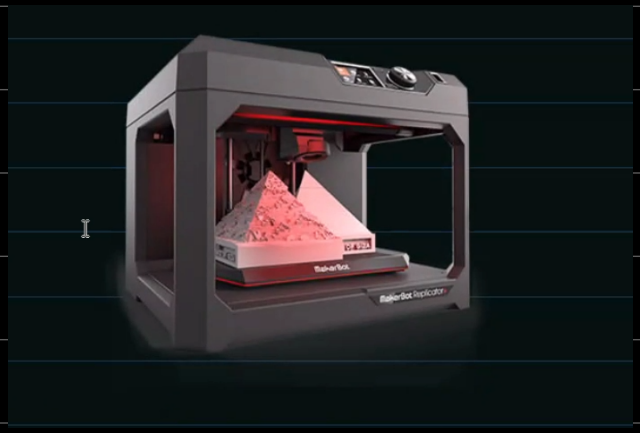
Hardware

I/O Devices

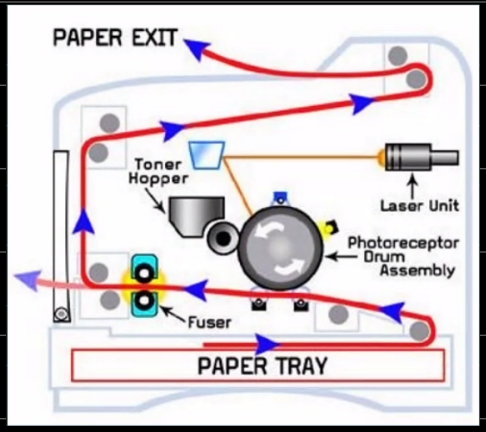
3D Printer



- The object is designed using Computer Aided Design Software
- The software splits the object into slices (layers)
- The data about slices is sent to the printer.
- The solid plastic is melted and transferred to the nozzle.
- The stepper motor moves the nozzle into position.
- The nozzle extrudes the molten plastic
- The previous steps are repeated until the layer is complete

- A fan cools the layer
- Each layer is printed by following the same steps.

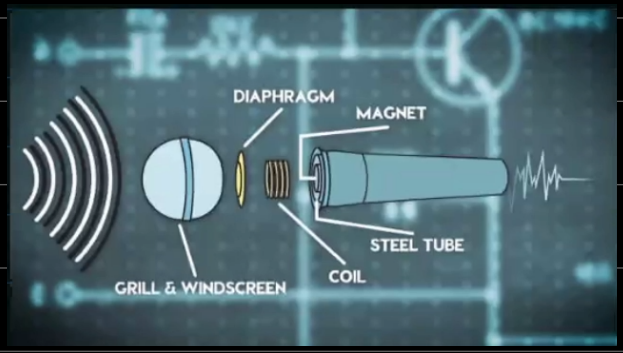
Laser Printer



- The revolving drum is initially given an electrical charge
- A laser beam bounces of mirror and scans back and forth across the drum.
- Discharching certain points such as letters or images to be printed as electrical charges.
- The drum is coated with oppositely charged Toner which only sticks to charged areas
- The pattern on the drum is transferred to the paper.

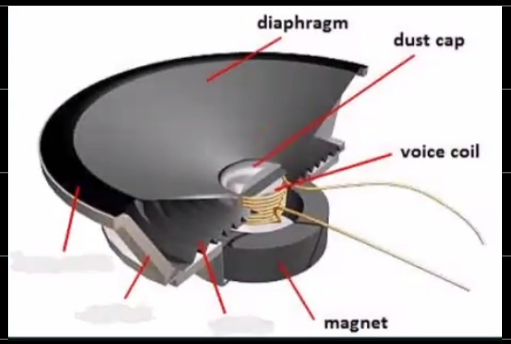
- The paper is passed through the fuser to seal the image.
- The electrical charge is removed from the drum and excess toner is collected

Microphone



- The microphone has a diaphragm
- The incoming sound waves causes vibration
- causing a coil to move past a magnet
- An electrical signal is produced.

Speakers



- Takes an electrical signal and translates them into physical vibrations to create sound waves
- An electric current in the coil creates an electromagnetic field.
- Changes in the audio signal causes the direction of electric current to change
- The direction of the current determines the polarity of the electromagnet.
- The electromagnet is repelled by or attracted to the permenant magnet.
- Causing the coil to vibrate.
- The movement of the coil causes the cone to vibrate.
- The vibration is transmitted to the air in front of the cone.
- The amount of movement will determine frequency and amplitude of the sound wave produced.

Q- What are the components of the speaker?

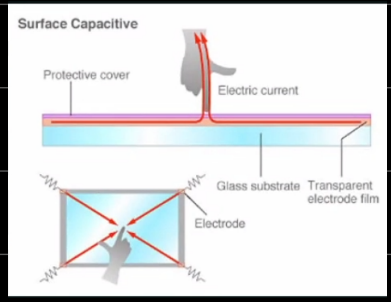
- Cone
- Coil of wire
- Permenant Magnet
- Dust Cap

Resistive Touch Screen

- Consists of two charged plates
- Pressure causes the plates to touch
- Completing the circuit
- Point of contact registered
- Coordinates used to calculate the position

Capacitive Touch Screen

- Made from materials that store electric charge
- When touched, charge is transferred to the finger



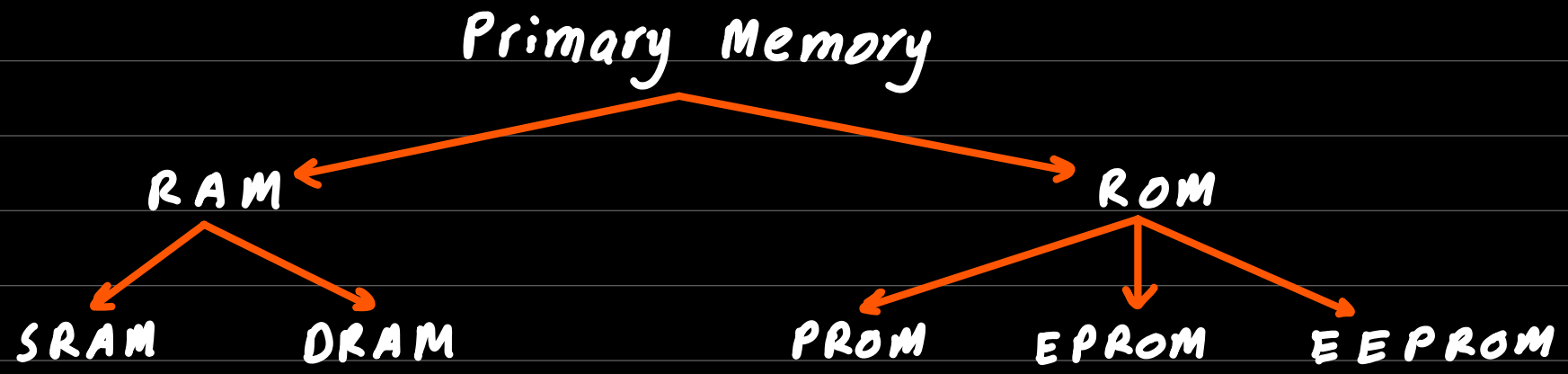
- Sensors at the screen corners detect the change
- Point of contact registered
- Coordinates used to calculate the position

Virtual Reality Headset

- Video is sent from the computer to the headset using a cable
- Two feeds are sent to a LCD.
- Sometimes two screens are used.
- Lenses are used for focusing and reshaping the image
- Most headset use 60-120 frame rate and 110° field of view to make it realistic
- Gyroscopic or accelerometer are used to detect the head movement
- Headset uses binaural sounds.

Memory

① Primary Memory
② Secondary Memory



Q- What is the difference between RAM and ROM?

- RAM is volatile memory (Temporary memory) → Data is lost when comp shuts down
- ROM is non-volatile memory (Permenant) → Data is not lost after comp. shuts down

- Data can be altered in RAM
- Data can not be changed in ROM

- RAM stores data in use
- ROM stores bootup instructions.

- RAM is read/write only
- ROM is write only.

Uses of RAM and ROM in 3D-Printer

RAM:

- Stores current running parts of 3D-printer software.
- Stores the content of buffer.
- Stores the current progress of the printer.
- Stores the data about the layers being printed.
- Stores the data about the printer e.g: Nozzle position.

Note: Use of RAM and ROM will vary according to the situation.

ROM

- Stores the operating system of the printer
- Stores the setup instructions for 3-D printer.
- bootup instructions for OS.

Uses of RAM and ROM in Laser Printer

RAM:

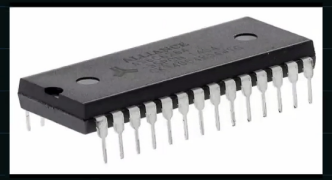
- Stores the currently running parts of the laser printer software
- Stores the data being printed or in buffer
- Stores the current progress of printing
- Stores information of printer e.g: toner level.

ROM:

- Stores the operating system of the printer
- Stores the setup instructions for the printer.
- Stores bootup instructions for operating system.

Primary Memory

DRAM (Dynamic Random Access Memory)



SRAM (Static Random Access Memory)

Q- Explain the difference between DRAM and SRAM

- DRAM has to be refreshed due to charge leak
- SRAM has no need to be refreshed.

- DRAM stores each bit as a charge.
- SRAM stores each bit using flip flop. (bit trapping)

- DRAM uses single transistor and capacitor
- SRAM uses more than one transistor

- DRAM has higher power consumption due to more refreshing
- SRAM has lesser power consumption // // less refreshing

- DRAM less expensive as less transistors are used.
- SRAM more expensive as more transistors are used.

- DRAM has slower access time bcoz refreshing is required
- SRAM has faster access time bcoz no requirement for refreshing.

- DRAM more storage
- SRAM less storage

- DRAM used in main memory.
- SRAM used in cache memory. (Cache memory is used to store frequently used instructions and it uses SRAM)

Note: SRAM uses transistors arranged as flip-flops and DRAM uses transistors and capacitors to store each bit

Read Only Memory (ROM)

PROM: Programmable Read-Only Memory

EPROM: Eraseable Programmable Read-Only Memory

EEPROM: Electrically Erasable programmable Read-Only Memory

PROM

- Initially empty
- User can write data on it only once
- If there is any error in writing instructions, the error can not be removed.
- The chip becomes unusable

EPROM

- Initially Empty
- Can be overwritten multiple times
- If there is an error in writing instructions the error can be removed

- EPROM can be erased using UV light
- EPROM needs to be removed from device. (drawback)
- EPROM must be entirely erased before writing.

EEPROM

- Initially Empty
- Can be overwritten multiple times
- If there is an error in writing instructions the error can be removed
- EEPROM can be erased using voltage.
- EEPROM can be erased in its original position in the device (Situ M.S)
- EEPROM does not have to be entirely erased before writing.

Q- Explain the difference b/w PROM, EPROM and EEPROM.

- PROM can be set once, EPROM and EEPROM can be overwritten multiple times.
- EPROM can be erased using UV light, EEPROM can be erased using voltage.
- EPROM needs to be removed from device, EEPROM can be erased in situ
- EPROM must be entirely erased before writing but EEPROM does not have to be entirely erased before writing

Buffer: Buffer memory is temporary storage area in the RAM that stores data transferring b/w two or more devices.

Secondary Memory

Different types of Storage Media

Magnetic Media:

- Surface coated with magnetic material
- Magnetic properties are altered to represent the bits
- Used by hard-disks, magnetic tapes, floppy disks

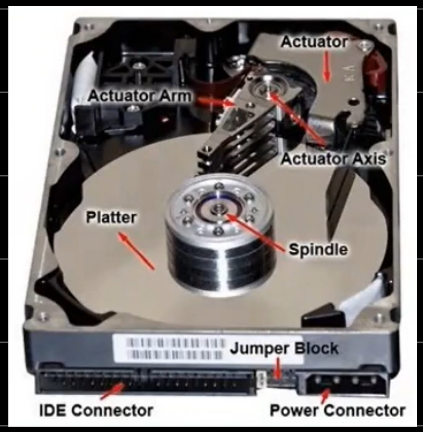
Optical Media:

- Surface coated with light sensitive material
- Read/written by lasers
- CD's use one spiral track
- Used by DVD-RAM, CD-R, CD ROM, CD RW, Bluray disk

Solid State Media:

- Uses millions of tiny transistors
- where movement of electrons are controlled within a microchip
- has no moving parts
- Used by memory sticks, MP3 player etc...

Basic Internal operation of Hard disk



- HDD has one or more platters made of aluminum
- Each surface of the platter is ferous-oxide which is capable of being magnitised
- The platters are mounted on a central spindle
- The disks are rotated at high speed
- Each disk has read/write head mounted on an arm positioned just above

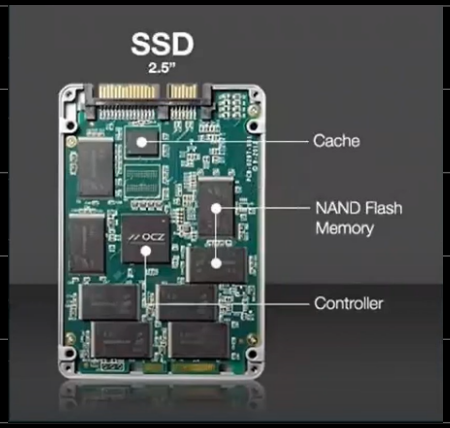
the surface

- The surface of the platter is divided into concentric tracks and sectors
- One track in one sector is basic unit of storage called block.
- The data is coded in magnetic pattern for each block.

Q- What is Flash memory?

- Most are NAND - based flash memory
- There are no moving parts.
- Uses a grid of columns and rows that has 2 transistors at each intersection.
- One transistor is called floating gate.
- Second transistor is called control gate
- Memory cells store voltages which can represent 0 or 1
- Essentially, the movement of electrons is controlled to read/write
- No overwriting data // first erase, then add.

Basic Internal Operations of SSD

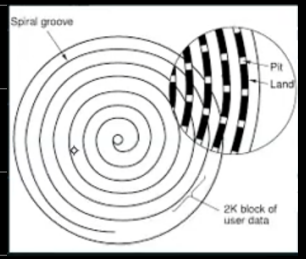


- No moving parts
- Non-volatile
- Uses NAND Gates, NOR Gates // transistors and integrated circuit
- SSD controller manages the components.
- Uses a grid of columns and rows that has 2 transistors at each intersection.
- one transistor is floating gate
- One transistor is control gate
- Memory cells store voltages which either represent 0 or 1.
- Essentially, movement of electrons is controlled to read/write
- No overwriting data / first erase, then add

Optical Disc

- Driver motor is used to spin the disc.
- Tracking mechanism moves the laser assembly
- A lens focuses laser on the disc.
- Laser beam is shone onto disc to read/write.

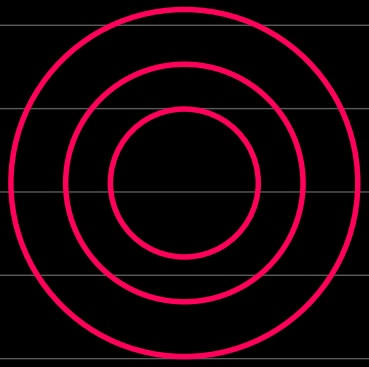
DVD-RW



- Uses a single spiral track
- Only allows write or read operation to occurr as seperate operations
- Requires special packet reading/writing software
- In order to write new data to the disc. The existing data must be completely erased
- By time, the performance of DVD-RW degrades
- Single sided, 4.7 GB capacity
- rotates at changing speeds

DVD-RAM

- Uses several concentric tracks
- Allows simultaneous read/write operations
- No special read/write software required
- Make use of sector to store data
- Single or double sided; 4.7 GB per side
- Disc rotates at constant speed.



Embedded Systems

Explain why the lane detection system is an example of an embedded system.

- The lane detection system is built into the car
- The lane detection system only performs one task
- The lane detection system is not easily updated by the car owner.

[2]

General Purpose Computers

- Performs more than one task
- e.g: PC, mobiles

Special Purpose Computers

- Performs one specific task
- e.g: Home appliances, calculator
- Embeded System

Q- What is meant by embedded systems?

- Microprocessor within a larger system that performs one specific task