DATABASE

CSE3103 : Database

Nazmus Sakib
Assistant Professor
Department of Computer Science and Engineering
Ahsanullah University of Science and Technology

Classification of Physical Storage Media

- Speed with which data can be accessed

- Cost per unit of data

- Reliability
  - data loss on power failure or system crash
  - physical failure of the storage device

- Can differentiate storage into:
  - **volatile storage:** loses contents when power is switched off
  - **non-volatile storage**:
    - Contents persist even when power is switched off.
    - Includes secondary and tertiary storage, as well as batter-   backed up main-memory.

Physical Storage Media

- **Cache** – fastest and most costly form of storage; volatile; managed by the computer system hardware.

- **Main memory**:
  - fast access (10s to 100s of nanoseconds; 1 nanosecond = 10^{-9} seconds)
  - generally too small (or too expensive) to store the entire database
    - capacities of up to a few Gigabytes widely used currently
    - Capacities have gone up and per-byte costs have decreased steadily and rapidly (roughly factor of 2 every 2 to 3 years)
  - **Volatile** — contents of main memory are usually lost if a power failure or system crash occurs.

Storage Hierarchy
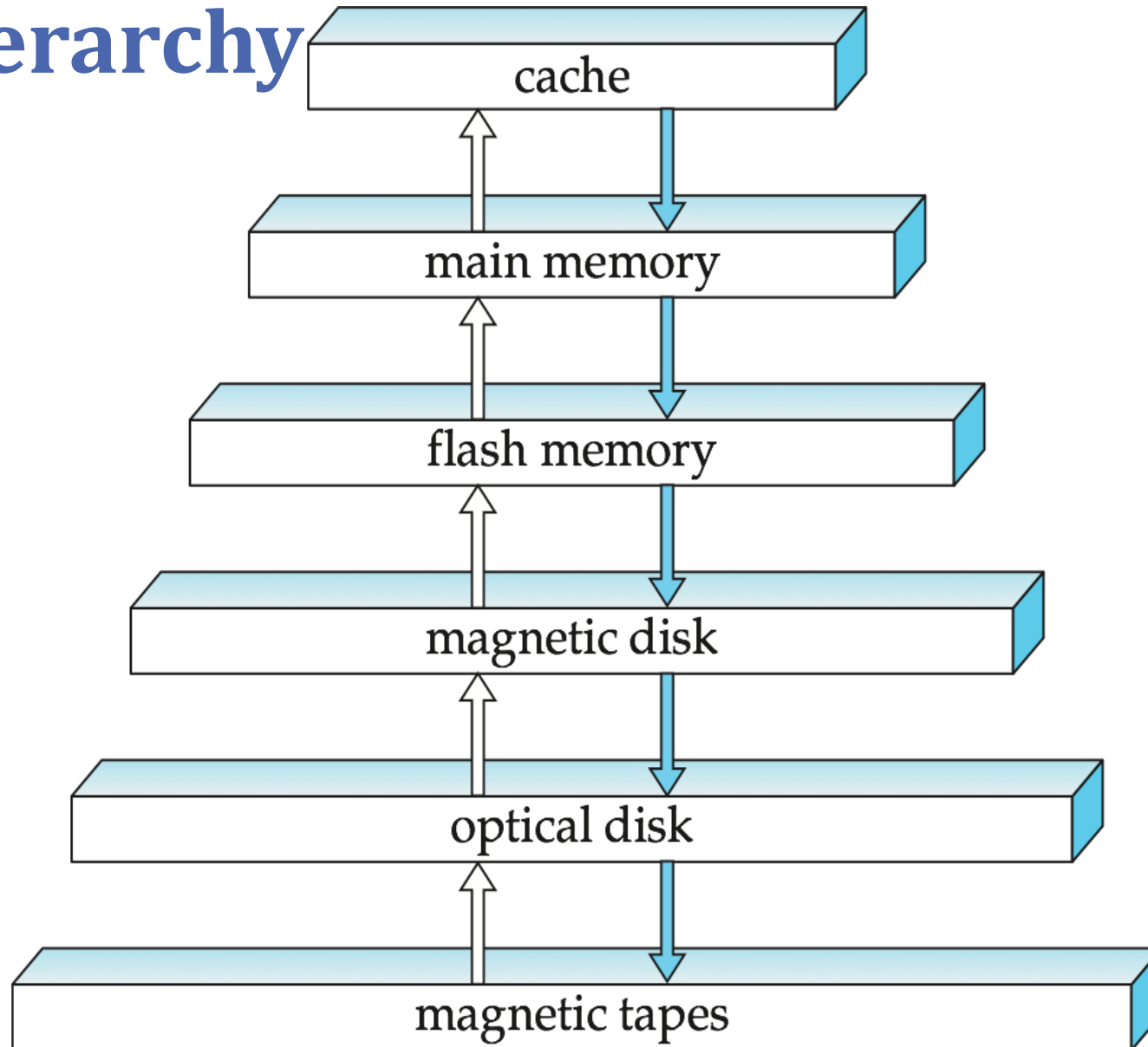
Storage Hierarchy (Cont.)

- **Primary storage:** Fastest media but volatile (cache, main memory).
- **Secondary storage:** next level in hierarchy, non-volatile, moderately fast access time
  - also called **on-line storage**
  - E.g. flash memory, magnetic disks
- **Tertiary storage:** lowest level in hierarchy, non-volatile, slow access time
  - also called **off-line storage**
  - E.g. magnetic tape, optical storage

Disk Subsystem

- Disks usually connected directly to computer system

- In **Storage Area Networks (SAN)**, a large number of disks are connected by a high-speed network to a number of servers

- In **Network Attached Storage (NAS)** networked storage provides a file system interface using networked file system protocol, instead of providing a disk system interface

Storage Area Network

- Common in large storage environments

- Multiple hosts attached to multiple storage arrays - flexible
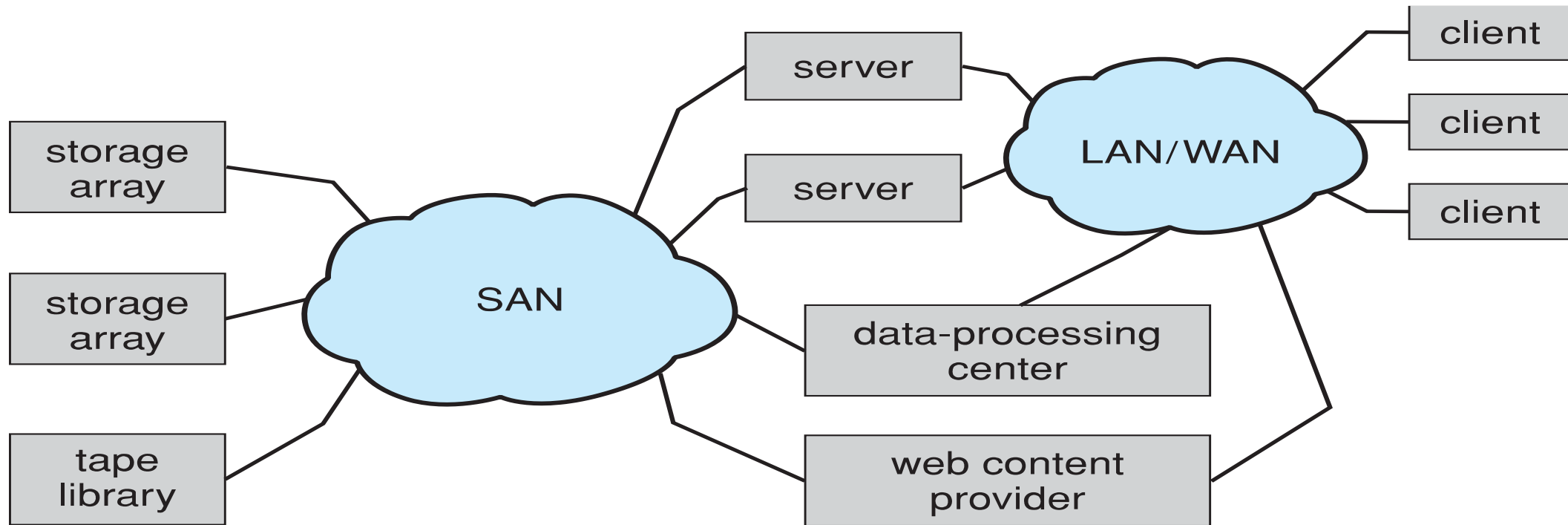
Storage Area Network (Cont.)

- SAN is one or more storage arrays
  - Connected to one or more Fibre Channel switches

- Hosts also attach to the switches

- Storage made available via **LUN Masking** from specific arrays to specific servers

- Easy to add or remove storage, add new host and allocate it storage
  - Over low-latency Fibre Channel fabric

- Why have separate storage networks and communications networks?
  - Consider iSCSI, FCOE

Network-Attached Storage

- Network-attached storage (**NAS**) is storage made available over a network rather than over a local connection (such as a bus)
  - Remotely attaching to file systems
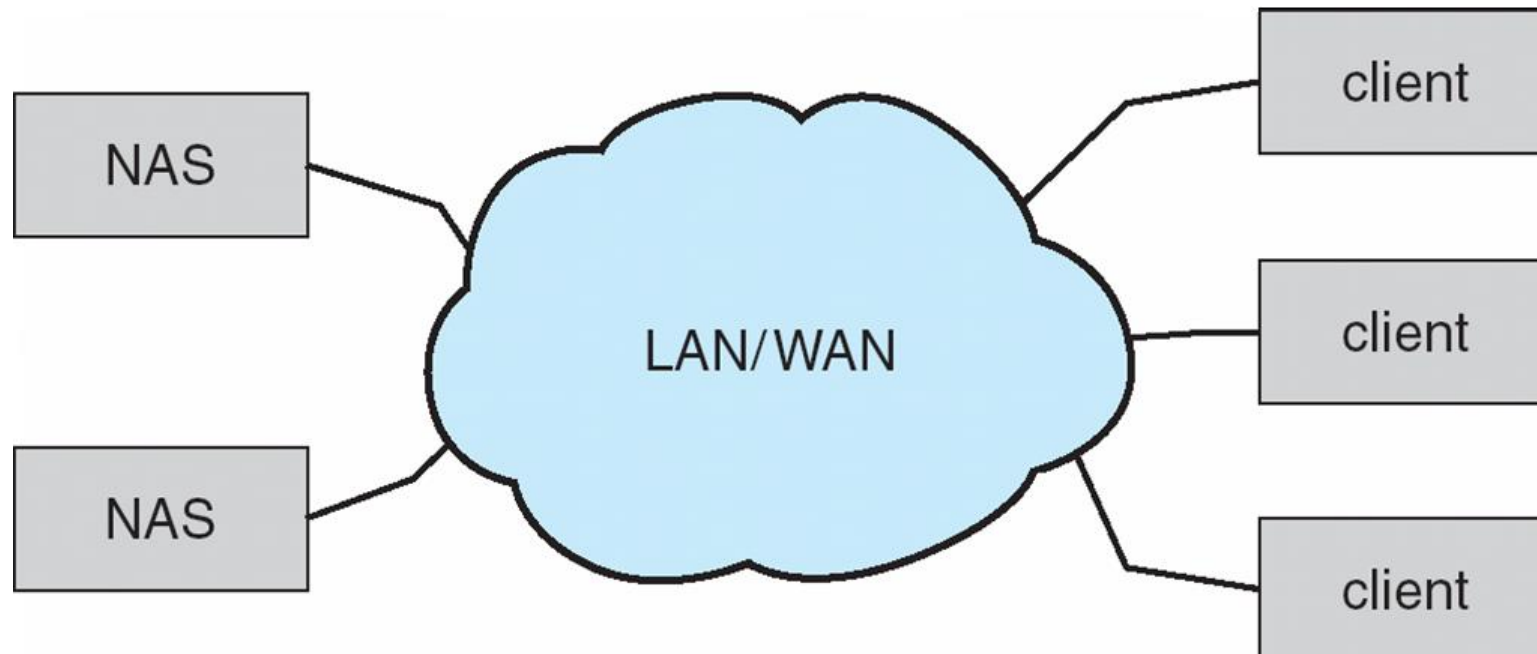
Network-Attached Storage

- NFS and CIFS are common protocols

- Implemented via remote procedure calls (RPCs) between host and storage over typically TCP or UDP on IP network

- **iSCSI** protocol uses IP network to carry the SCSI protocol
  - Remotely attaching to devices (blocks)