

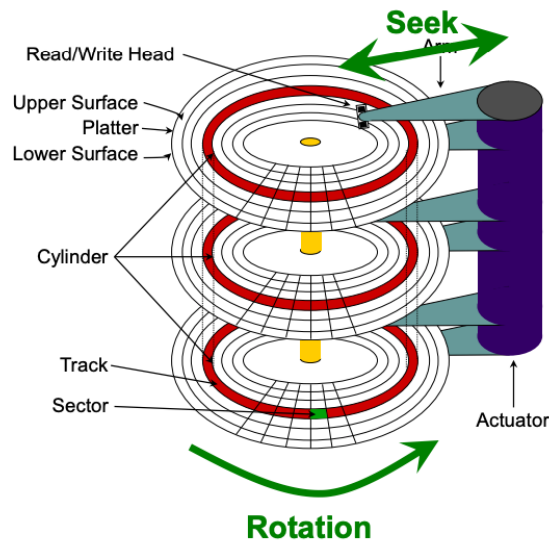
CSC369 Week 9 Notes

Hyungmo Gu

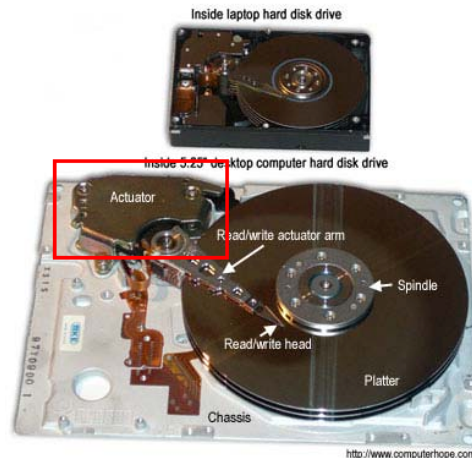
September 11, 2020

1 Disk I/O

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



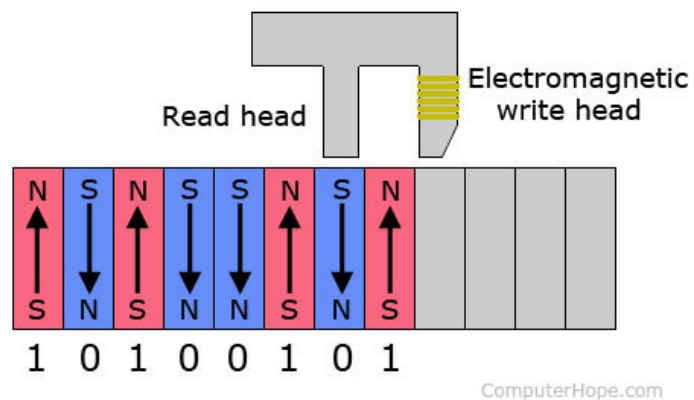
- **Actuator:**
 - * is an electronic device controlled by a motor that moves the hard drive head arm. ^[1]



– Read/Write Heads:

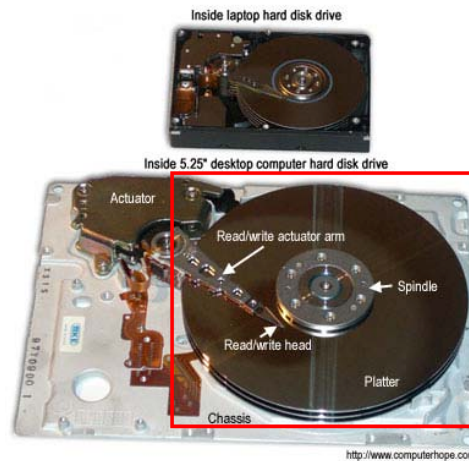
- * are the small parts of a hard drive which move above the disk platter and transform the platter's magnetic field into electric current ^[1]

Hard drive read/write head



– 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.



References:

- 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

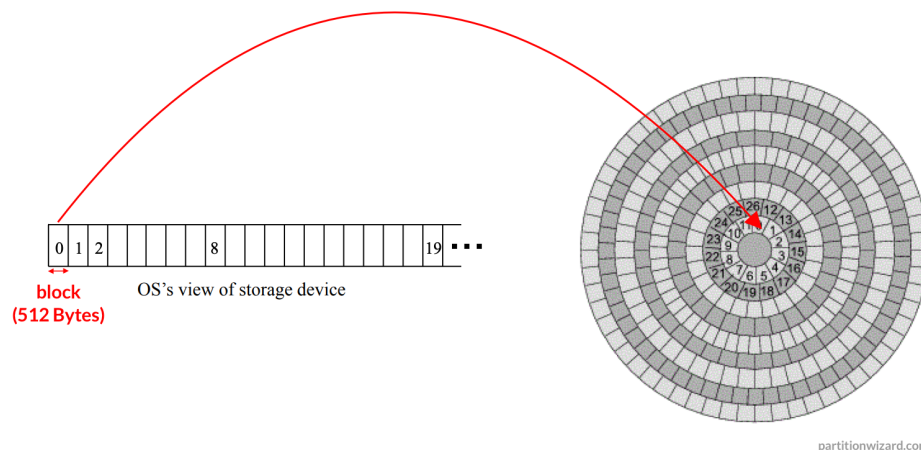
- * Is called **Extended CHS** (Extended Cylinder, Head, Sector)
 - * Specifying disk requests requires a lot of info
 - Cylinder #, Surface #, Track #, Sector #, transfer size ...
 - * Modern disks are even more complicated
 - Not all tracks have the same number of sectors
 - Sectors are remapped
 - * 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:

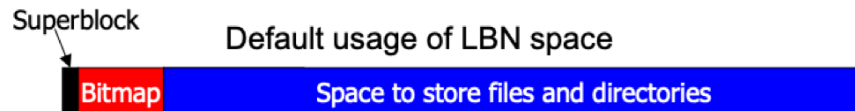
1) Wikipedia: Logical Block Addressing, [link](#)

- 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](#)

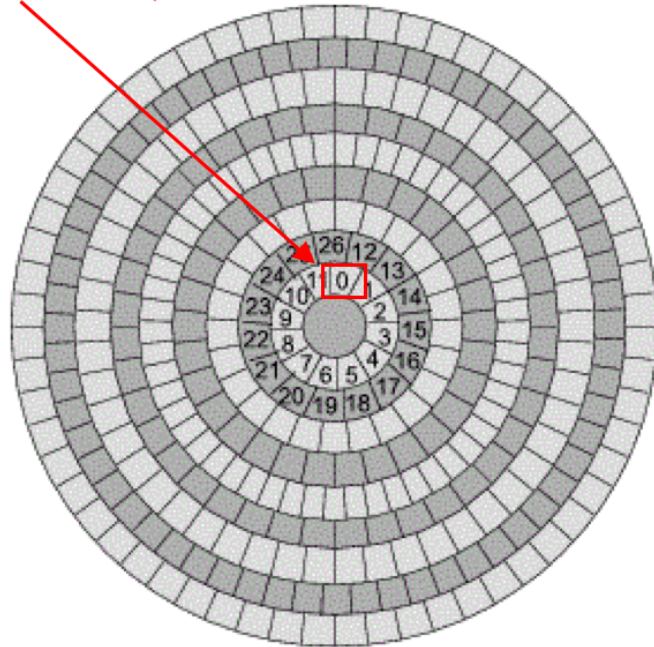
- File System Implementation
 - **Master Block / Super Block** determines location of root directory
 - **Free map / Bitmap** determines which blocks are free, allocated
 - Remaining disk blocks used to store files (and dirs)



Aside

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

Linear Block Number :)



partitionwizard.com

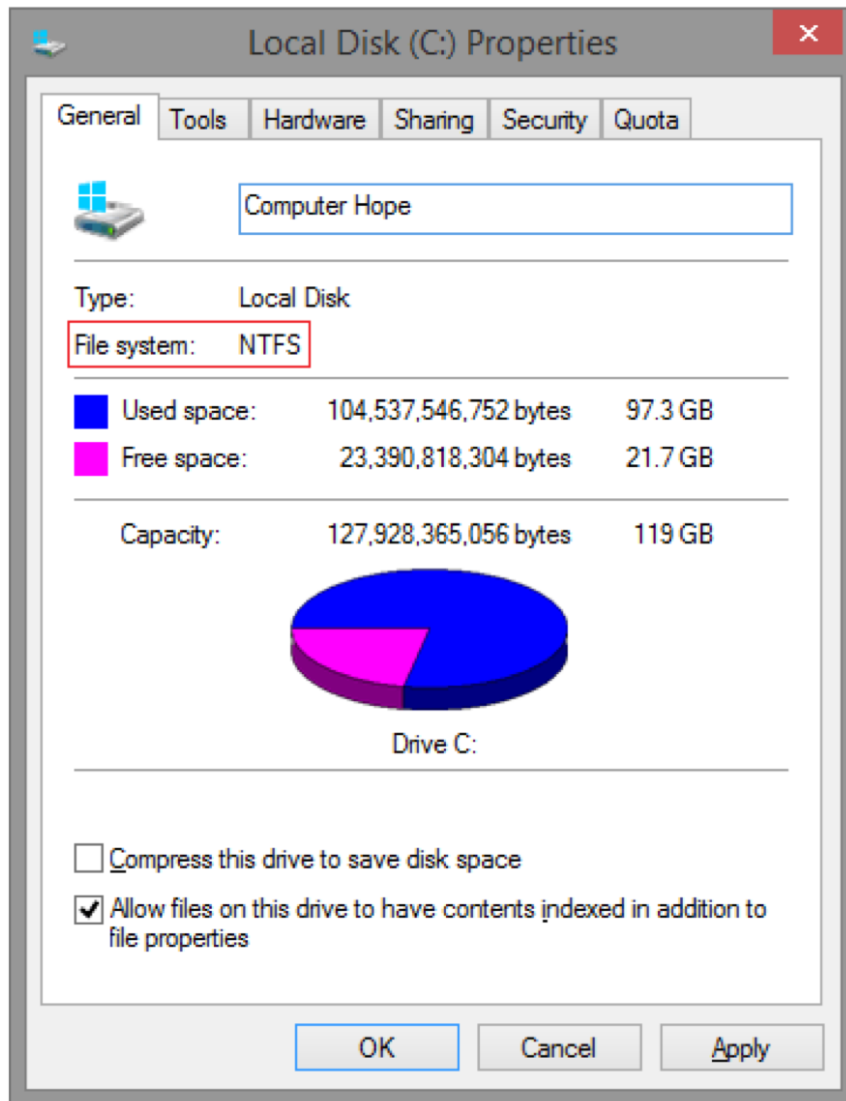
- FFS (Fast File System)
 - Is an improvement made to original Unix File System
 - Is done in early-mid 80s
 - Improved disk utilization and decreased response time
 - Uses **Cylinder Groups**
- Log Structured File System (LSF)
 - Is file system designed to address exponentially improving CPU speed and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

References:

- 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

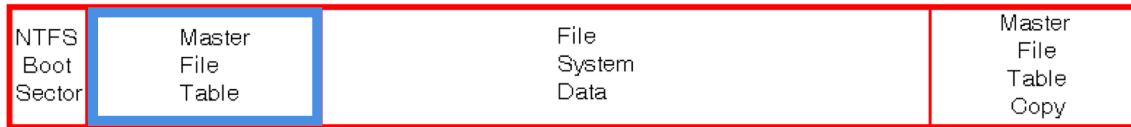


Figure 2: NTFS partition structure.

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](#)