File Systems

Chapters 10-11

Storage Basics

- Files are simply chunks of 1's and 0's
  - Organization defined by creator
    - Pure binary (executable)
    - ASCII
    - mp3
    - mpeg
  - Directories -> files maintained by file system - contain listing and location info

- Physically, the disk is organized as a series of **blocks**, typically 512 bytes. All data is stored in increments of blocks.

File Actions

- File Actions
  - Create
  - Write
  - Read
  - Seek
  - Delete

Key File system Consideration

- How do you locate free space on disk?
- How do store files that require multiple blocks?
  - Contiguous? Spread out?
- How do you detect and correct errors on disk?
- How do you leverage physical characteristics of device to speed up requests?

High-level considerations

- File Descriptors can serve as placeholders/bookmarks for *where* next byte will be read/write **within** a file

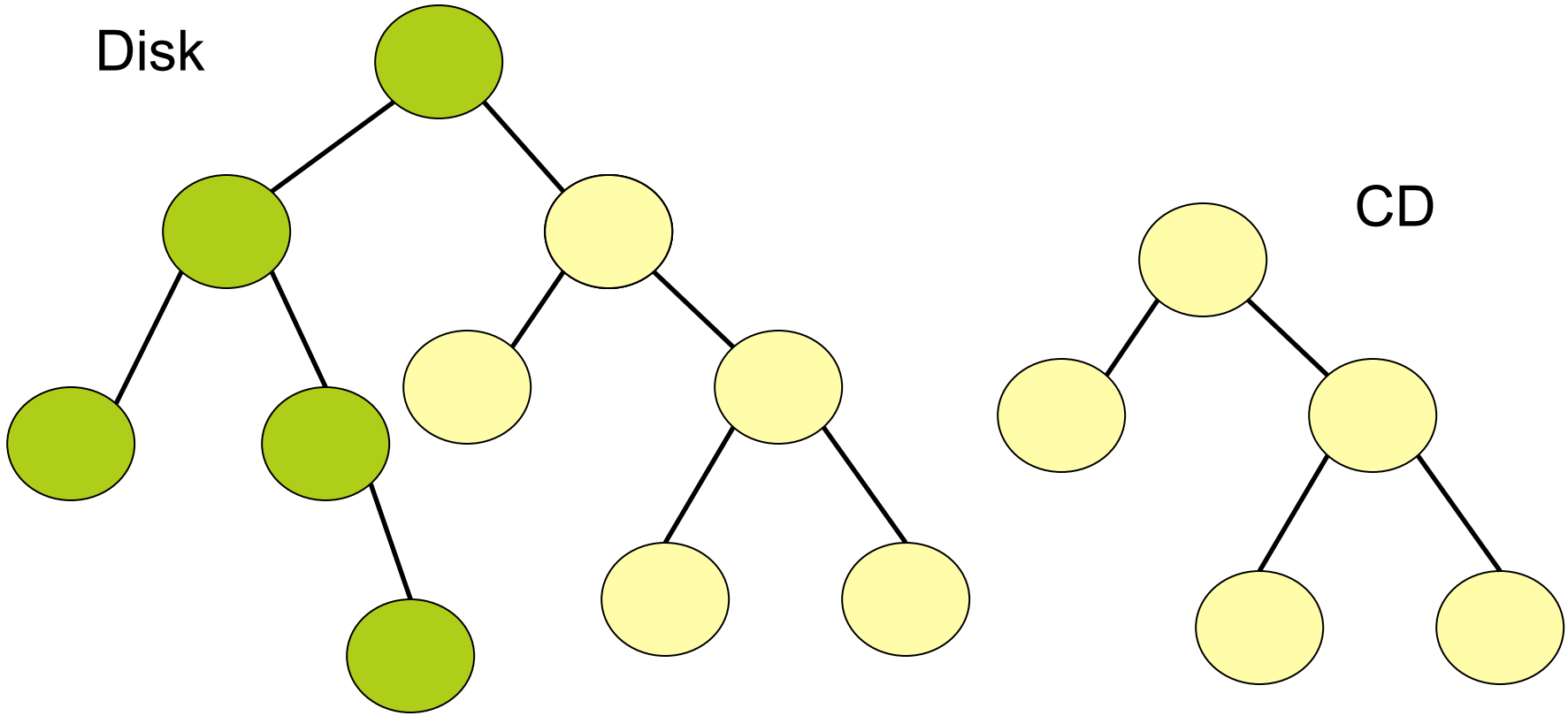
- Regular File Access Methods
  - Sequential
  - Random

- File system will be stored on a volume/partition
  - Can have multiple volumes on single disk
  - *Logical* Volume can extend over multiple disks

Directory Presentation

- The file system is presented to user as relationships between directories and files
  - Operations on directories:
    - Search
    - Create
    - Delete
    - List
    - Rename contained file
    - Traverse
  - Directory organization
    - Single Level
    - Tree
    - Acyclic Graph
    - General Graph?

Mounting File Systems



Implementation Details

- Structures on Disk:
  - Boot-Control-Block
  - Volume-Control Block
  - File-Control Blocks
- Structure in OS (memory)
  - Mount Table
  - Directory Cache
  - Open File Tables

Block Allocation

- Contiguous
- Linked List Allocation
  - File Allocation Table (FAT)
- Indexed Allocation

Free Space Management

- Must keep track of where we have “unused” blocks…
  - Bit Vector: Each block represented by a “bit” - 1 for empty, 0 for used
  - Linked List: Surprisingly efficient - why?

Request Scheduling

- Access time determined by:
  - Latency (rotational)
  - Seek (arm movement)
  - Transfer time

Fixed, out of our control

Schedulable…

Constant, unavoidable

More Scheduling Algorithms

- Goal: Reduce arm movement
  - First-come, first-served
  - Shortest-Seek First
  - SCAN, LOOK
  - C-SCAN, C-LOOK

Other Considerations

- Disk Formatting:
  - Low-Level blocks
  - Partitions
  - Logical File System
- Bad Bocks: Detecting and Recovering

Swap Management

- Different Priorities: Speed over storage efficiency

- 2 Types:
  - Regular File
  - Raw partition