

Input Devices

- Allow data to be sent to the computer
- Keyboard
 - Main input device for computers
- A mouse is a pointing device that functions by detecting two-dimensional motion relative to its supporting surface.
- A trackball is a pointing device consisting of a ball held by a socket containing sensors to detect a rotation of the ball about two axes.

Keyboard

- Typewriter styled keyboard – Mechanical and electronically activated.
- Various sizes – standard, laptop sized, thumb sized.
- A keyboard layout is any specific mechanical, visual, or functional arrangement of the keys, legends, or key-meaning associations (respectively) of a computer, typewriter, or other typographic keyboard.
- PS/2, USB, wireless.

Mouse

- A mouse consists of an object held under one of the user's hands, with one or more buttons.
- Types
 - Mechanical
 - Optical
 - Air mice
 - Tactile
- Two, three buttons, wheels and more buttons.
- PS/2, USB, Serial, wireless.

Trackball

- An upside-down mouse with an exposed protruding ball.
- Has no limits on effective travel.
- Can be made more durable.
- Large and well made ones allow easier high precision work.
- Combined with a mouse.
- Mobile phones.

Trackpad

- A touchpad (or trackpad) is a pointing device featuring a tactile sensor, a specialized surface that can translate the motion and position of a user's fingers to a relative position on screen.
- Virtual mouse.
- Hotspots, multi touch – drivers.
- Laptops, mobiles.

Output Devices

- Computer hardware used to communicate the results of data processing carried out by a computer to the outside world.
 - The PC speaker is generally the first output device to be activated during the boot process.
 - The computer monitor is the most common output device.
 - The printer is a peripheral which produces a text or graphics of documents stored in electronic form, usually on physical print media such as paper or transparencies.

PC Speaker

- A PC speaker is a loudspeaker, built into some IBM PC compatible computers.
- A PC speaker generates waveforms using the programmable interval timer.
- Limited use
 - BIOS error codes.
 - Early Games.
 - Sound generation in some apps.

Computer Monitor

- A monitor or display (also called screen or visual display unit) is an electronic visual display for computers.
- The monitor comprises the display device, circuitry, and an enclosure.
- The display device in modern monitors is typically a thin film transistor liquid crystal display (TFT-LCD) thin panel, while older monitors use a cathode ray tube about as deep as the screen size.

Computer Monitor

- Size – 14 to 30 inches diagonal.
- Aspect Ratio – 4:3, 5:4, 16:10, 16:9.
- Resolution – 640x480 to 3840x2400
 - 720p, 1080p.
- PPI – IBM 220/221.
- Integrated accessories.
- Glossy screen.
- 3D displays.

Touchscreen

- A touchscreen is an electronic visual display that can detect the presence and location of a touch within the display area.
 - The term generally refers to touching the display of the device with a finger or hand.
 - Touchscreens can also sense other passive objects, such as a stylus.
- Touchscreens are common in devices such as game consoles, all-in-one computers, tablet computers, and smartphones.
- Resistive, Capacitive.

Printer

- Local or network – printer cable, USB, network.
- Printers that include non-printing features are sometimes called multifunction printers (MFP), multi-function devices (MFD), or all-in-one (AIO) printers.
 - Most MFPs include printing, scanning, and copying among their many features.
- Inkjets, Laser printers, Plotters.

Multimedia Devices

- Devices used to provide multimedia content.
 - CD-ROMs – a pre-pressed compact disc that contains data accessible to, but not writable by, a computer for data storage and music playback.
 - Computer speakers, or multimedia speakers, are speakers external to a computer, that disable the lower fidelity built-in speaker.
 - A video card, Graphics Card, or Graphics adapter is an expansion card which generates output images to a display.

CD-ROM

- A CD-ROM (Compact Disc Read-only memory) is a pre-pressed compact disc that contains data accessible to, but not writable by, a computer for data storage and music playback.
- ISO9660 standard.
- Originally developed to store and play back sound recordings only, but the format was adapted for:
 - storage of data (CD-ROM) – 650 MB
 - write-once audio and data storage (CD-R)
 - rewritable media (CD-RW)
 - Video Compact Discs (VCD)
 - Super Video Compact Discs (SVCD) etc.
- CD-ROM drives are rated with a speed factor relative to music CDs (1× or 1-speed which gives a data transfer rate of 150 KiB/s).

Computer Speaker

- Computer speakers, or multimedia speakers, are speakers external to a computer, that disable the lower fidelity built-in speaker.
 - They often have a low-power internal amplifier.
 - The standard audio connection is a 3.5 mm stereo jack plug often color-coded lime green for computer sound cards.
- The internal amplifiers require an external power source, usually an AC adapter.
- There are also USB speakers which are powered from the 5 volts at 500 milliamps provided by the USB port, allowing about 2.5 watts of output power.

Video Card

- A video card (also called a display card, graphics card, graphics board, display adapter or graphics adapter) is an expansion card which generates a feed of output images to a display.
- Most video cards offer various functions such as accelerated rendering of 3D scenes and 2D graphics, MPEG-2/MPEG-4 decoding, TV output, or the ability to connect multiple monitors.

Video Card

- A modern video card consists of a printed circuit board on which the components are mounted.
 - Graphics Processing Unit
 - Heat Sink
 - Video BIOS
 - Video memory
 - RAMDAC
 - Outputs
 - VGA
 - DVI
 - Video In Video Out (S-Video, Composite video and Component video)
 - HDMI
 - DisplayPort

Storage Devices

- Internal Storage Devices – Storage devices inside the computer.
 - A hard disk drive (HDD; also hard drive or hard disk) is a non-volatile, random access digital magnetic data storage device.
 - A solid-state drive (SSD), sometimes called a solid-state disk or electronic disk, is a data storage device that uses solid-state memory to store persistent data with the intention of providing access in the same manner of a traditional block i/o hard disk drive.

Hard Disk

- A hard disk drive consists of one or more rigid rapidly rotating discs (platters) coated with magnetic material, and with magnetic heads arranged to write data to the surfaces and read it from them.
- Introduced by IBM in 1956.
- MB vs MiB
- Form factors – 3.5, 2.5, 1.8 inches.
- Power consumption, access time, failure rate

Solid State Drive

- A solid-state drive (SSD) is a data storage device that uses integrated circuit assemblies as memory to store data persistently.
- SSD technology uses electronic interfaces compatible with traditional block input/output (I/O) hard disk drives.
- SSDs do not employ any moving mechanical components
- Compared with electromechanical disks, SSDs are typically less susceptible to physical shock, are silent, and have lower access time and latency.
- Most SSDs use NAND-based flash memory, which retains data without power.

Solid State Drives

- Hybrid drives combine the features of SSDs and HDDs in the same unit, containing a large hard disk drive and an SSD cache to improve performance of frequently accessed data.
- Controller – embedded processor
- Memory – NAND flash or DRAM
- Cache – optional DRAM
- Host interface – SATA, PCI Express, USB, Fiber Channel

Storage Devices

- Removable storage – removable media refers to storage media which is designed to be removed from the computer without powering the computer off.
 - An optical disc drive (ODD) is a disk drive that uses laser light or electromagnetic waves near the light spectrum as part of the process of reading or writing data to or from optical discs.
 - CD-ROM
 - DVD
 - Blu-Ray

DVD

- DVD is an optical disc storage format which offer higher storage capacity than CDs while having the same dimensions – 4.7GB
 - Pre-recorded DVDs are mass-produced using molding machines that physically stamp data onto the DVD.
- DVD uses 650 nm wavelength laser diode light as opposed to 780 nm for CD.
- DVD recordable and rewritable, Dual-layer recording
- Writing speeds for DVD were 1×, that is, 1,385 kB/s (1,353 KiB/s) initially.
 - More recent models have 18× or 20× speed.

Blu-ray

- Blu-ray Disc (BD) is an optical disc storage medium designed to supersede the DVD format.
 - The plastic disc is 120 mm in diameter and 1.2 mm thick, the same size as DVDs and CDs.
- Conventional Blu-ray Discs contain 25 GB per layer, with dual layer discs (50 GB) being the industry standard for feature-length video discs.
- Blu-ray Disc drives are mostly capable of reading standard DVDs and CDs.

Storage Devices

- A memory card or flash card is an electronic flash memory data storage device used for storing digital information.
- A USB flash drive is a data storage device that consists of flash memory with an integrated Universal Serial Bus (USB) interface.
- External removable hard disk drives offer independence from system integration, establishing communication via connectivity options, such as USB.