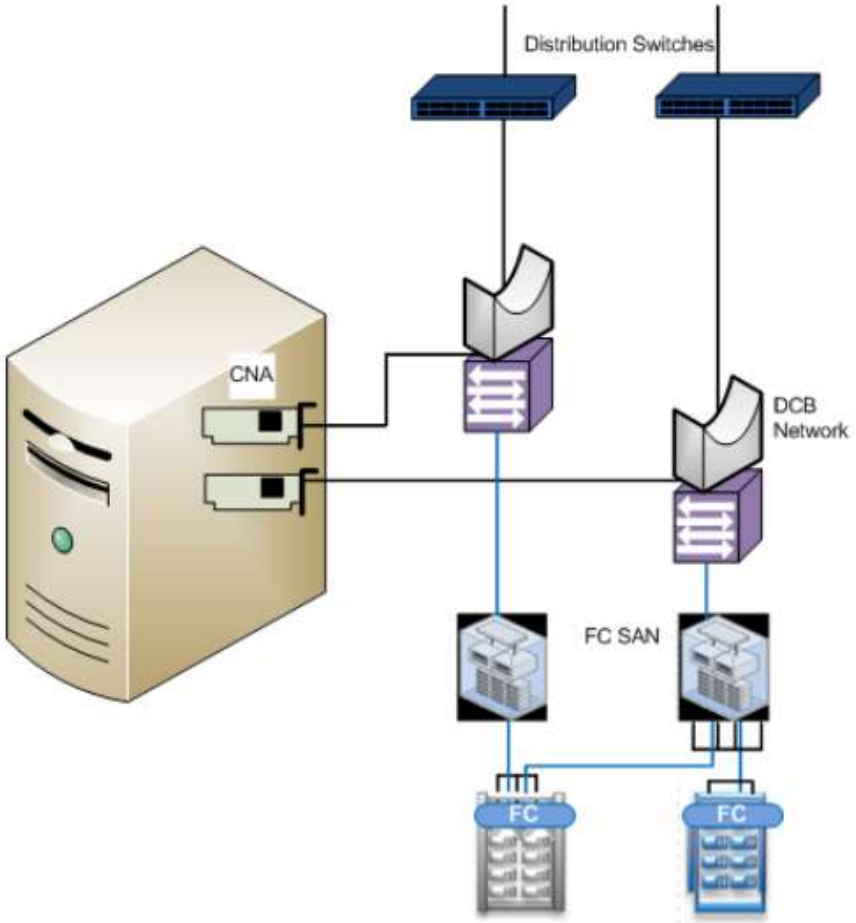



Traditional Deployment

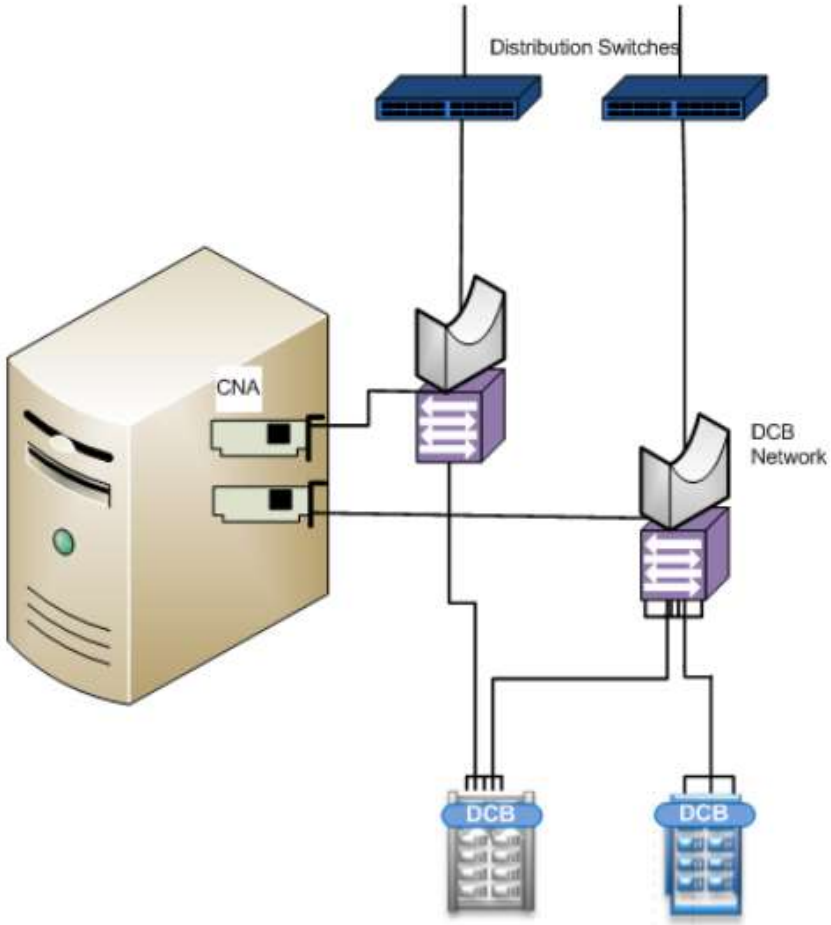



Converged Network – Phase 1

# Convergence Networks VIII (FCoE)




Converged Network – Phase 2




Converged Network – Phase 3