POLITECNICO DI MILANO



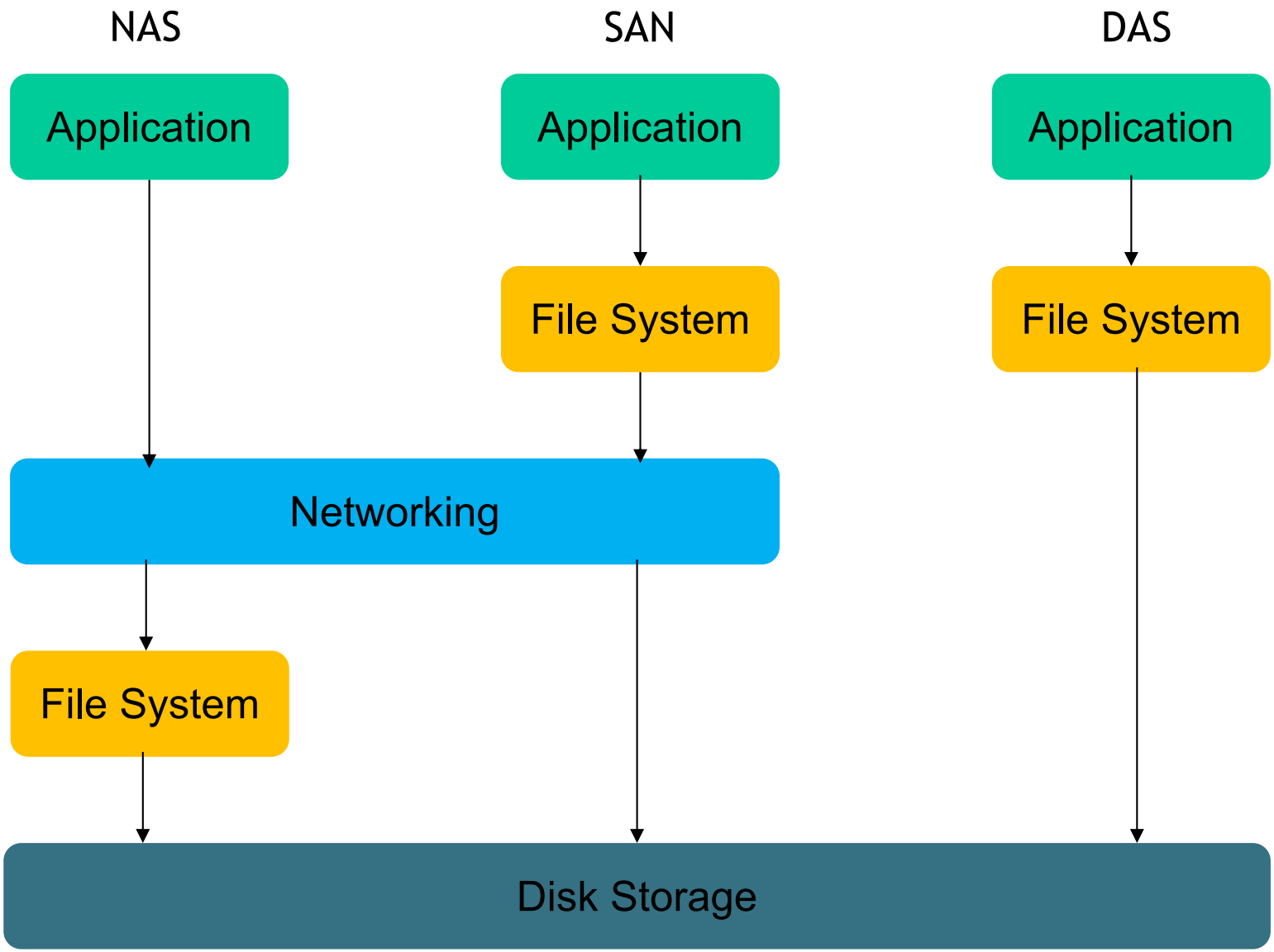


Storage systems: DAS, NAS and SAN

DAS, NAS and SAN

- A **Direct Attached Storage (DAS)** is a storage system directly attached to a server or workstation. They are visible as disks/volumes by the client OS
- A **Network Attached Storage (NAS)** is a computer connected to a network that provides only file-based data storage services (e.g., FTP, Network File System and SAMBA) to other devices on the network and is visible as File Server to the client OS
- **Storage Area Networks (SAN)** are remote storage units that are connected to servers using a specific networking technology (e.g., Fiber Channel) and are visible as disks/volumes by the client OS

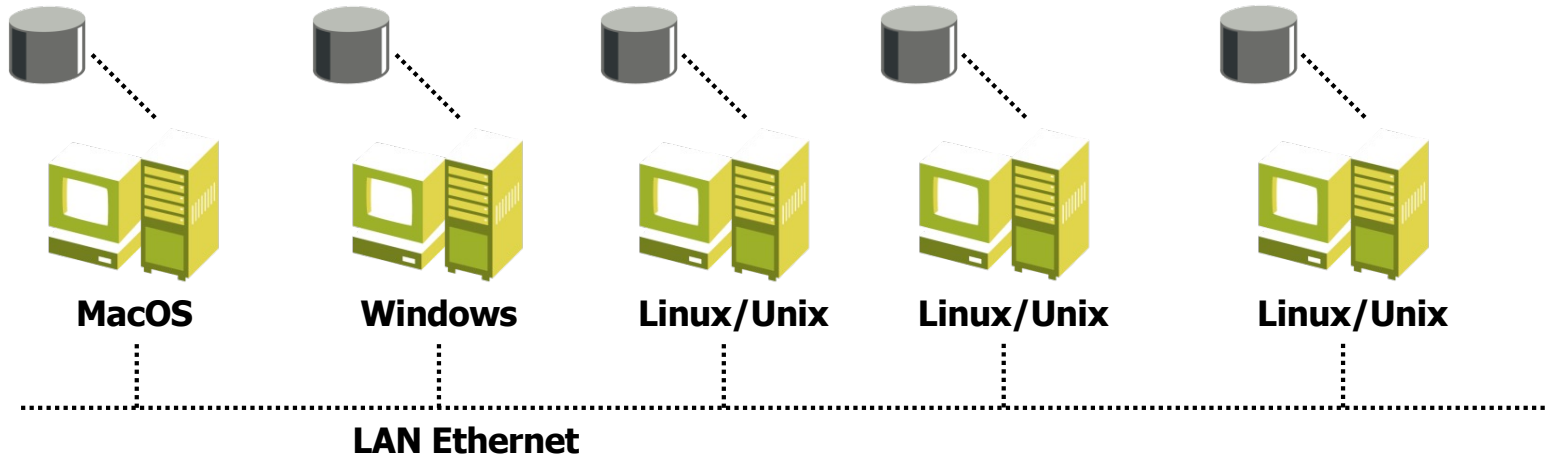
DAS, NAS, SAN: an architectural comparison



DAS
Direct Attached Storage

Direct Attached Storage

- DAS is a storage system directly attached to a server or workstation
- The term is used to differentiate non-networked storage from SAN and NAS (that will be described later)



Direct Attached Storage (DAS): physical model

Main features:

- limited scalability
- complex manageability
- to read files in other machines, the “file sharing” protocol of the OS must be used

Internal and external:

- DAS does not necessary mean “internal drives”
- All the external disks, connected with a point-to-point protocol to a PC can be considered as DAS

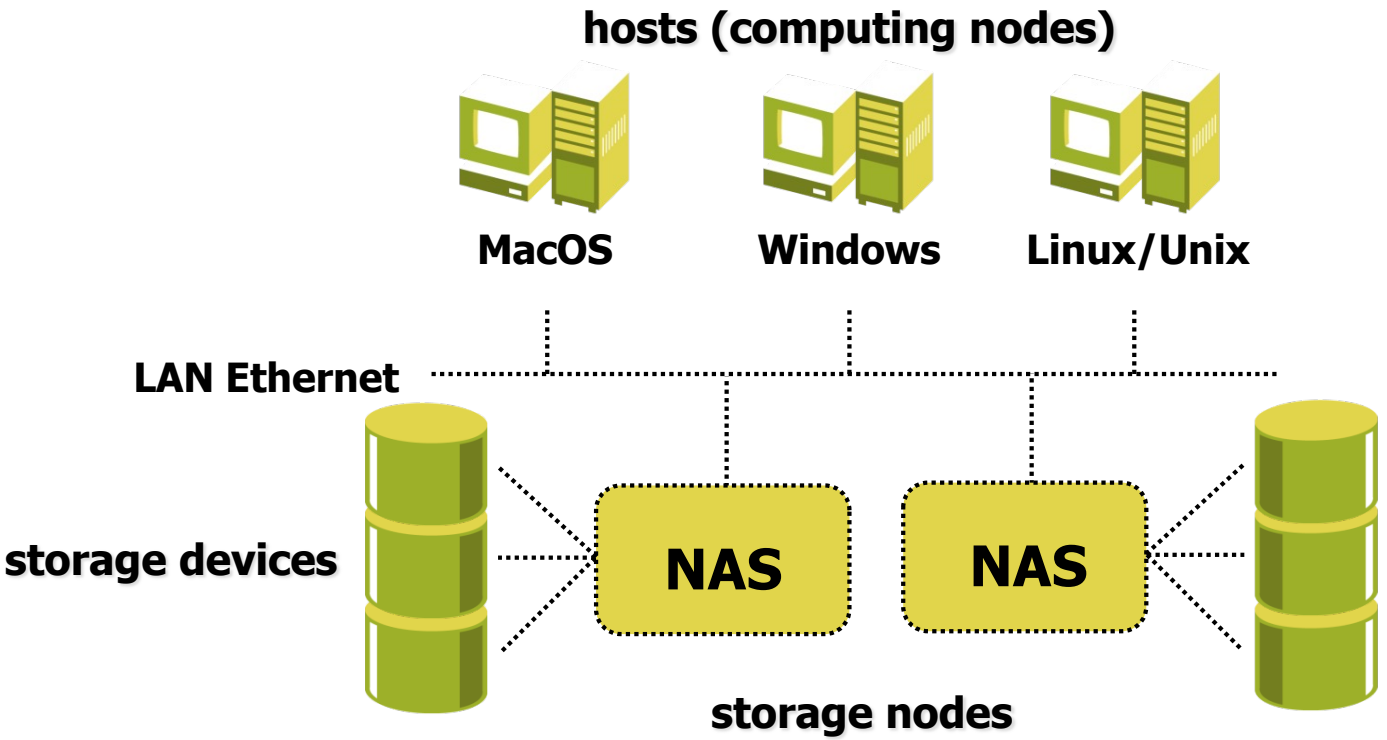
NAS
Network Attached Storage

Network Attached Storage (NAS)

- A NAS unit is a computer connected to a network that provides only file-based data storage services to other devices on the network
- NAS systems contain one or more hard disks, often organized into logical redundant storage containers or RAID
- Provide file-access services to the hosts connected to a TCP/IP network though Networked File Systems/SAMBA

Network Attached Storage (NAS): physical model

- Each NAS element has its own IP address
- Good scalability (incrementing the devices in each NAS element or incrementing the number of NAS elements)



NAS vs DAS

- The key differences between direct-attached storage (DAS) and NAS are
  - DAS is simply an extension of an existing server and is not necessarily networked
  - NAS is designed as an easy and self-contained solution for sharing files over the network

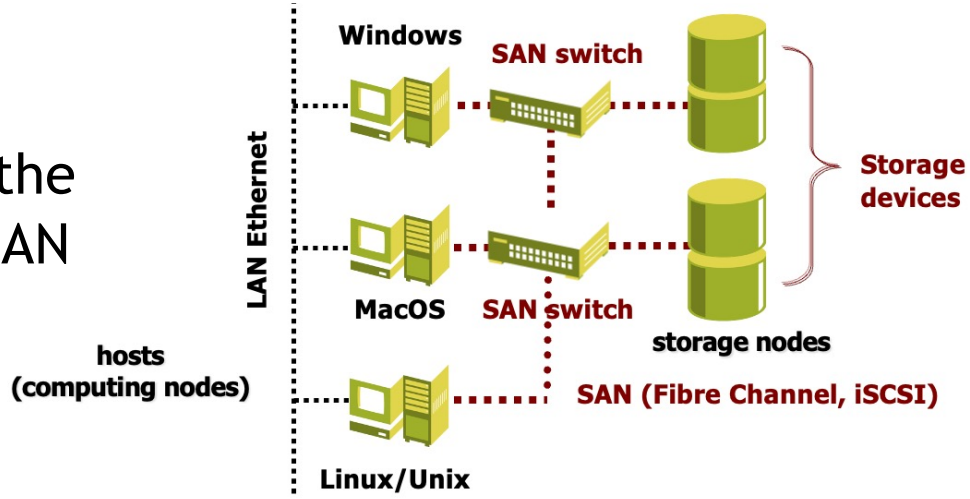
- The performance of NAS depends mainly on the speed of and congestion on the network

SAN:

Storage Area Network

Storage Area Network - SAN

- **Storage Area Networks**, are remote storage units that are connected to Servers using a specific networking technology
- SANs have a special network devoted to the accesses to storage devices
- Two distinct networks (one TCP/IP and one dedicated network, e.g., Fiber Channel)
- High scalability (simply increasing the storage devices connected to the SAN network)



NAS vs SAN

- NAS provides both storage and a file system
- This is often contrasted with SAN which provides only block-based storage and leaves file system concerns on the "client" side

- One way to loosely conceptualize **the difference between a NAS and a SAN** is that
  - **NAS appears to the client OS (operating system) as a file server** (the client can map network drives to shares on that server)
  - **a disk available through a SAN still appears to the client OS as a disk**: it will be visible in the disks and volumes management utilities (along with client's local disks), and available to be formatted with a file system

- Traditionally:
  - NAS is used for low-volume access to a large amount of storage by many users
  - SAN is the solution for petabytes (10^{12}) of storage and multiple, simultaneous access to files, such as streaming audio/video

DAS vs. NAS vs. SAN

	Application Domain	Advantages	Disadvantages
DAS	• Budget constraints • Simple storage solutions	• Easy setup • Low cost • High performance	• Limited accessibility • Limited scalability • No central management and backup
NAS	• File storage and sharing • Big Data	• Scalability • Greater accessibility • Performance	• Increased LAN traffic • Performance limitations • Security and reliability
SAN	• DBMS • Virtualized environments (Datacenters!)	• Improved performance • Greater scalability • Improved availability	• Costs • Complex setup and maintenance