# Memory Management, Process Management Storage Management, Mass-Storage Management

# Memory Management

- All data in memory before and after processing

- All instructions in memory in order to execute

- Memory management determines what is in memory when
  - Optimizing CPU utilization and computer response to users

- Memory management activities
  - Keeping track of which parts of memory are currently being used and by whom
  - Deciding which processes (or parts thereof) and data to move into and out of memory
  - Allocating and deallocating memory space as needed

# Process Management

- Process and Program:
  - A **process** is a program in execution (unit of work within the system).
  - **Program** is a *passive entity*, process is an *active entity*.
- Process needs resources to accomplish its task
  - CPU, memory, I/O, files (received upon creation and along execution)
  - Initialization data (e.g., a process for presenting the status of a file)
- Process termination requires reclaim of any reusable resources
- Single-threaded process has one **program counter** specifying location of next instruction to execute
  - Process executes instructions sequentially, one at a time, until completion
- Multi-threaded process has one program counter per thread
- Typically system has many processes, some user, some operating system running concurrently on one or more CPUs
  - Concurrency by multiplexing the CPUs among the processes / threads

# Storage Management

- OS provides uniform, logical view of information storage
  - Abstracts physical properties to logical storage unit - **file**
  - Each medium is controlled by device (i.e., disk drive, tape drive)
    - Varying properties include access speed, capacity, data-transfer rate, access method (sequential or random)
- File-System management
  - Files usually organized into directories
  - Access control on most systems to determine who can access what
  - OS activities include
    - Creating and deleting files and directories
    - Primitives to manipulate files and dirs
    - Mapping files onto secondary storage
    - Backup files onto stable (non-volatile) storage media

# Mass-Storage Management

- Main memory – only large storage media that the CPU can access directly

- Why using disks?
  - Store data that does not fit in main memory
  - Store data that must be kept for a "long" period of time

- Proper management is of central importance

- Entire speed of computer operation hinges on disk subsystem and its algorithms

- OS activities
  - Free-space management
  - Storage allocation
  - Disk scheduling

# torage Structure

- Secondary storage:
  - Extension of main memory
  - Provides large nonvolatile storage capacity

- Magnetic disks – rigid metal or glass platters covered with magnetic recording material
  - Disk surface is logically divided into **tracks**, which are subdivided into **sectors**
  - The **disk** **controller** determines the logical interaction between the device and the computer
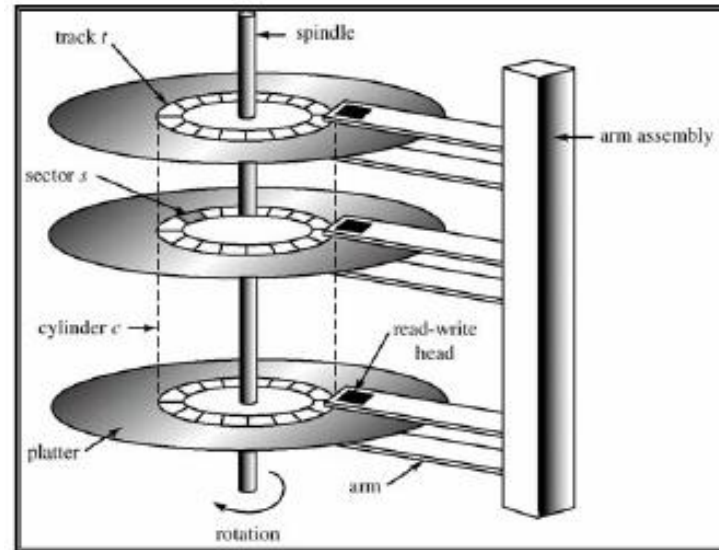
# Storage Hierarchy

- Storage systems organized in hierarchy
  - Speed
  - Cost
  - Volatility

*It takes some time (several CPU cycles) to read/write to main memory – in the meantime the processor needs to stall because it doesn't have the necessary data*

Expensive but faster

registers

cache

main memory

electronic disk

magnetic disk

optical disk

magnetic tapes