PART 3 – HARDWARE KOMPUTER

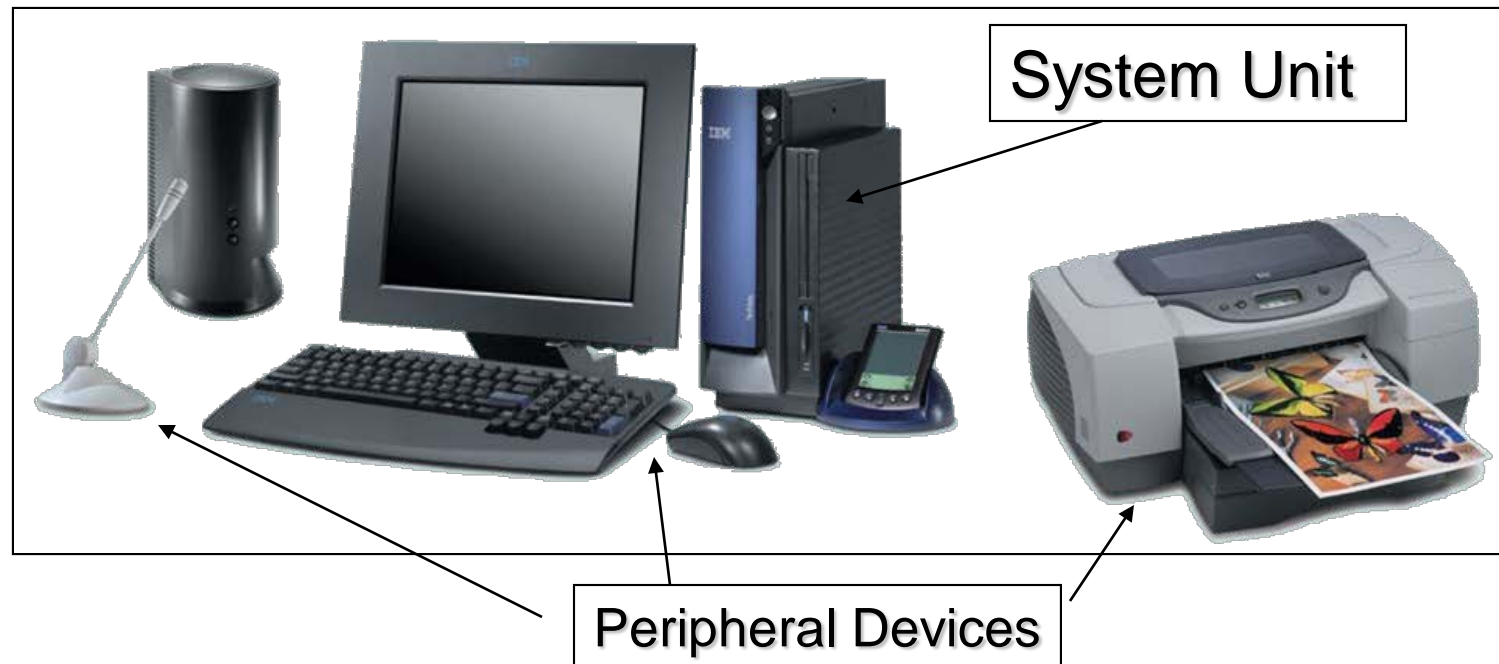Dosen Pengampu : Yelna Yuristiary, ST, MT

Hardware (Perangkat Keras)

- Hardware adalah peralatan fisik pada komputer seperti :
  - Case
  - Drive penyimpanan
  - Keyboard
  - Monitor
  - Speaker
  - Kabel
  - Printer

Hardware

- System Unit
- Peripheral Devices

System Unit

Peripheral Devices
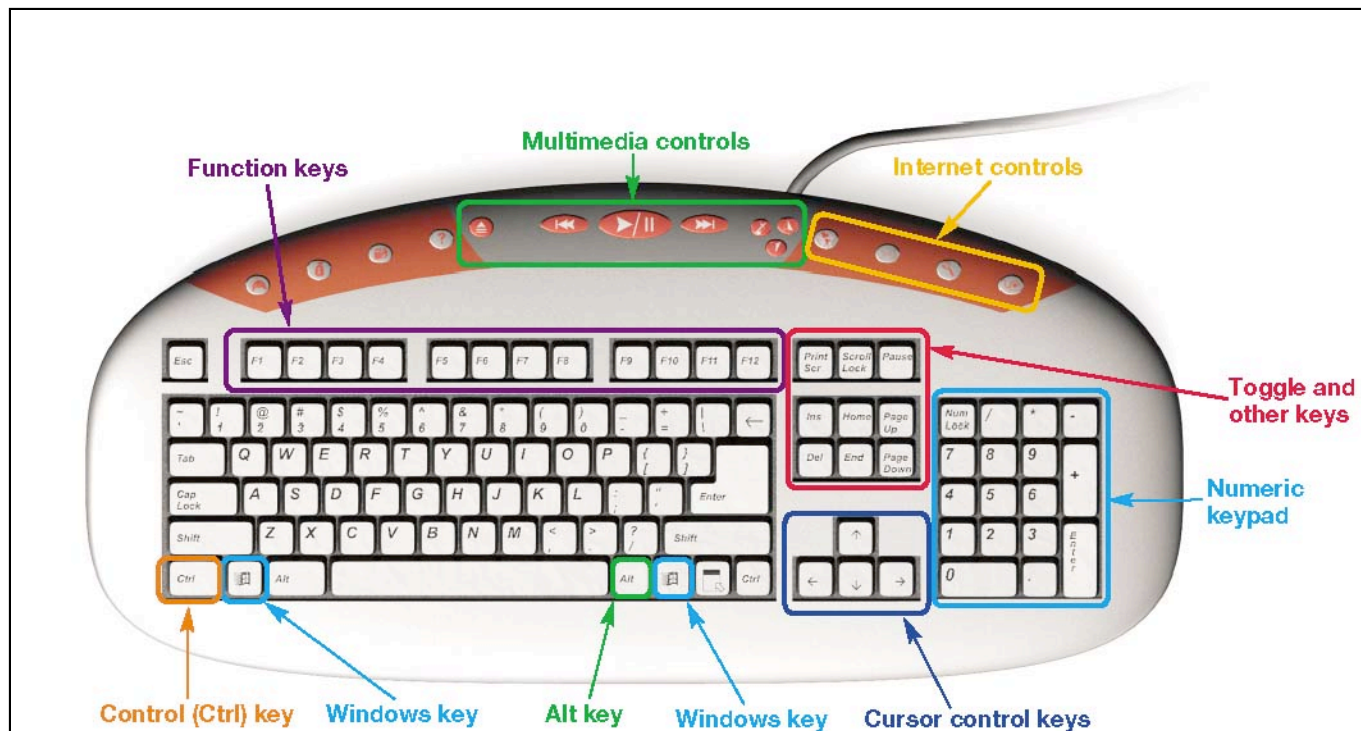
Computer Hardware

Input Devices

- Merupakan Device yang digunakan untuk memasukkan informasi atau informasi ke komputer.
  - Keyboard
  - Mouse / pointing device
  - Microphone
  - Scanner
  - Digital camera

Keyboard

- Keyboard QWERTY dengan fitur tambahan merupakan standar dari personal komputer modern

Dvorak Keyboard

- Meletakkan key yang umum digunakan pada "home keys" → key yang berada baris tengah dari keyboard
- Mengurangi jarak jangkauan jari.
- Meningkatkan kecepatan pengetikan

Keyboard Khusus

- Laptops
- PDAs
- Wireless
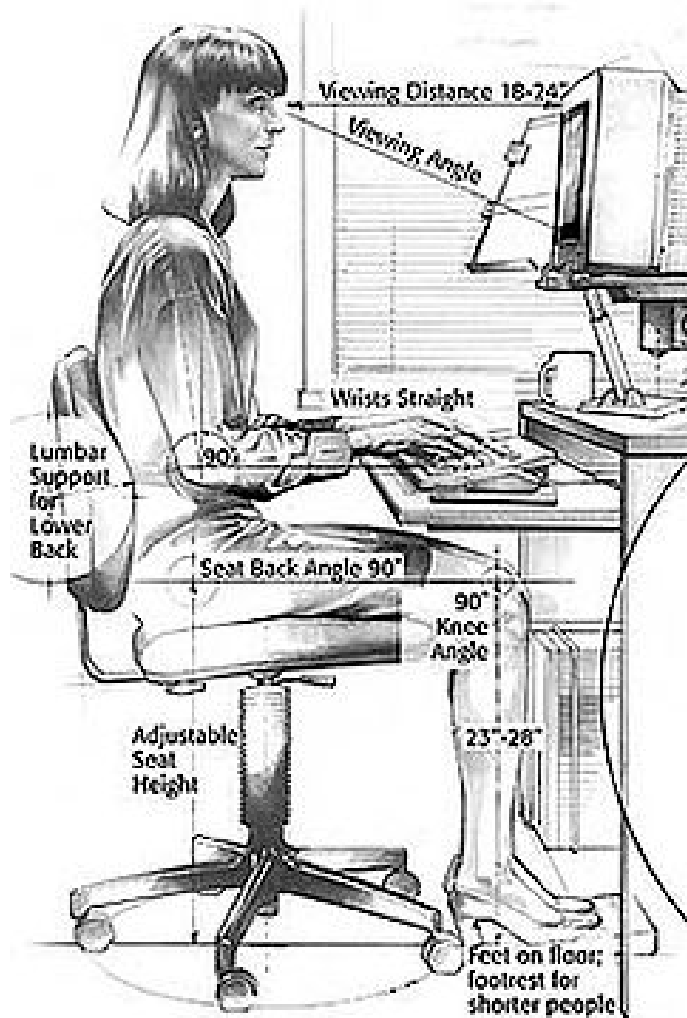- Ergonomic

Laptop

PDA

Ergonomic

Ergonomic

- **Ergonomics** adalah disiplin ilmu yang memperhatikan perancangan / desain sesuai dengan kebutuhan manusia

- Juga sesuai dengan pekerjaan yang mana menggaplikasikan teori, prinsip-prinsip, data dan metode untuk merancang dengan tujuan agar mengoptimalkan "human well-being" (kesejahteraan) dan kinerja sistem secara keseluruhan.

Ergonomic

- Ergonomics is the science of designing the job, equipment, and workplace to fit the worker.

- Proper ergonomic design is necessary to prevent repetitive strain injuries, which can develop over time and can lead to long-term disability.[1]

Mouse

- Roller ball mouse
  - Lebih murah
  - Sulit untuk menjaga agar bersih
- Trackball
  - Sulit untuk dikendalikan
  - Tidak bergerak di meja
- Optical mouse
  - Tidak perlu mouse pad
  - Tidak perlu membersihkan
  - Lebih mahal

Input Devices yang lain

- Scanners
  - Text
  - Images
- Digital cameras
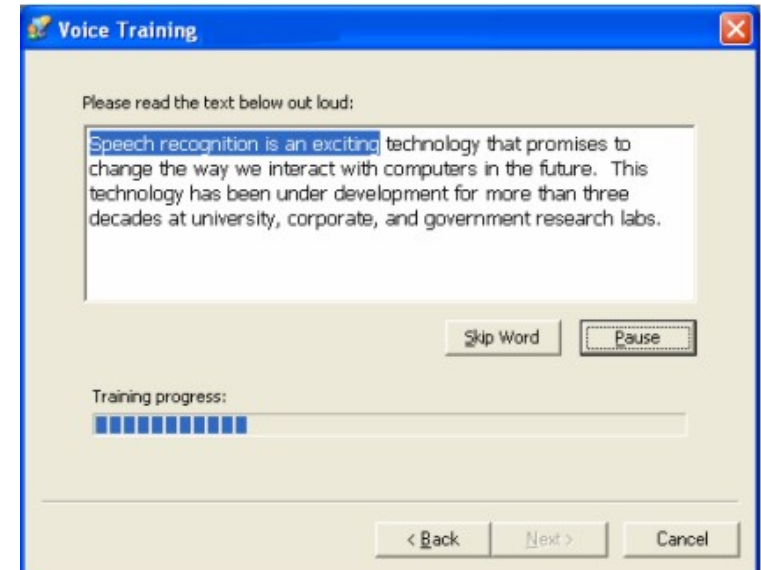 - Images
  - Video

Handheld

Flatbed

Camera

Inputting Sound

- Microphone Input
  - Teleconferencing
  - Voice over Internet
  - Voice Recognition

Output Devices

- Retrieving information (mengambil informasi) dari komputer

- Output devices
  - Softcopy (video, sounds, control signals)
  - Hardcopy (print)

Tipe Monitor

- **CRT** **Cathode Ray Tube**
  - Lebih murah
  - Banyak ruang yang terpakai
  - Penggunaan daya lebih besar
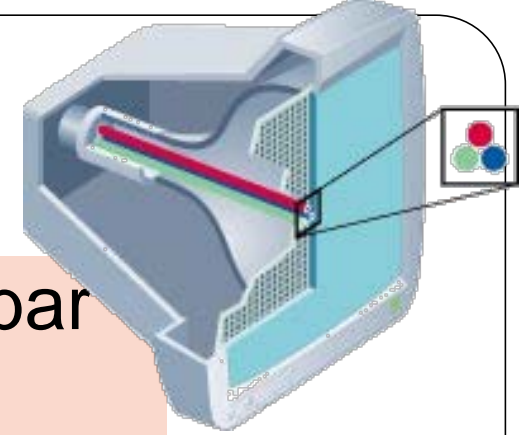 - Sudut pandang lebih baik.

- **LCD** **Liquid Crystal Display**
  - Lebih mahal
  - Ruang jauh lebih sedikit
 - Efisien daya
  - Sudut pandang tidak lebih baik

CRT Monitors

- Menggunakan teknologi tabung gambar
- Ukuran layar – Ukuran diagonal dari layar (15, 17, 19, 21)
- Resolution – Ketajaman dari ditentukan oleh jumlah pixel yang dapat di display (800 x 600, 1024 x 768, 1600 x 1200)
- Refresh rate – Kecepatan yang mana layar di refresh (60Hz, 75Hz) Kecepatan yang lebih cepat akan mengurangi kedipan

Liquid Crystal Display

- Liquid crystal diapit antara 2 lapisan transparent form image
- Digunakan untuk notebook computers, PDAs, cellular phones, dan personal computers
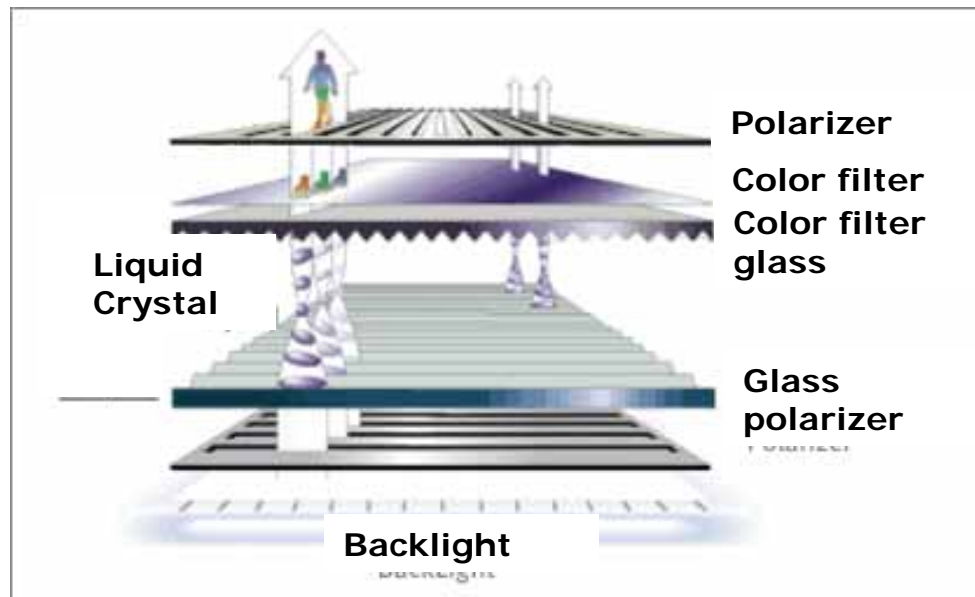
Printers

- **Impact printers**
  - Dot-matrix
- **Non-impact printers**
  - Inkjet
  - Laser
  - Multifunction
- **Specialty printers**
  - Plotters
  - Thermal printers

Inkjet

Dot-matrix

Laser

Multifunction

Plotter

Thermal printer

Non-impact Printers

- **Ink Jet**
  - Devais yang lebih murah
  - Full color printing
  - Slower in pages per minute (PPM)
  - More expensive per page in B&W

- **Laser**
  - Devais yang lebih mahal
  - Black and White (Color lasers are very expensive)
  - Faster in PPM
  - Less expensive in B&W

Outputting Sound

- Speakers and Headphones

The System unit

The System Unit

Box yang berisi komponen elektronik pusat dari komputer :

- CPU/RAM/ motherboard
- Expansion cards
- Power supply
- Storage devices

The Front Panel

- Drive Bays
- Memory card reader
- Floppy Drive
- Productivity Ports
- Power Button
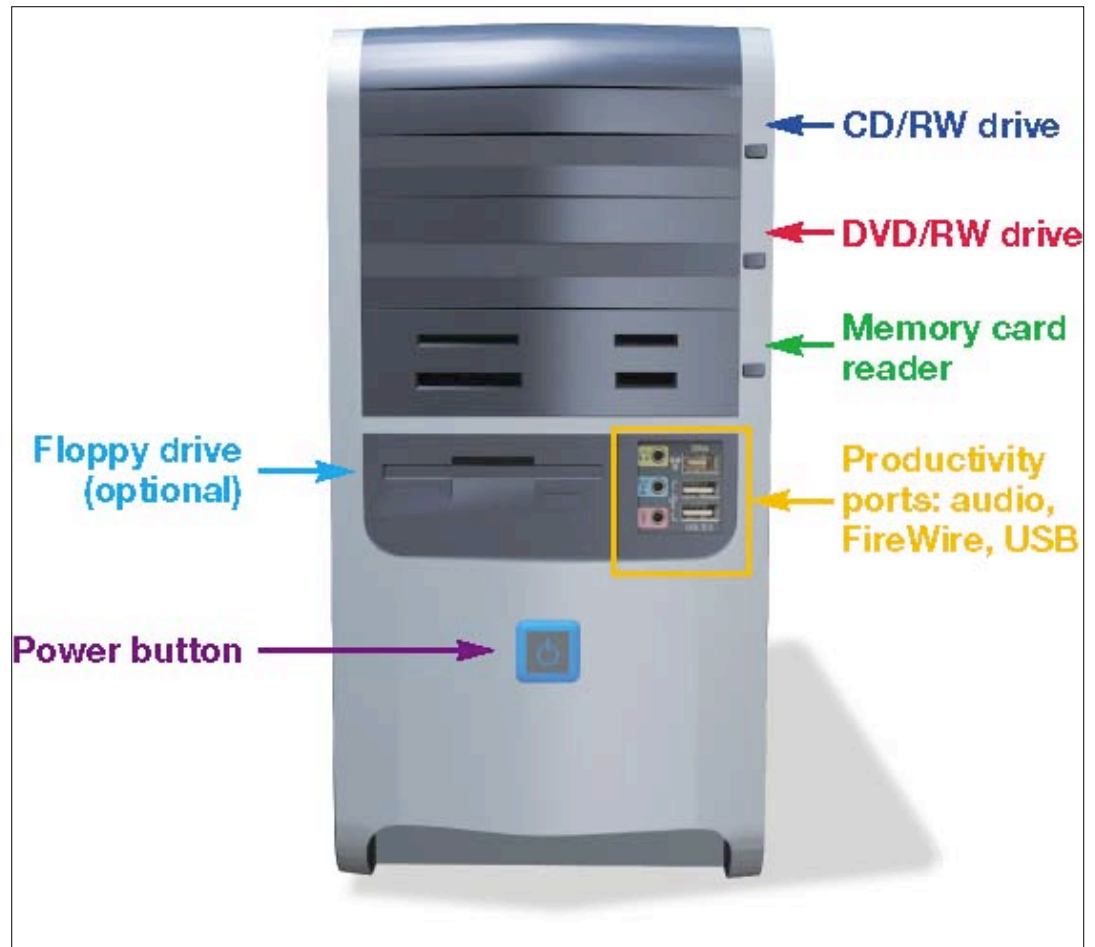
The Back

- Ports for peripheral devices
- Types of ports:
  - Serial
  - Parallel
  - VGA
  - USB
  - Connectivity

Serial ports

USB ports

Parallel port

Ethernet and
USB ports

Audio ports

Video ports

Modem port

FireWire ports

Computer Case dan Catu Daya
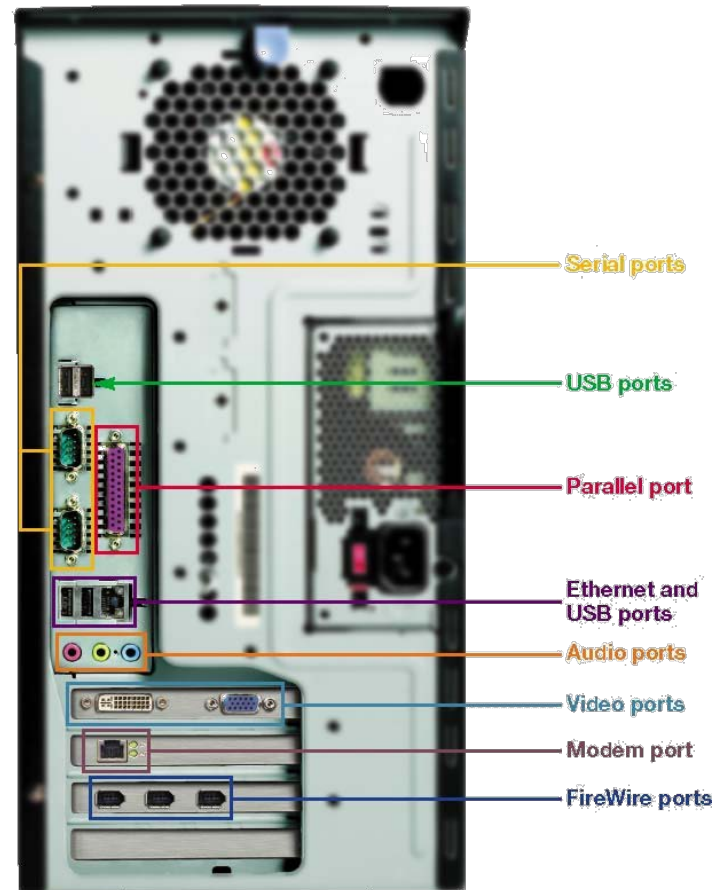
- **Computer case:**
  - Memberikan perlindungan pada komponen yang ada di dalamnya
  - Tahan lama, mudah diservis dan cukup ruang untuk dapat dikembangkan
- **Catu Daya**
  - Menkonversi AC ke DC
  - Harus memberikan daya yang cukup untuk komponen yang ada, dan juga penambahan yang akan datang.

Computer Case

- Merupakan kerangka untuk men-support dan melindungi komponen yang ada didalamnya

- Biasanya terbuat dari plastik, besi dan aluminium

- Ada bermacam-macam bentuk

Computer Case

- Ukuran dan layout case ini disebut dengan form factor

- Dirancang agar komponen di dalamnya aman dan tetap dingin

- Menjaga agar tidak terjadi kerusakan karena listrik statik

Computer Case

Factor	Rationale
Model Type	Two main case models (one for desktop PCs and the other for tower PCs). The type of motherboard determines the type of case. Size and shape must match exactly.
Size	If a computer has many components, it will need more room for airflow to keep the system cool.
Available Space	Desktop cases allow space conservation in tight areas because the monitor can be placed on top of the unit. The case design may limit the number and size of the components that can be added.
Power Supply	Match the power rating and connection type of the power supply to the type of motherboard chosen.
Appearance	There are many case designs to choose from if it is necessary to have a case that is attractive.
Status Display	LED indicators that are mounted on the front of the case can tell you if the system is receiving power, when the hard drive is being used, and when the computer is on standby or sleeping.
Vents	All cases have a vent on the power supply. Some cases have more vents to dissipate an unusual amount of heat.

Power Supply

- Konversikan AC → DC
- Daya DC diperlukan oleh semua komponen yang ada di dalam komputer
- Semua kebel, konektor dan komponen ditata rapi didalam komputer

Power Supply

- Caution: Don't open a power supply
- Ada kapasitor di dalamnya dan dapat menahan muatan untuk beberapa saat

Satuan Dasar Listrik

- Voltage (V)
- Current (I)
- Power (P)
- Resistance (R)

Voltage

- Voltage (V) → Tegangan, merupakan pengukuran pada tekanan yang diperlukan untuk mendorong elektron melalui rangkaian. Tegangan ini diukur dalam volt

- Catu Daya komputer umumnya menghasilkan voltase yang berbeda-beda

Current

- Current (I) → Arus, merupakan pengukuran pada jumlah elektron yang melewati rangkaian

- Arus diukur dalam ampere, atau amps (A). Catu daya dapat memberikan berbagai ukuran ampere untuk setiap tegangan output

Power & Resistance

- **Power :**
  - Adalah tegangan dikalikan dengan arus
  - P = V * I
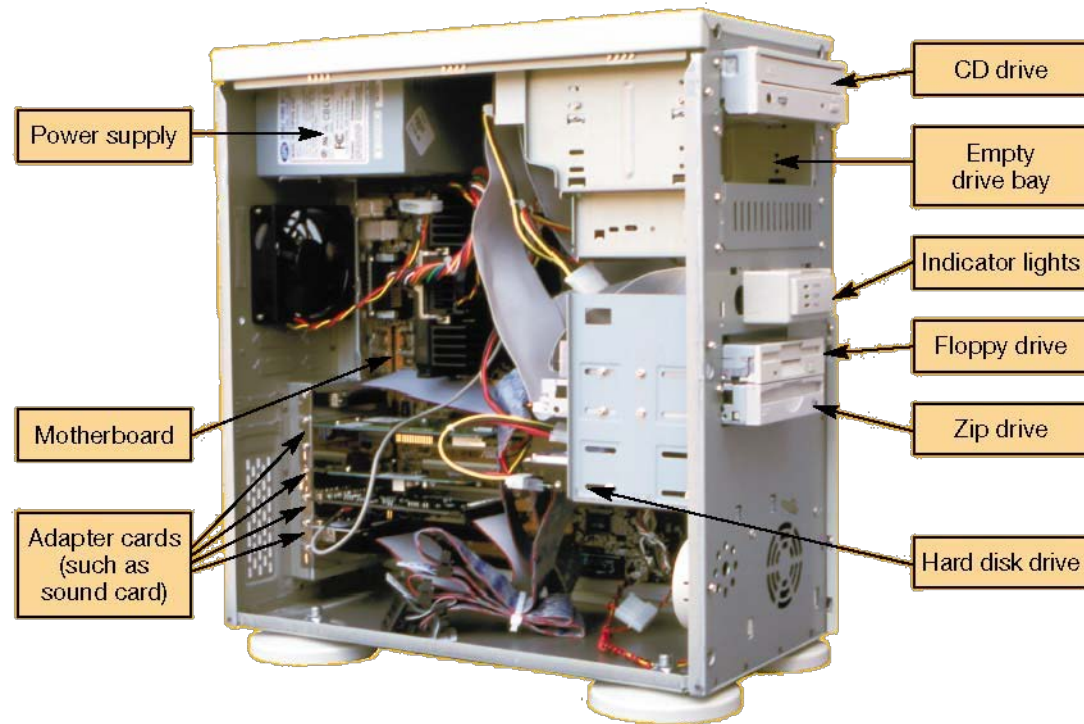 - Satuannya adalah watt

- **Tahanan :**
  - Satuannya Ohm (Ω)
  - Semakin rendah tahanan, semakin banyak arus yang dilewatkan

Komponen Internal

Inside the System Unit

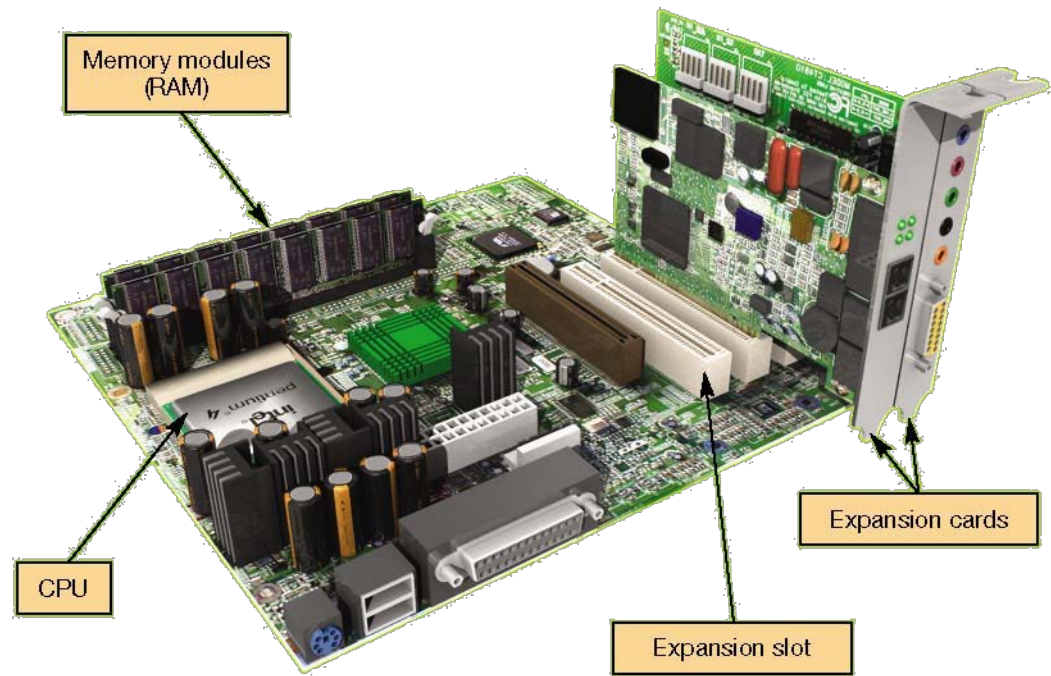- Komponen elektronik utama yang digunakan untuk proses data
- Tipe dari komponen:
  - Power supply
  - Hard disk drive
  - Motherboard
  - CPU
  - Expansion cards

Power supply

CD drive

Empty drive bay

Indicator lights

Floppy drive

Zip drive

Motherboard

Adapter cards (such as sound card)

Hard disk drive

The Motherboard

- CPU
- RAM
- Expansion Cards
- Chip Set
- Built-in components

Motherboards

- Printed circuit board utama
- Terdiri dari bus, atau electrical pathway yang ada dikomputer. **Buses melewatkan data antar beraneka komponen.**
- Juga dikenal sebagai system board, backplane, atau board utama.
- Meng-akomodasikan CPU, RAM, expansion slots, heat sink/fan assembly, BIOS chip, chip set, sockets, konektor internal and external, beraneka ports, dan embedded wires yang interkoneksi komponen motherboard.

Motherboards

Motherboards Form Factors

- Form factor dari motherboard adalah ukuran dan bentuk dari board.
- Juga menggambarkan pada mother layout fisik dari komponen dan desais yang berbeda board.
- Bermacam-macam form factors yang ada untuk motherboards.
  - AT – Advanced Technology
  - ATX – Advanced Technology Extended
  - Mini-ATX – Smaller footprint of ATX
  - Micro-ATX – Smaller footprint of ATX
  - LPX – Low-profile Extended
  - NLX – New Low-profile Extended
  - BTX – Balanced Technology Extended

Central Processing Unit (CPU)

- Known as the brain of the computer. Also referred to as the processor.

- Most important element of a computer system. Executes a program, which is a sequence of stored instructions.

- Two major CPU architectures related to instruction sets:
  - **Reduced Instruction Set Computer (RISC)**
  - **Complex Instruction Set Computer (CISC)**

Central Processing Unit (CPU)

- To an operating system, a single CPU with **hyperthreading** appears to be two CPUs.

- The wider the processor data bus width, the more powerful the processor. Current processors have a 32-bit or a 64-bit processor data bus.

- **Overclocking is a technique used to make a processor work at** a faster speed than its original specification.

Central Processing Unit (CPU)

- **MMX enabled microprocessors can handle many common** multimedia operations that are normally handled by a separate sound or video card.

- The latest processor technology has resulted in CPU manufacturers finding ways to incorporate more than one CPU core onto a single chip.
  - **Single core CPU and Dual core CPU**

Cooling Systems

- Electronic components generate heat. Too much heat can damage components.
- A **case fan makes the cooling** process more efficient.
- A **heat sink draws heat away** from the core of the CPU. A fan on top of the heat sink moves the heat away from the CPU.
- Fans are dedicated to cool the **Graphics-processing unit (GPU).**

Cooling System

Case Fan

CPU Fan
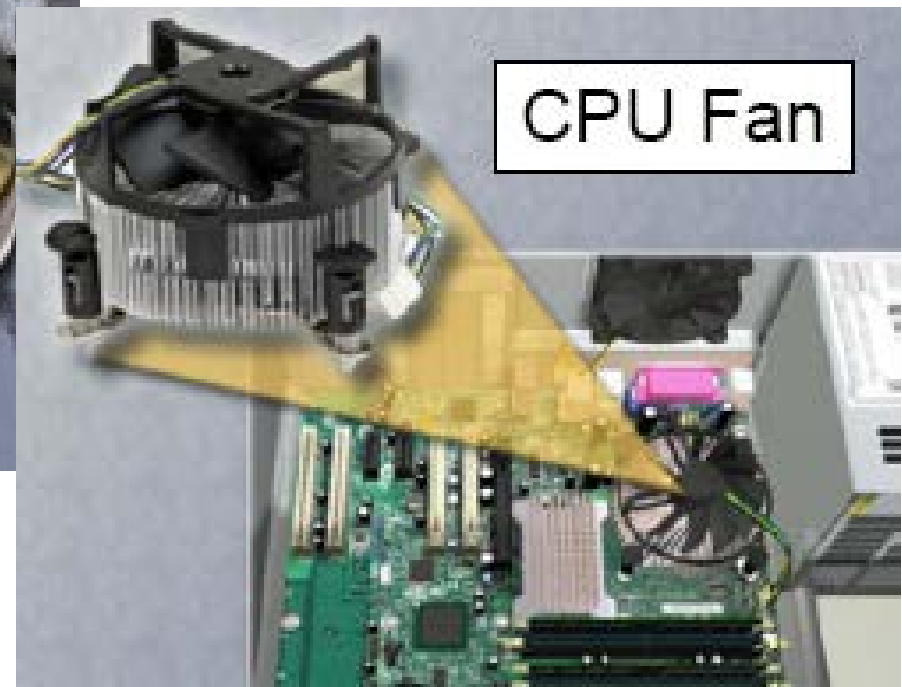
Read-only Memory (ROM)

- Basic instructions for booting the computer and loading the operating system are stored in ROM.

ROM Types	ROM Types	Description
ROM	Read-only memory chips	Information is written to a ROM chip when it is manufactured. A ROM chip cannot be erased or re-written and can become obsolete.
PROM	Programmable read-only memory	Information is written to a PROM chip after it is manufactured. A PROM chip cannot be erased or re-written.
EPROM	Erasable programmable read-only memory	Information is written to an EPROM chip after it is manufactured. An EPROM chip can be erased with exposure to UV light. Special equipment is required.
EEPROM	Electrically erasable programmable read-only memory	Information is written to an EEPROM chip after it is manufactured. EEPROM chips are also called Flash ROMs. An EEPROM chip can be erased and re-written without having to remove the chip from the computer.

Random-access Memory (RAM)

- Temporary storage for data and programs that are being accessed by the CPU

- Volatile memory, which means that the contents are erased when the computer is powered off

- More RAM means more capacity to hold and process large programs and files, as well as enhance system performance.

Random-access Memory (RAM)

- Types of RAM:
  - Dynamic Random Access Memory (DRAM)
  - Static Random Access Memory (SRAM)
  - Fast Page Mode DRAM (FPM Memory)
  - Extended Data Out RAM (EDO Memory)
  - Synchronous DRAM (SDRAM)
  - Double Data Rate SDRAM (DDR SDRAM)
  - Double Data Rate 2 SDRAM (DDR2 SDRAM)
  - RAMBus DRAM (RDRAM)

Memory Modules

- Dual Inline Package (**DIP) is an individual memory chip. A** DIP had dual rows of pins used to attach it to the motherboard.

- Single Inline Memory Module (**SIMM) is a small circuit** board that holds several memory chips. SIMMs have 30-pin and 72-pin configurations.

- Dual Inline Memory Module (**DIMM) is a circuit board that** holds SDRAM, DDR SDRAM, and DDR2 SDRAM chips. There are 168-pin SDRAM DIMMs, 184-pin DDR DIMMs, and 240-pin DDR2 DIMMs.

- RAM Bus Inline Memory Module (**RIMM) is a circuit board** that holds RDRAM chips. A typical RIMM has a 184-pin configuration.

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Cache and Error Checking

Cache

- SRAM is used as cache memory to store the most frequently used data.

- SRAM provides the processor with faster access to the data than retrieving it from the slower DRAM, or main memory.

Error Checking

- Memory errors occur when the data is not stored correctly in the RAM chips.

- The computer uses different methods to detect and correct data errors in memory.

FSB

- FSB = Front Side Bus
- The bus that carries data between the CPU and the northbridge.
- The bandwidth or maximum theoretical throughput of the front-side bus is determined by the product of the width of its data path, its clock frequency (cycles per second) and the number of data transfers it performs per clock cycle.
- Example :
  8B x 100MHz x 4/cycle
  = 8B x 100M x Hz x 4/cycle
  = 8B x 100M x cycle/s x 4/cycle
  = 3200MB/s

Motherboard Diagram
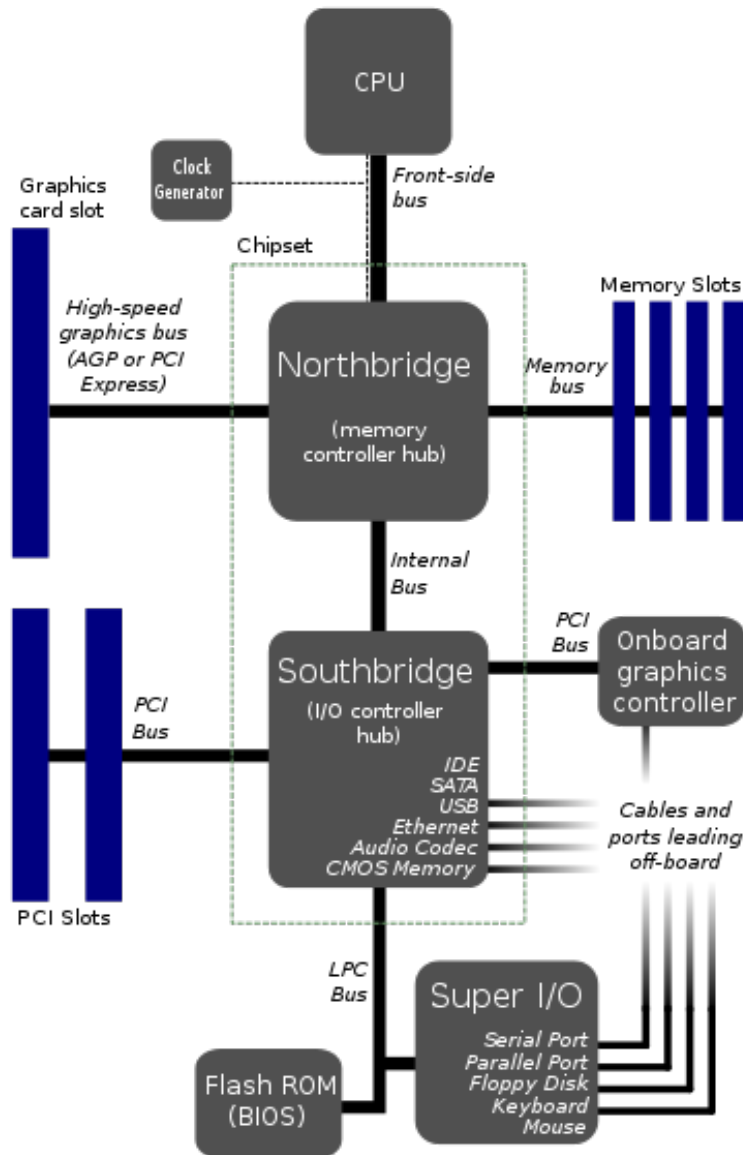
Bit

- A bit or binary digit is the basic unit of information in computing and telecommunications; it is the amount of information that can be stored by a digital device or other physical system that can usually exist in only two distinct states.

- Using Binary Number which is 0 and 1

- The unit of Bit : byte (8 bits), kilobit (either 1000 or 210 = 1024 bits), megabyte (either 8000000 or 8×220 = 8388608bits), etc.

Decimal number system

- Ten digits : 0,1,2,3,4,5,6,7,8,9
- Every digit position has a weight which is a power of 10.
- Base or radix is 10.

Binary number system

- Two digits : 0,1
- Every digit position has a weight which is a power of 2.
- Base or radix is 2.

First integers and their binary equivalent

decimal	binary	
0	0000	$(0*2^3 + 0*2^2 + 0*2^1 + 0*2^0)$
1	0001	$(0*2^3 + 0*2^2 + 0*2^1 + 1*2^0)$
2	0010	$(0*2^3 + 0*2^2 + 1*2^1 + 0*2^0)$
3	0011	$(0*2^3 + 0*2^2 + 1*2^1 + 1*2^0)$
4	0100	$(0*2^3 + 1*2^2 + 0*2^1 + 0*2^0)$
5	0101	$(0*2^3 + 1*2^2 + 0*2^1 + 1*2^0)$
6	0110	$(0*2^3 + 1*2^2 + 1*2^1 + 0*2^0)$
7	0111	$(0*2^3 + 1*2^2 + 1*2^1 + 1*2^0)$
8	1000	$(1*2^3 + 0*2^2 + 0*2^1 + 0*2^0)$
9	1001	$(1*2^3 + 0*2^2 + 0*2^1 + 1*2^0)$

Examples

1. 101011 ➔ $1 \times 2^5 + 0 \times 2^4 + 1 \times 2^3 + 0 \times 2^2 + 1 \times 2^1 + 1 \times 2^0$

$$= 43$$

$(101011)_2 = (43)_{10}$

2. $.0101$ ➔ $0 \times 2^{-1} + 1 \times 2^{-2} + 0 \times 2^{-3} + 1 \times 2^{-4}$

$$= .3125$$

$(.0101)_2 = (.3125)_{10}$

3. 101.11 ➔ $1 \times 2^2 + 0 \times 2^1 + 1 \times 2^0 + 1 \times 2^{-1} + 1 \times 2^{-2}$

$$5.75$$

$(101.11)_2 = (5.75)_{10}$

Example 1 :: 239

2	239	
2	119	--- 1
2	59	--- 1
2	29	--- 1
2	14	--- 1
2	7	--- 0
2	3	--- 1
2	1	--- 1
2	0	--- 1

$(239)_{10} = (11101111)_2$

Example 2 :: 64

2	64	
2	32	--- 0
2	16	--- 0
2	8	--- 0
2	4	--- 0
2	2	--- 0
2	1	--- 0
2	0	--- 1

$(64)_{10} = (1000000)_2$

Example 3: .634

.634 x 2 = **1**.268

.268 x 2 = **0**.536

.536 x 2 = **1**.072
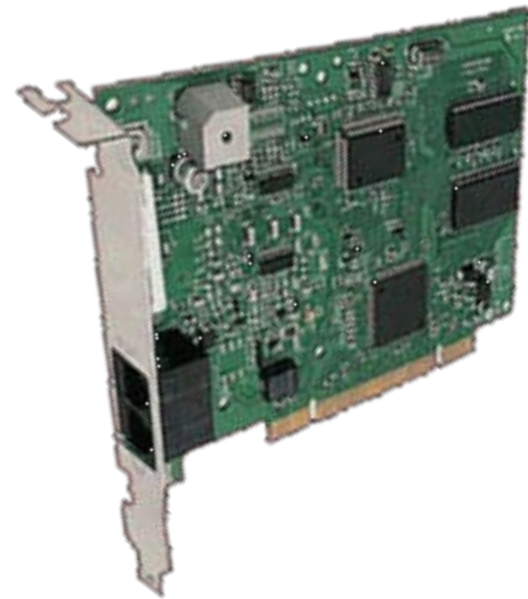
.072 x 2 = **0**.144

.144 x 2 = **0**.288

:

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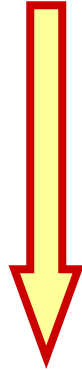
$(.634)_{10} = (.10100\ldots\ldots)_2$

Expansion Cards

- Adds functions
- Provides new connections for peripheral devices
- Common types:
  - Sound
  - Modem
  - Video (VGA)
  - Network (NIC)

Adapter Cards

- Types of expansion slots:
  - Industry Standard Architecture (ISA)
  - Extended Industry Standard Architecture (EISA)
  - Microchannel Architecture (MCA)
  - Peripheral Component Interconnect (PCI)
  - Advanced Graphics Port (AGP)
  - PCI-Express
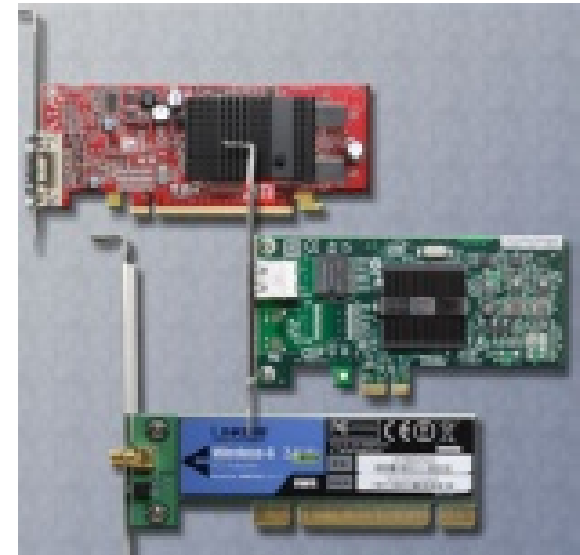
Adapter Cards

- Increase the functionality of a computer by adding controllers for specific devices or by replacing malfunctioning ports.
- Examples of adapter cards:
  - Sound adapter and video adapter
  - USB, parallel, and serial ports
  - RAID adapter and SCSI adapter
  - Network Interface Card (NIC), wireless NIC, and modem adapter

Hard Disk Drive

- Stores data and program instructions

- Permanent (nonvolatile) storage

- Storage capacities up to 250 GB and higher

- Transfers data in milliseconds

Hard Drives and Floppy Drives

- Reads or writes information to magnetic or optical storage media
- May be fixed or removable
- The **hard disk drive (HDD) is a** magnetic storage device installed inside the computer. The storage capacity is measured in gigabytes (GB).
- A **floppy disk drive (FDD) is storage** device that uses removable 3.5 inch floppy disks that can store 1.44 MB of data.
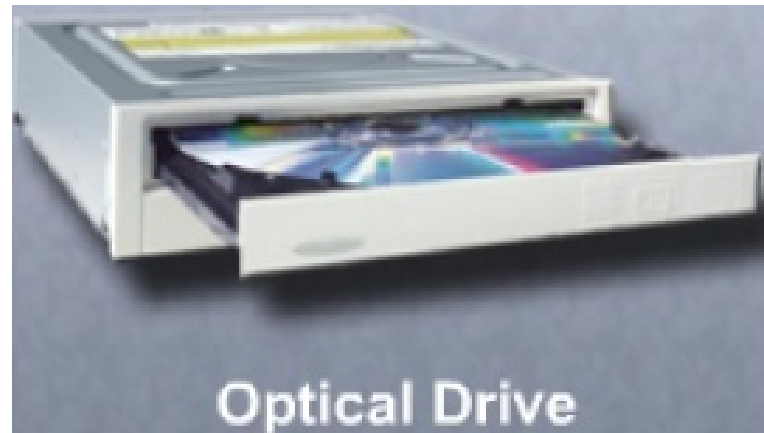
Hard Drives and Floppy Drives

Floppy Drive

Hard Drive

Optical Drives and Flash Drives

- An **optical drive is a storage device that uses lasers** to read data on the optical media. The two types are CD and DVD.

Flash Drive

Optical Drive

Internal Cables

- Data cables connect drives to the drive controller, which is located on an adapter card or on the motherboard.
  - Floppy disk drive (FDD) data cable
  - PATA (IDE) data cable
  - PATA (EIDE) data cable
  - SATA data cable
  - SCSI data cable

Optical Drives and Flash Drives

- A **flash drive is a removable storage device that** connects to a USB port. A flash drive uses a type of memory that requires no power to maintain the data.
- Some common drive interfaces:
  - Integrated Drive Electronics (IDE)
  - Enhanced Integrated Drive Electronics (EIDE)
  - Parallel ATA (PATA)
  - Serial ATA (SATA)
  - Small Computer System Interface (SCSI)

Serial Ports and Cables

- A serial port can be either a DB-9, as shown, or a DB-25 male connector.

- Serial ports transmit one bit of data at a time.

- To connect a serial device, such as a modem or printer, a serial cable must be used.

- A serial cable has a maximum length of 50 feet (15.2 m).

USB Ports and Cables

- USB is a standard interface for connecting peripheral devices to a computer.

- USB devices are hot-swappable.

- USB ports are found on computers, cameras, printers, scanners, storage devices, and many other electronic devices.

- A single USB port in a computer can support up to 127 separate devices with the use of multiple USB hubs.

FireWire Ports and Cables

- FireWire is a high-speed, hot-swappable interface.

- A single FireWire port in a computer can support up to 63 devices.

- Some devices can also be powered through the FireWire port, eliminating the need for an external power source.

- The IEEE 1394a standard supports data rates up to 400 Mbps and cable lengths up to 15 feet (4.5 m). This standard uses a 6-pin connector or a 4-pin connector.

- The IEEE 1394b standard supports data rates in excess of 800 Mbps and uses a 9-pin connector.

Parallel Ports and Cables

- Parallel ports can transmit 8 bits of data at one time and use the IEEE 1284 standard.

- To connect a parallel device, such as a printer, a parallel cable must be used.

- A parallel cable has a maximum length of 15 feet (4.5 m).

Network Ports and Cables

- A network port, also known as an RJ-45 port, connects a computer to a network.

- Standard Ethernet can transmit up to 10 Mbps.

- Fast Ethernet can transmit up to 100 Mbps.

- Gigabit Ethernet can transmit up to 1000 Mbps.

- The maximum length of network cable is 328 feet (100 m).

PS/2 Ports and Audio Ports

- A PS/2 port connects a keyboard or a mouse to a computer.

- The color-coded PS/2 connection ports (purple for keyboards and green for mice)

- The **PS/2 connector** is used for connecting some keyboards and mice to a PC compatible computer system. Its name comes from the IBM Personal System/2 series of personal computers, with which it was introduced in 1987

- The PS/2 port is a 6-pin mini-DIN female connector.

PS/2 connector

- Line In connects to an external source
- Microphone In connects to a microphone
- Line Out connects to speakers or headphones
- Gameport/MIDI connects to a joystick or MIDI-interfaced device

Line In   Line Out   gameport/MIDI
Microphone In
Auxiliary In
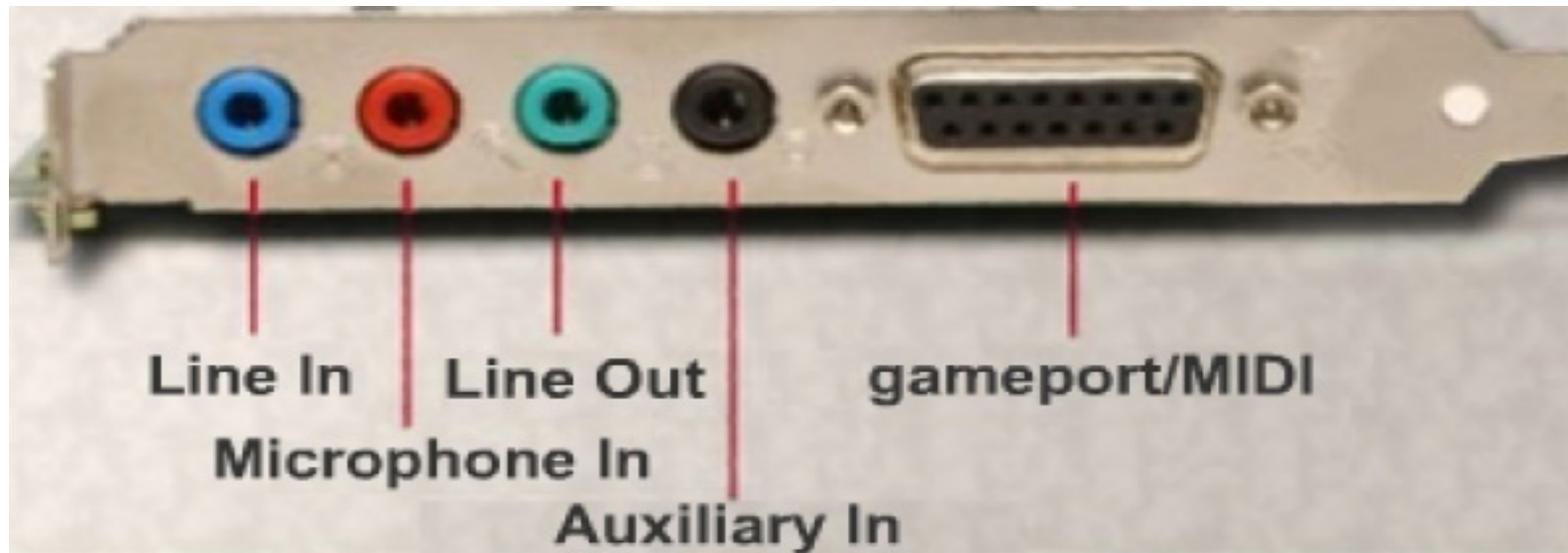
Video Ports

- A video port connects a monitor cable to a computer.

- Video Graphics Array (VGA)

- Digital Visual Interface (DVI)

- High-Definition Multimedia Interface (HDMi)

- S-Video

- Component/RGB

Mouse Port   VGA   DVI

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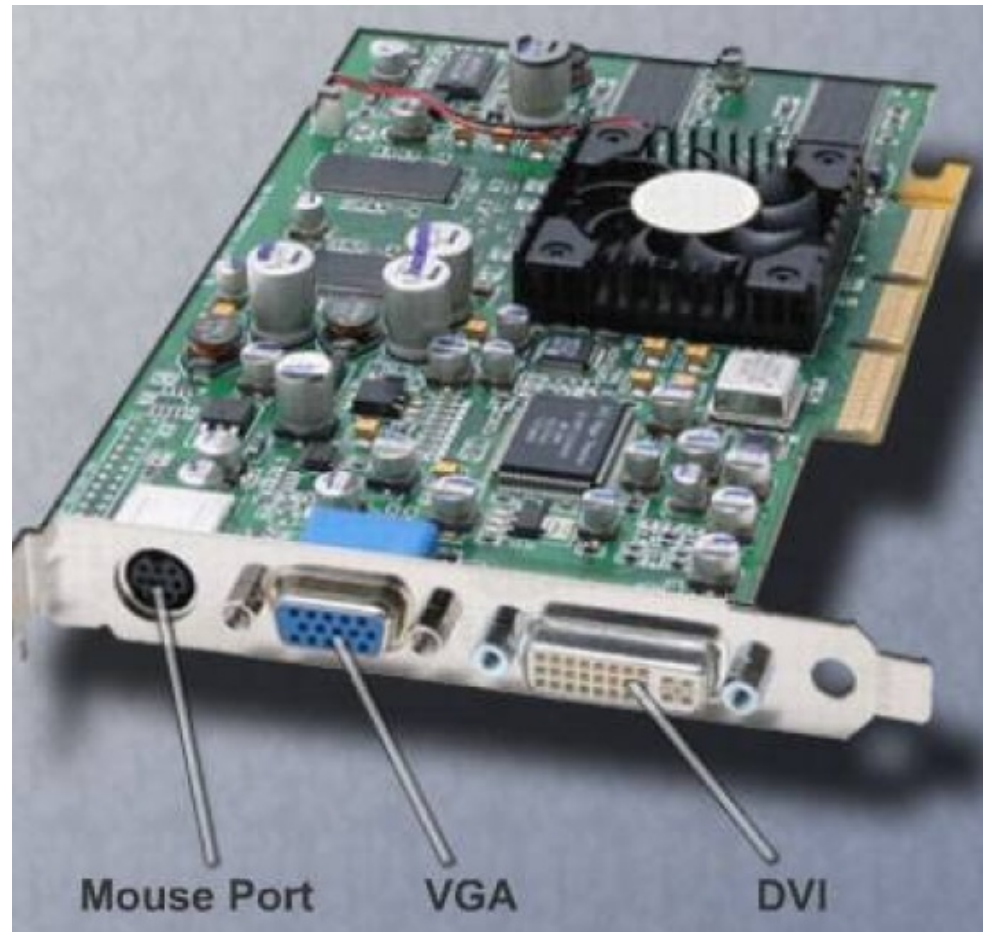
Input Devices

- Input devices used to enter data or instructions into a computer:
- Mouse and Keyboard
- Digital camera and digital video camera
- Biometric authentication device
- Touch screen
- Scanner

Monitors and Projectors

CRT

LCD

Projector

- The most important difference between these monitor types is the technology used to create an image:

- Cathode-ray tube (CRT) monitor is the most common monitor type. Most televisions also use this technology.

- Liquid crystal display (LCD) is commonly used in laptops and some projectors. LCD comes in two forms, active matrix and passive matrix.

- Digital light processing (DLP) is another technology used in projectors.

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Other Output Devices

- Printers, Scanners, and Fax Machines - Printers are output devices that create hard copies of computer files. Other all-in-one type printers are designed to provide multiple services such as printing, fax, and copier functions.

Other Output Devices

Speakers
Headphones

- Speakers and headphones are output devices for audio signals.
- Most computers have audio support either integrated into the motherboard or on an adapter card.
- Audio support includes ports that allow input and output of audio signals.