CSC369 Week 9 Notes

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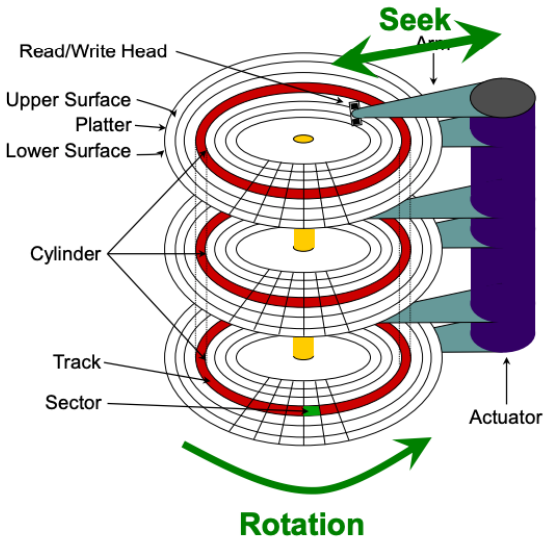
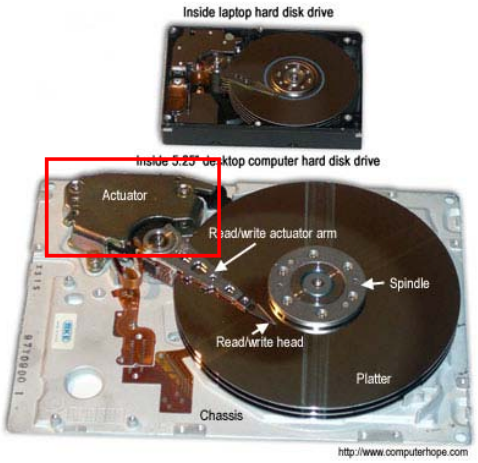
September 16, 2020

1 Disk I/O

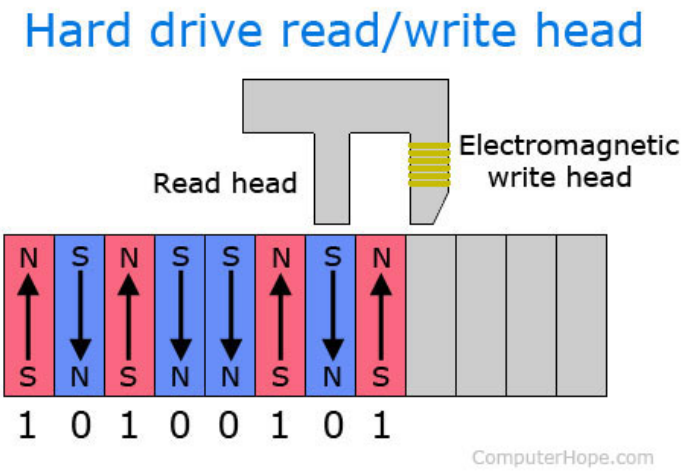
- File system implementation
  - Files and directories live on **secondary storage**
    - Anything outisde of "Primary memory"
    - Is persistent (or non-volatile): Data survives loss of power
- Disk components



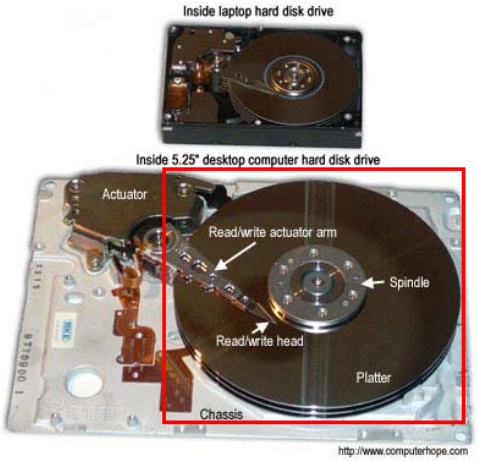
  - **Actuator:**
    - is an electronic device controlled by a motor that moves the hard drive head arm. [1]



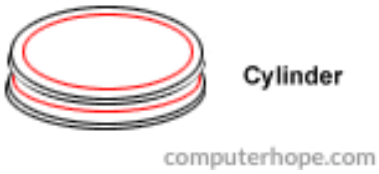
- **Read/Write Heads:**
  - are the small parts of a hard drive which move above the disk platter and transform the platter's magnetic field into electric current [1]



- **Platter:**
  - One or more aluminum, glass, or ceramic disk that is coated in a magnetic media [1]
  - All modern drives use glass or glass-ceramic platters [2]



- **Cylinder:**
  - is any set of all tracks of equal diameter in a hard disk drive (HDD) [3]



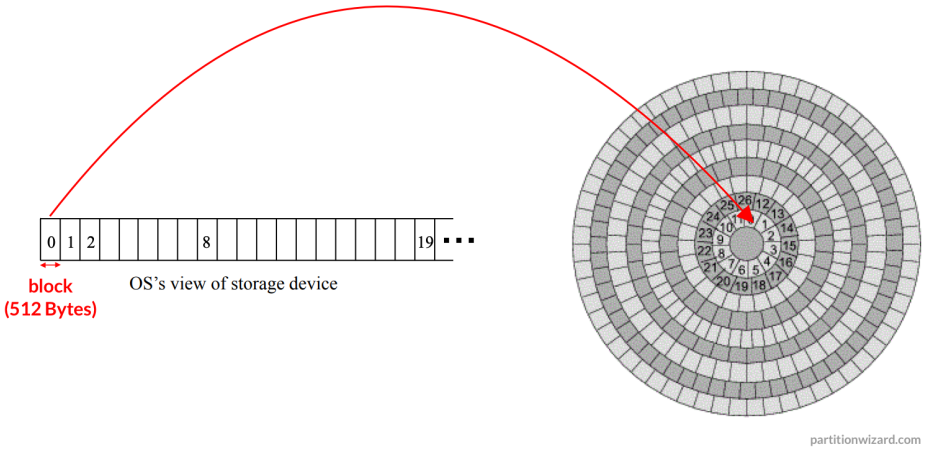
- **Track:**
  - is a data storage ring on a computer hard drive that is capable of storing information.

- **Sector:**
  - A division of storage medium on a hard drive that is a wedge shaped section of one of the circular tracks.
  - Each arc is sector that usually holds 512 byte of data.

Refernces:

1) Computer Hope: Actuator, link
2) Etty94. (2016, August 1). *Hard disk drive components*. Medium. link
3) The Linux Information Project : Cylinder Definition, link

- OS ↔ disk interaction
  - The old way
    - Is called **Extended CHS** (Extended Cylinder, Head, Sector)
    - Specifying disk requests requires a lot of info
      - Cylinder #, Surface #, Track #, Sector #, transfer size ⋯
    - Modern disks are even more complicated
      - Not all tracks have the same number of sectors
      - Sectors are remapped
    - Older disks require OS to specify all of this
      - The OS needs to know all disk parameters
  - Now
    - **Logical Block Addressing**
- Logical Block Addressing
  - Is a common scheme used for specifying the location of blocks of data on computer storage device [1]
  - Is implemented in most hard disk drives after 1996 [1]
  - Hides disk parameters from the OS
  - Exposes storage as linear array of blocks
    - Maps blocks to cylinder/surface/track/sector
    - Each block size is 512 bytes



Refernces:

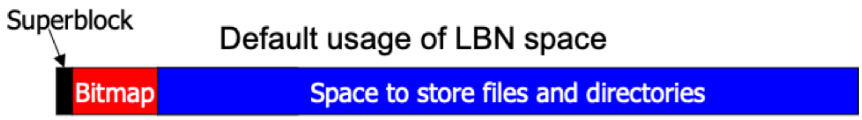
1) Wikipedia: Logical Block Addressing, link

- Disk Scheduling
  - Is also known as I/O scheduling [1]
  - Is done by operating systems [1]
  - Is important because [1]
    - Hard drives are one of the slowest parts of the computer system and thus need to be accessed in an efficient manner

Refernces:

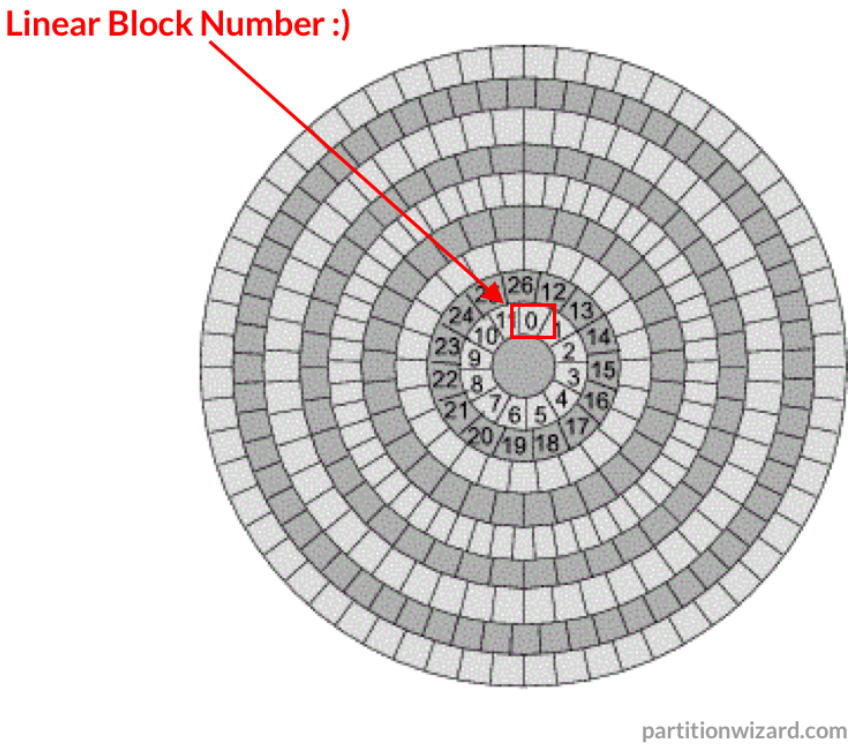
1) Geeks for Geeks: Disk Scheduling Algorithms, link

- File System Implementation
  - **Master Block / Super Block** determines location of root directory
  - **Free map / Bitmap** determines which blocks are free, allocated
  - Remaining disk blocks used to store files (and dirs)



Aside

- LBN (Logical Block Number)
  - Is the index of linear array of blocks



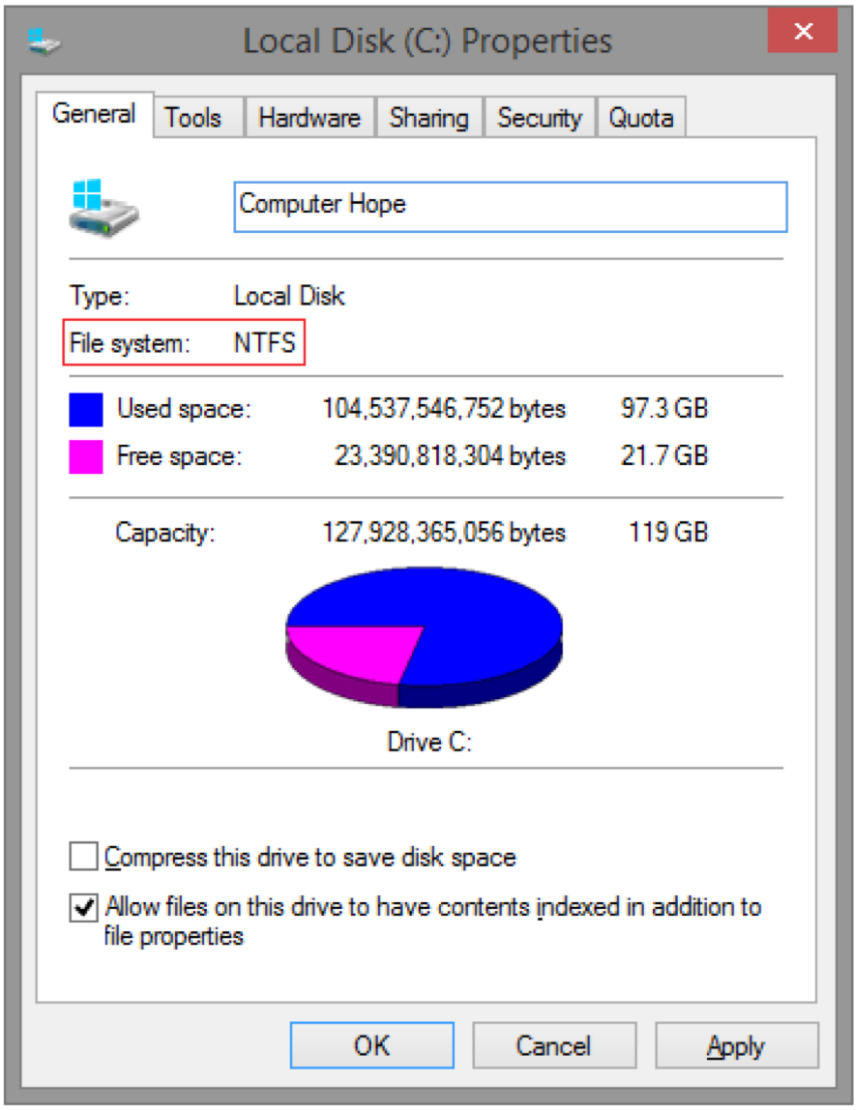
- FFS (Fast File System)
  - Is an improvement made to original Unix File System
  - Is done in early-mid 80s
  - Improved disk utilization and decreased response time
  - Uses **Cylinder Groups**
- Log Structured File System (LSF)
  - Is file system designed to address exponentially improving CPU speed and slowly improving HDD speed. [1]

Refernces:

1) Ousterhout J. (1991). *The Design and Implementation of a Log-Structured File System*. link

- NTFS (Windows)

- Is an acronym for **NT File System**
- Was first introduced in 1993, as part of Windows NT 3.1 Release [1]
- Replaces traditional FAT (File Allocation Table) file system
- Is used in Windows NT, Windows 2000 and above [1]



computerhope.com

Refernces:

1) Datto : What Is NTFS and How Does It Work?, link

- MFT Record

- Is also called **Master File Table Record** [1]
- Contains records about every other file and directory in NTFS volume [1]
- Is a table of metadata like inodes but more flexible

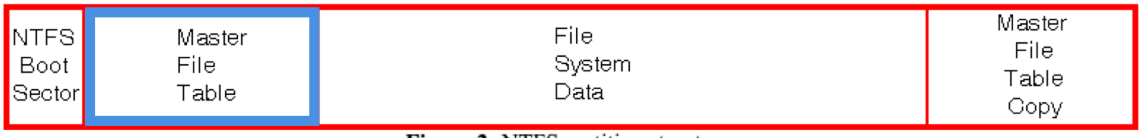


Figure 2: NTFS partition structure.

cse.scu.edu, COEN 252 Computer Forensics, NTFS

Refernces:

1) Webopedia : MFT - Master File Table, link
2) Santa Clara University : COEN 252 Computer Forensics, link