Computer Fundamentals

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Lecture 11

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Outline

- Types of storage devices

Storage Devices

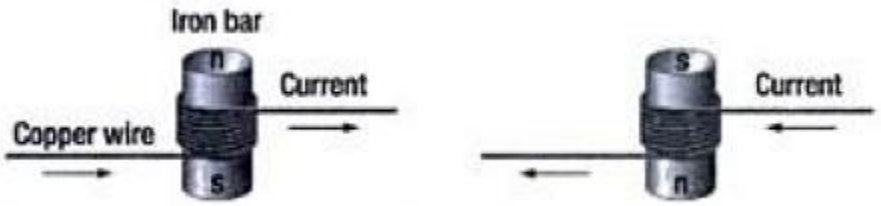
- Store data when computer is off
- Two processes
  - Writing data
  - Reading data
- Storage media
  - Media is the material storing data
  - Storage devices manage media
    - Magnetic devices use a magnet
    - Optical devices use lasers
    - Solid-state devices have physical switches

Magnetic Storage Devices

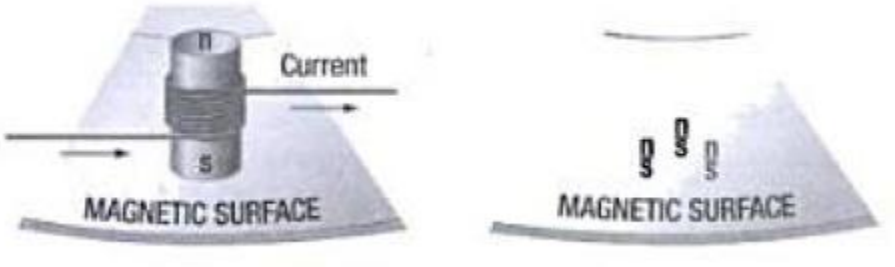
- Most common form of storage
  - Hard drives, floppy drives, tape
- All magnetic drives work the same

Magnetic Storage Devices (cont.)

- Making a magnet
  - Polarity (N/S) determined by current direction



- Electromagnetic induction
  - Placing electromagnet against magnetic surface induces magnetic field

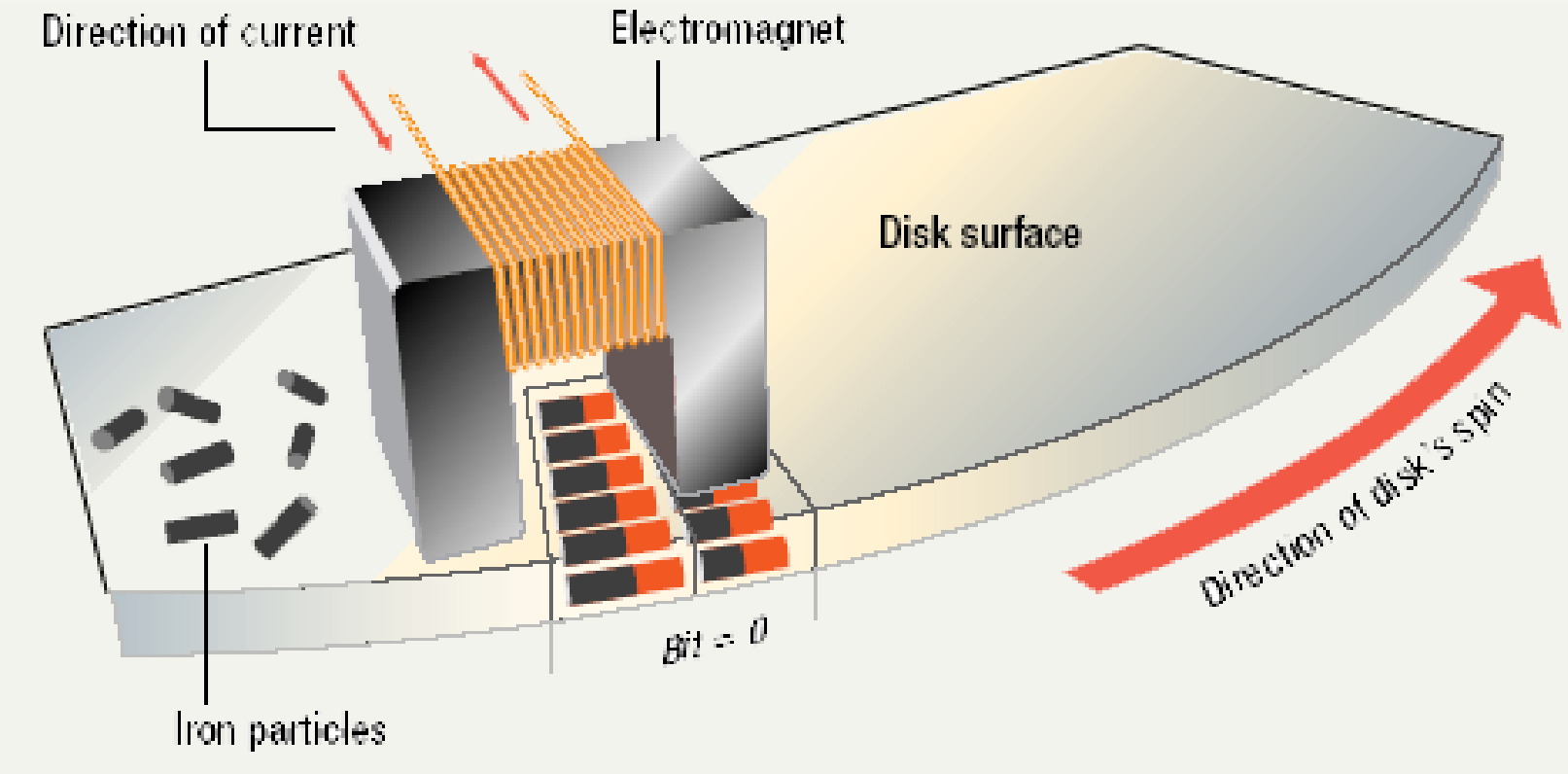


Magnetic Storage Devices (cont.)

- Data storage and retrieval
  - Media is covered with iron oxide
  - Read/write head is a magnet
  - Magnet writes charges on the media
    - Positive charge is a 1 (if N is used)
    - Negative charge is a 0 (if S is used)
  - Magnet reads charges
  - Drive converts charges into binary
  - Better than transistor for 0 and 1 as continuous power not required

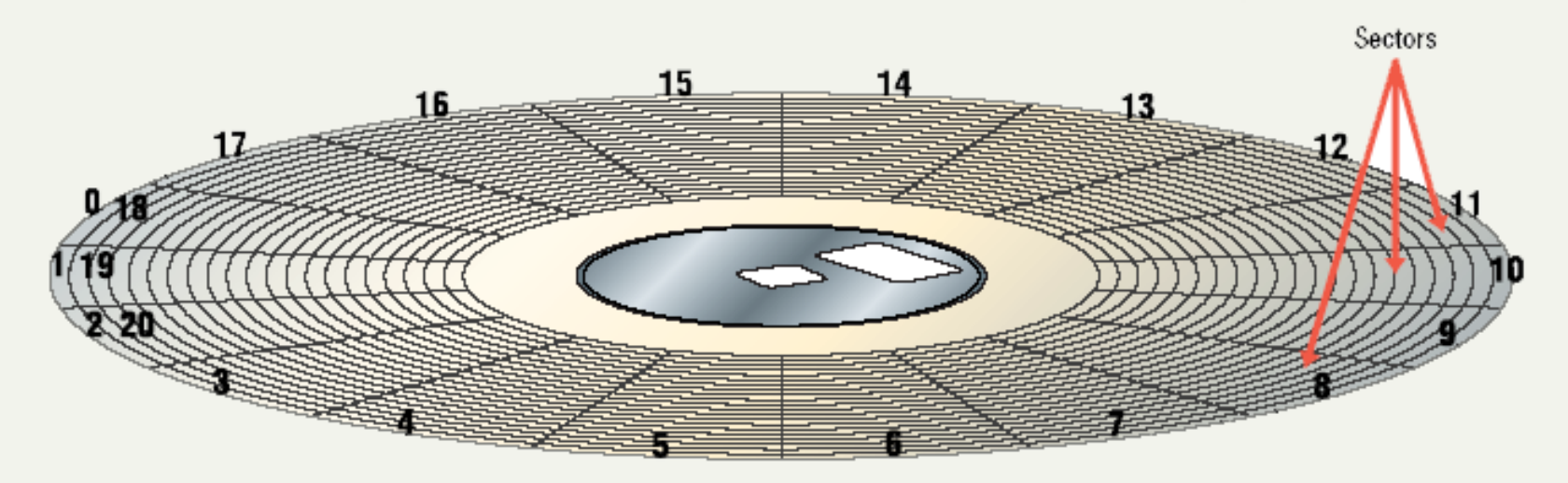
Magnetic Storage Devices (cont.)

- Data retrieval



Magnetic Storage Devices (cont.)

- Data organization
  - Disks must be formatted before use
    - Mapping disk before use
  - Format draws tracks on the disk
    - Concentric rings
  - Tracks are divided into sectors
    - Amount of data a drive can read
    - Assume 80 tracks on each side, 18 sectors, totals 2880 sectors



Magnetic Storage Devices (cont.)

- Finding data on disk
  - Each track and sector is labeled (logical formatting)
  - File system
    - Logical method for storing data on disk surface
    - Listing of where files are stored
  - File system examples
    - File Allocation Table (FAT)
    - FAT32
    - NTFS
  - Data is organized in clusters
    - A group of sectors, storage units
    - Size of data the OS can handle as a single unit

Magnetic Storage Devices (cont.)

- After FAT format, disk contains four areas
  - Boot sector
    - Program that run on computer startup (booting)
    - Control of computer handed over to boot sector after POST
  - FAT area
    - Records status of each sector
    - Keep track of allocation status of clusters
    - Possible FAT entries for clusters: allocated, unallocated, end of file, bad sector
  - Root folder
    - Folder required for organizing files on disk
    - Records location of each file and directory
    - Root folder is master folder
    - All other folders are subfolders in root folder
  - Data area
    - Kept free for data storage

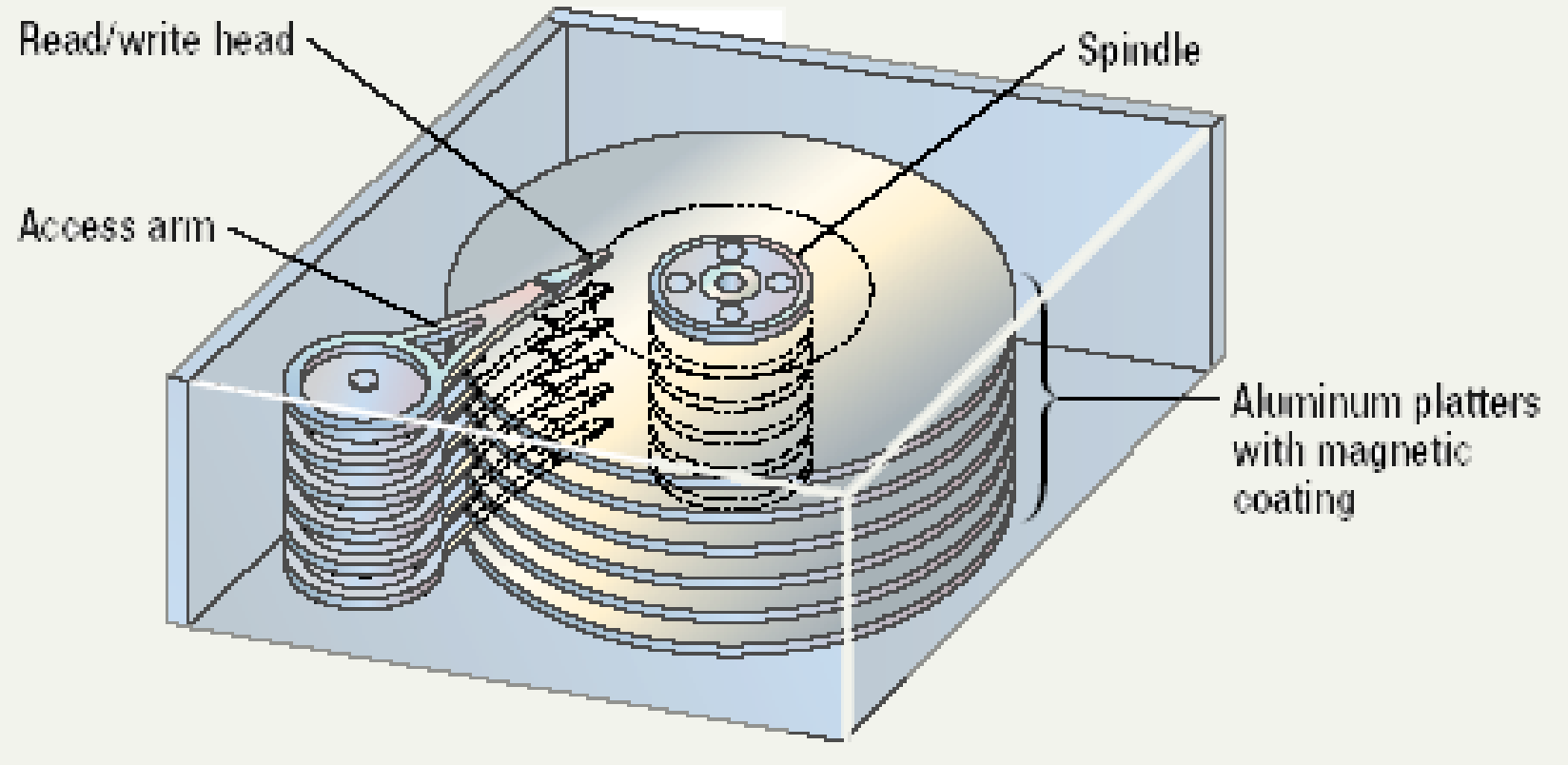
Magnetic Storage Devices (cont.)

- Diskettes
  - Also known as floppy disks
  - Read with a disk drive
  - Recording media of *Mylar*
    - A strong polyester film
  - Spin at 300 RPM
  - Takes .2 second to find data with head
  - 3 ½ floppy disk holds 1.44 MB
- Hard disks
  - Primary storage device in a computer
  - 2 or more aluminium platters
  - Each platter has 2 sides
  - Spin between 5,400 to 15,000 RPM
  - Data found in 9.5 ms or less
  - Drive capacity up to 4 TB

Source: *https://www.amazon.com/Double-Density-MF2-DD-Diskettes-Formatted/dp/B006NNGZ9S*

Magnetic Storage Devices (cont.)

- Hard disk illustrated



Magnetic Storage Devices (cont.)

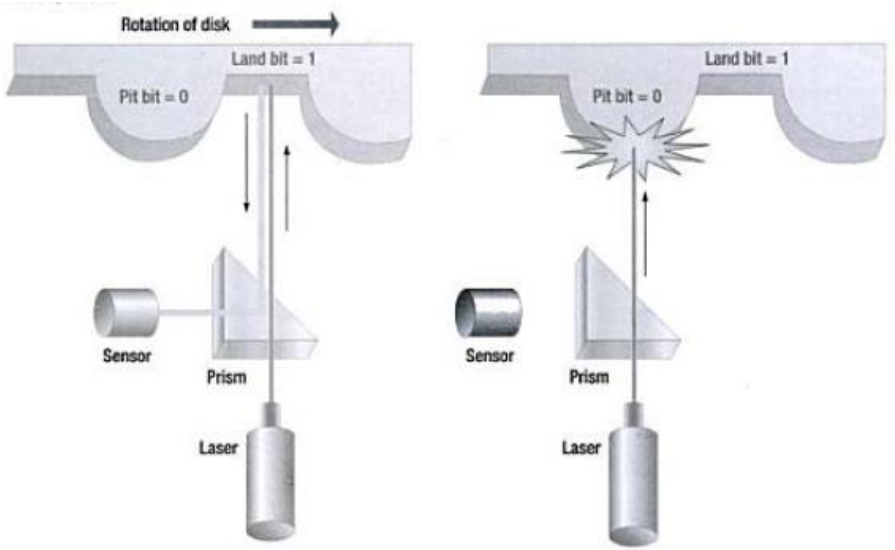
- Removable high capacity disks
  - Speed of hard disk
  - Portability of floppy disk
  - Several variants have emerged
  - High capacity floppy disk
    - Stores up to 750 MB of data
  - Hot swappable hard disks
    - Provide up to TB of data space
    - Connect via USB

Magnetic Storage Devices (cont.)

- Tape drives
  - Best used for
    - Infrequently accessed data
    - Back-up solutions
  - Slow sequential access
  - Capacity exceeds 200 GB

Optical Storage Devices

- CD-ROM
  - Most software ships on a CD
  - Read using a laser
    - Lands, binary 1, reflect data
    - Pits, binary 0, scatter data
  - Spiral sectors (all of same width)
  - Written from the inside out
  - CD speed is based on the original
    - Original CD read 150 Kbps
    - A 10 X will read 1,500 Kbps
  - Standard CD holds 650 MB
- DVD-ROM
  - Digital Video Disk
  - Use both sides of the disk
  - Capacities can reach 18 GB
  - DVD players can read CDs



Optical Storage Devices (cont.)

- CD Recordable (CD-R)
  - Create a data or audio CD
  - Data cannot be changed
  - Can continue adding until full
- CD ReWriteable (CD-RW)
  - Create a reusable CD
  - Cannot be read in all CD players
  - Can reuse about 100 times
- Photo CD
  - Developed by Kodak
  - Provides for photo storage
  - Photos added to CD until full
  - Original pictures cannot be changed

Optical Storage Devices (cont.)

- DVD Recordable
  - Several different formats exist
  - None are standardized
  - Allows home users to create DVDs
  - Cannot be read in all players
- DVD-RAM
  - Allow reusing of DVD media
  - Erasing possible
  - Not standardized
    - Cannot be read in all players

Solid State Devices

- Data is stored physically
  - Using physical switches
- No magnets or laser
- Very fast

Solid State Devices (cont.)

- Flash memory
  - Found in cameras and USB drives
  - Combination of RAM and ROM
  - Long term updateable storage
- Smart cards
  - Credit cards with a chip
  - Chip stores data
  - Eventually may be used for cash
  - Hotels use for electronic keys
- Solid-state disks
  - Large amount of SDRAM
    - Not a disk actually, is volatile
  - For large organizations, for network storage or joint projects
    - Availability of quickly changing data for large number of users at once
  - Extremely fast
  - Volatile storage
    - Require battery backups
  - Most have hard disks copying data for backup