Review of

Computer Organization

Operating System (CSC1036 & INF1036)

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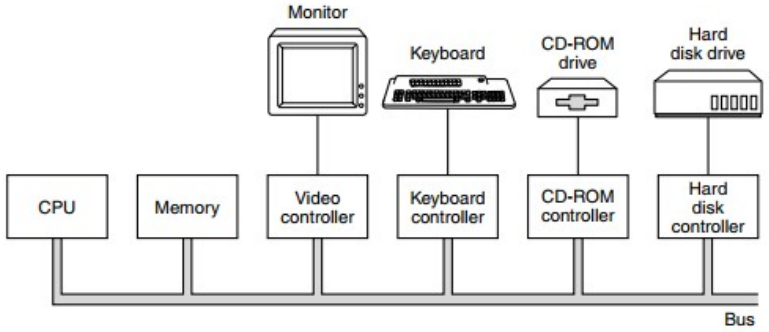
Bus

- The usual arrangement of a personal computer is a metal box with a large printed circuit board at the bottom or side, called the motherboard
- The motherboard contains the CPU chip, some slots into which DIMM modules can be clicked, and various support chips.
- It also contains a bus etched along its length, and sockets into which the edge connectors of I/O boards can be inserted.

Bus

- The logical structure of a simple personal computer is shown in the following figure



- This one has a single bus used to connect the CPU, memory, and I/O devices; most
- systems have two or more buses.

Bus

- Each I/O device consists of two parts: one containing most of the electronics, called the controller, and one containing the I/O device itself, such as a disk drive.
- The controller is usually integrated directly onto the motherboard or sometimes contained on a board plugged into a free bus slot.
- The job of a controller is to control its I/O device and handle bus access for it.
- When a program wants data from the disk, for example, it gives a command to the disk controller, which then issues seeks and other commands to the drive.

Bus

- A controller that reads or writes data to or from memory without CPU intervention is said to be performing Direct Memory Access, better known by its acronym DMA.
- When the transfer is completed, the controller normally causes an interrupt, forcing the CPU to immediately suspend running its current program and start running a special procedure, called an interrupt handler

Keyboard

- Nowadays, the cheaper keyboards have keys that just make mechanical contact when pressed.
- Better ones have a sheet of elastometric material (a kind of rubber) between the keys and the underlying printed circuit board.
- Under each key is a small dome that buckles when pressed far enough.
- A small spot of conductive material inside the dome closes the circuit.
- Some keyboards have a magnet under each key that passes through a coil when struck, thus inducing a current that can be detected.

Touch Screen

- Touch devices fall into two categories: opaque and transparent.
- A typical opaque touch device is the touchpad on a notebook computer.
- A typical transparent device is the screen of a smart phone or tablet.
- The major types of touch screens are: infrared, resistive, and capacitive.

Infrared Touch Screen

- Infrared screens have infrared transmitters, such as infrared light emitting diodes or lasers on (for example) the left and top edges of the bezel around the screen and detectors on the right and bottom edges.
- When a finger, stylus, or any opaque object blocks one or more beams, the corresponding detector senses the drop in signal and the hardware of the device can tell the operating system which beams have been blocked, allowing it to compute the (x, y) coordinates of the finger or stylus.
- While these devices have a long history and are still in use in kiosks and other applications, they are not used for mobile devices

Resistive Touch Screen

- Another old technology consists of resistive touch screens. These consist of two layers, the top one of which is flexible.
- It contains a large number of horizontal wires.
- The one under it contains vertical wires.
- When a finger or other object presses a point on the screen, one or more of the upper wires comes in contact with (or close to) the perpendicular wires in the lower layer
- These screens can be built very inexpensively and are widely used in price-sensitive applications.

Capacitive Touch Screen

- Both of these technologies are fine when the screen is pressed by one finger but have a problem when two fingers are used
- All touch screens that can detect two or more points of contact at the same time are known as multitouch screens.
- When a finger touches the screen, it changes the capacitance at all the intersections touched

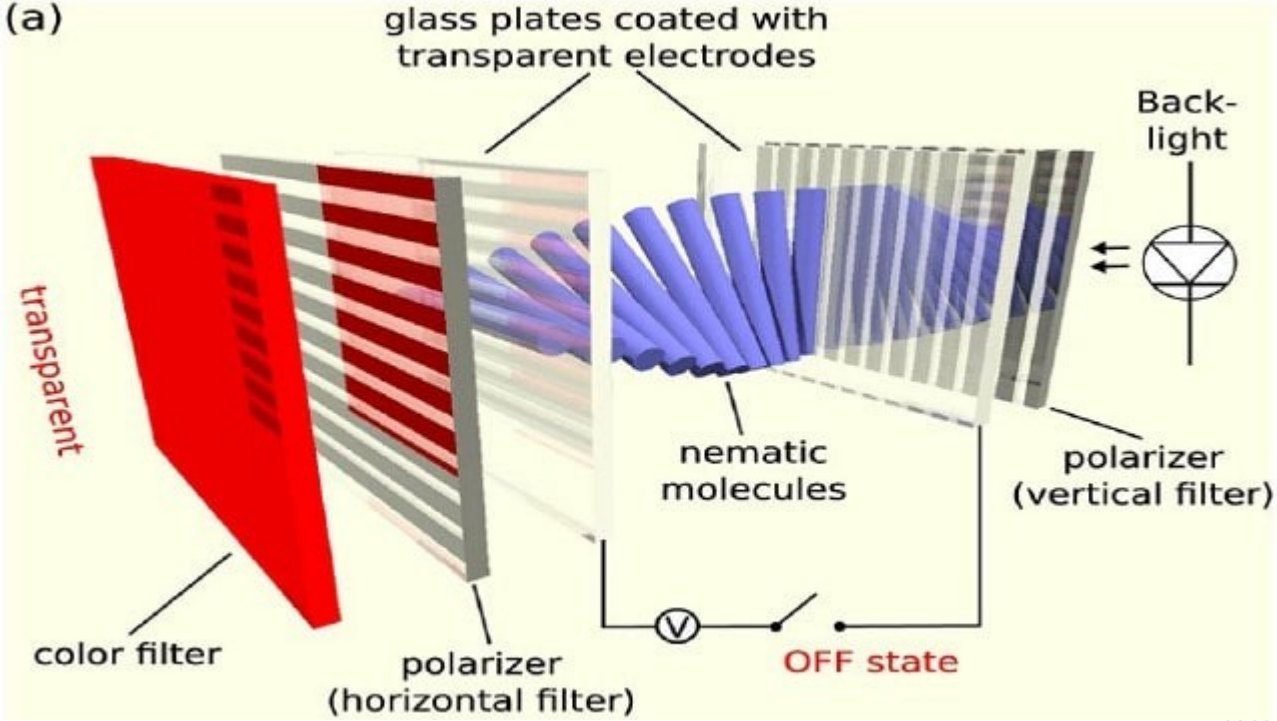
Flat Panel Display

- The first computer monitors used cathode ray tubes (CRTs), just like old television sets.
- They were far too bulky and heavy to be used in notebook computers.
- The most common flat panel display technology is the LCD (Liquid Crystal Display)

Flat Panel Display

- Liquid crystals are viscous organic molecules that flow like a liquid but also have spatial structure, like a crystal.
- LCD uses the light-modulating properties of liquid crystals combined with polarizers.
- Liquid crystals do not emit light directly, instead it uses a backlight or reflector to produce images in color or monochrome.

Flat Panel Display



Flat Panel Display

- An LCD display screen consists of two parallel glass plates between which is a sealed volume containing a liquid crystal.
- Transparent electrodes are attached to both plates.
- A light behind the rear plate (either natural or artificial) illuminates the screen from behind.
- The transparent electrodes attached to each plate are used to create electric fields in the liquid crystal.
- Different parts of the screen get different voltages, to control the image displayed.

Active Matrix and Passive Matrix LCD

- Passive-matrix LCDs use a simple grid to supply the charge to a particular pixel on the display.
- It starts with two glass layers called substrates.
- One substrate is given columns and the other is given rows made from a transparent conductive material.
- The rows or columns are connected to integrated circuits that control when a charge is sent down a particular column or row.
- The simplicity of the passive-matrix system is beautiful, but it has significant drawbacks, notably slow response time and imprecise voltage control.

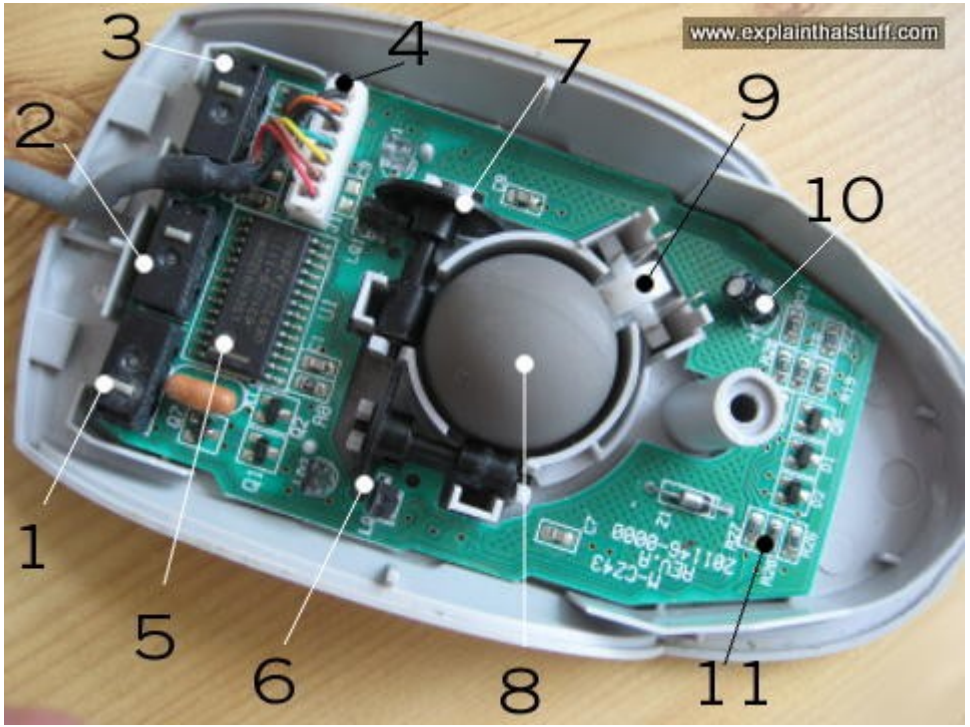
Active Matrix and Passive Matrix LCD

- Active-matrix LCDs depend on thin film transistors (TFT).
- Basically, TFTs are tiny switching transistors and capacitors.
- They are arranged in a matrix on a glass substrate.
- To address a particular pixel, the proper row is switched on, and then a charge is sent down the correct column.
- The capacitor is able to hold the charge until the next refresh cycle.

Mouse

- A mouse is something you push along your desktop to make a cursor (pointing device) move on your screen.
- So what a mouse has to do is figure out how much you're moving your hand and in which direction.
- There are two main kinds of mice and they do this job in two different ways, either using a rolling rubber ball (in a mechanical mouse) or by bouncing a light off your desk (in an optical mouse).

Machanical Mouse



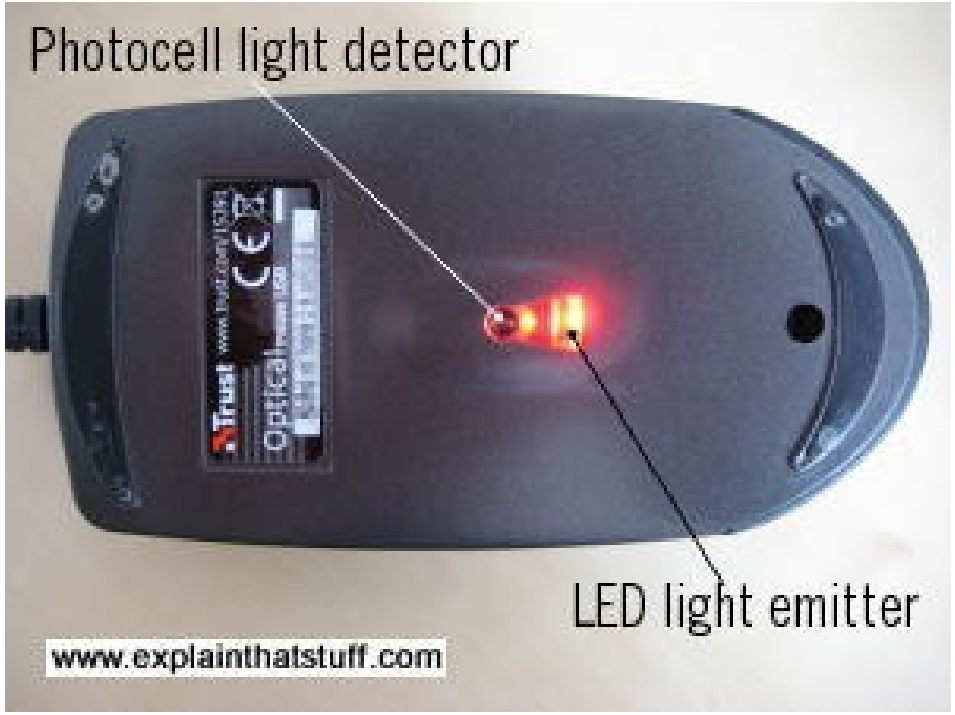
Mechanical Mouse

- As we move it across your desk, the ball rolls under its own weight and pushes against two plastic rollers linked to thin wheels
- One of the wheels detects movements in an up-and-down direction (like the y-axis on graph/chart paper); the other detects side-to-side movements (like the x-axis on graph paper).

Mechanical Mouse

- Each wheel is made up of plastic spokes and, as it turns, the spokes repeatedly break a light beam.
- The more the wheel turns, the more times the beam is broken.
- So counting the number of times the beam is broken is a way of precisely measuring how far the wheel has turned
- The counting and measuring is done by the microchip inside the mouse, which sends details down the cable to your computer.

Optical Mouse



Optical Mouse

- An optical mouse shines a bright light down onto your desk from an LED (light-emitting diode) mounted on the bottom of the mouse.
- The light bounces straight back up off the desk into a photocell (photoelectric cell), also mounted under the mouse, at a short distance from the LED.
- The photocell has a lens in front of it that magnifies the reflected light, so the mouse can respond more precisely to your hand movements.
- As you push the mouse around your desk, the pattern of reflected light changes, and the chip inside the mouse uses this to figure out how you're moving your hand.

Printers

Printer Types

- Inkjet Printers
- Laser Printers
- Dot Matrix Printers
- Thermal printer

Inkjet Printer

- An inkjet printer is any printer that places extremely small droplets of ink onto paper to create an image
- The core of an inkjet printer, the print head contains a series of nozzles that are used to spray drops of ink
- A stepper motor moves the print head assembly (print head and ink cartridges) back and forth across the paper

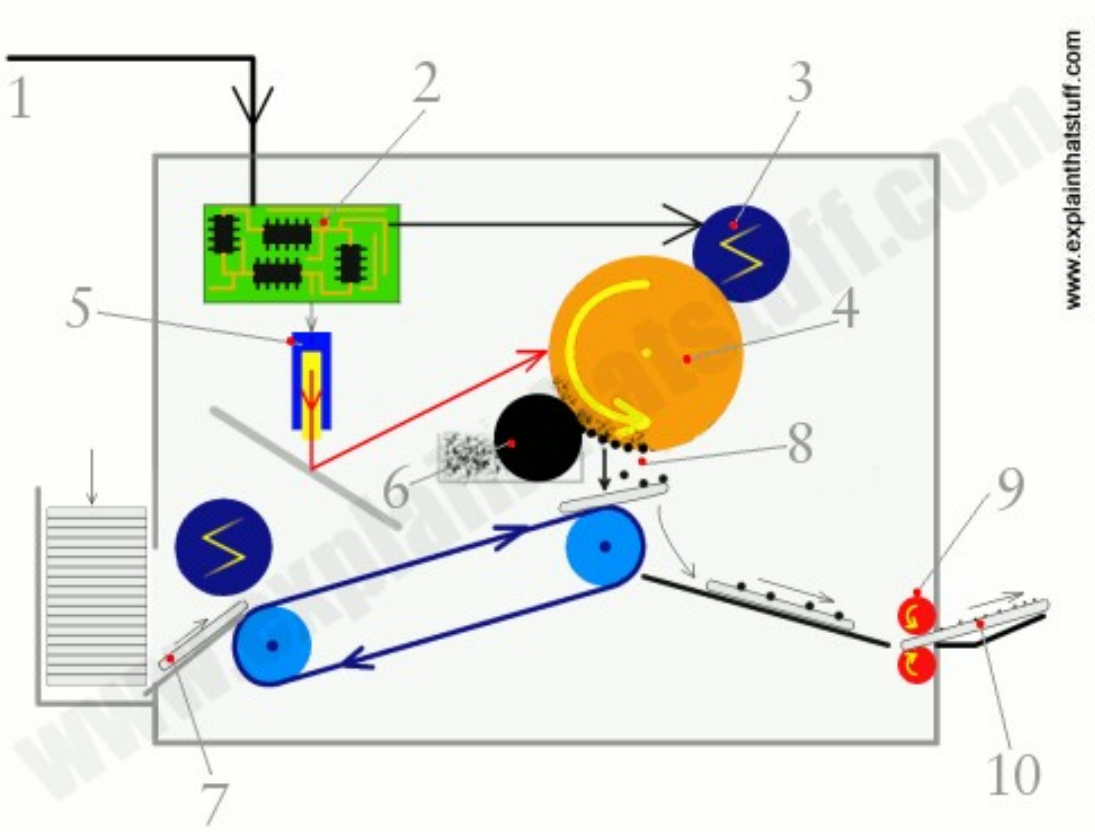
Inkjet Printer

- Thermal bubble - Used by manufacturers such as Canon and Hewlett Packard, this method is commonly referred to as bubble jet.
- In a thermal inkjet printer, tiny resistors create heat, and this heat vaporizes ink to create a bubble.
- As the bubble expands, some of the ink is pushed out of a nozzle onto the paper.
- When the bubble "pops" (collapses), a vacuum is created. This pulls more ink into the print head from the cartridge.
- A typical bubble jet print head has 300 or 600 tiny nozzles, and all of them can fire a droplet simultaneously.

Inkjet Printer

- Piezoelectric - Patented by Epson, this technology uses piezo crystals.
- A crystal is located at the back of the ink reservoir of each nozzle.
- The crystal receives a tiny electric charge that causes it to vibrate.
- When the crystal vibrates inward, it forces a tiny amount of ink out of the nozzle.
- When it vibrates out, it pulls some more ink into the reservoir to replace the ink sprayed out.

Laser Printer



Laser Printer

- The electronic circuit activates the corona wire. The corona wire charges up the photoreceptor drum so the drum gains a positive charge spread uniformly across its surface.
- At the same time, the circuit activates the laser to make it draw the image of the page onto the drum.
- The laser beam doesn't actually move: it bounces off a moving mirror that scans it over the drum.
- Where the laser beam hits the drum, it erases the positive charge that was there and creates an area of negative charge instead.

Laser Printer

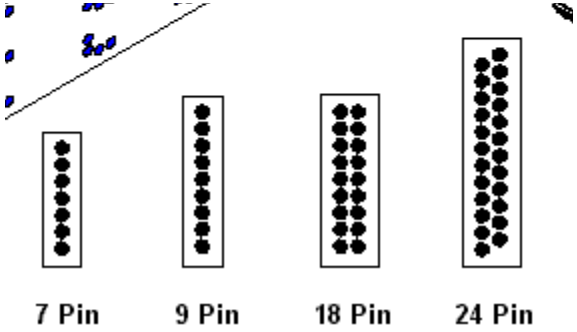
- An ink roller touching the photoreceptor drum coats it with tiny particles of powdered ink (toner).
- The toner has been given a positive electrical charge, so it sticks to the parts of the photoreceptor drum that have a negative charge
- No ink is attracted to the parts of the drum that have a positive charge. An inked image of the page builds up on the drum.

Laser Printer

- A sheet of paper from a hopper on the other side of the printer feeds up toward the drum.
- As it moves along, the paper is given a strong negative electrical charge by another corona wire.
- When the paper moves near the drum, its negative charge attracts the positively charged toner particles away from the drum.
- The image is transferred from the drum onto the paper but, for the moment, the toner particles are just resting lightly on the paper's surface.
- The inked paper passes through two hot rollers (the fuser unit). The heat and pressure from the rollers fuse the toner particles permanently into the fibers of the paper.

Dot Matrix Printer

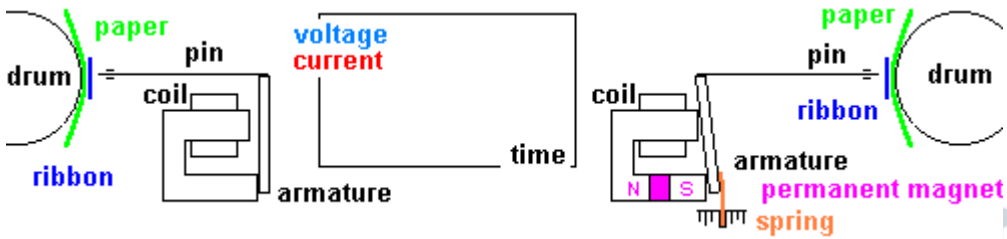
- In dot matrix printers the characters are formed by the print head
- Such a print head has a number of print wires (pins) arranged in vertical columns and electro-magnetic mechanism to shoot these wires.



Dot Matrix Printer

There are two main printhead technologies -

- In the first one electromagnetic field shoots the print head's wire.
- In the second one, the so called permanent magnet printheads, a spring shoots the printhead wire and the magnetic field just holds the spring in stressed and ready to shoot position.
- When the electromagnetic field equalizes the magnetic field, the spring is released to shoot the wire.



Thermal Printer

- Thermal printing is a process which produces a printed image by selectively heating thermal paper when the paper passes the thermal print head.
- The heat-sensitive paper’s coating turns black in the areas where it is heated, thus producing the required image.


thank you