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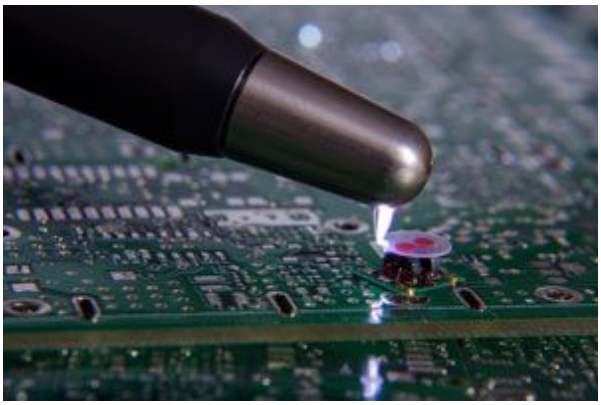
Chapter 1 Introduction to Personal Computer Hardware

Class	CompTIA A+
Created	@November 21, 2021 10:37 AM
Date	Monday
Importance	☐
Materials	
Packet Tracer	
Reviewed	☑
Study Schedule (Class notes)	
Type	Lecture

ESD

ESD: Electrostatic discharge can occur when there's a buildup of an electric charge (static electricity) that exists on a surface which comes into contact with another.



At least 3,000 volts of static electricity must build up before a person can feel ESD. Less than 30 volts of static electricity can damage a computer component.

Recommendations:

1. Keep all components in antistatic bags until you are ready to install them.
2. Use grounded mats on workbenches.
3. Use grounded floor mats on work areas.
4. Use antistatic wrist straps when working inside computers.

Cases

1. Horizontal case

2. Full-size tower
3. Compact tower
4. All-in-one

Power Supplies

1. AT: Advanced Technology: obsolete
2. ATX: Advanced Technology eXtended: obsolete
3. ATX12V: most common
4. EPS12V: high-end desktop models

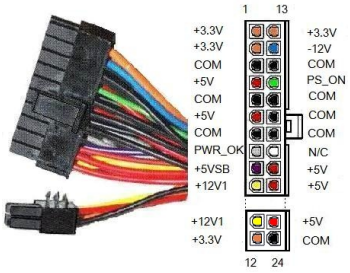
Power supply voltage

- 3.3V & 5V --> digital circus
- 12V --> run motors in disk drives and fans
- Single rail, dual rail, or multi rail

Connectors

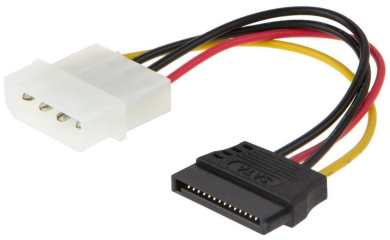
- 20-pin or 24-pin slotted connector

  Connects to the motherboard



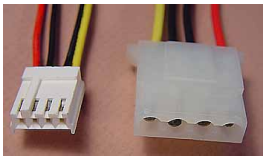
- SATA keyed connector

  Connects to disk drivers



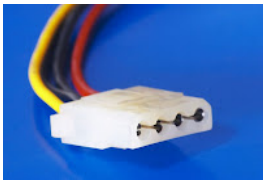
- Molex keyed connector

  Connects to hard drives, optical drives, or other devices

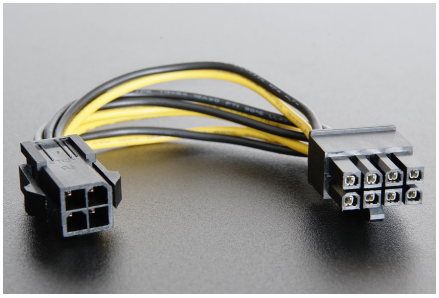


- Berg keyed connector

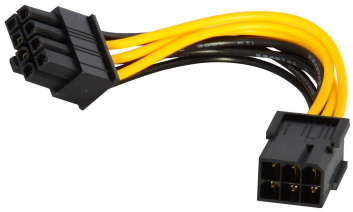
  Connects to legacy floppy devices



- 4-pin or 8-pin auxiliary power connector

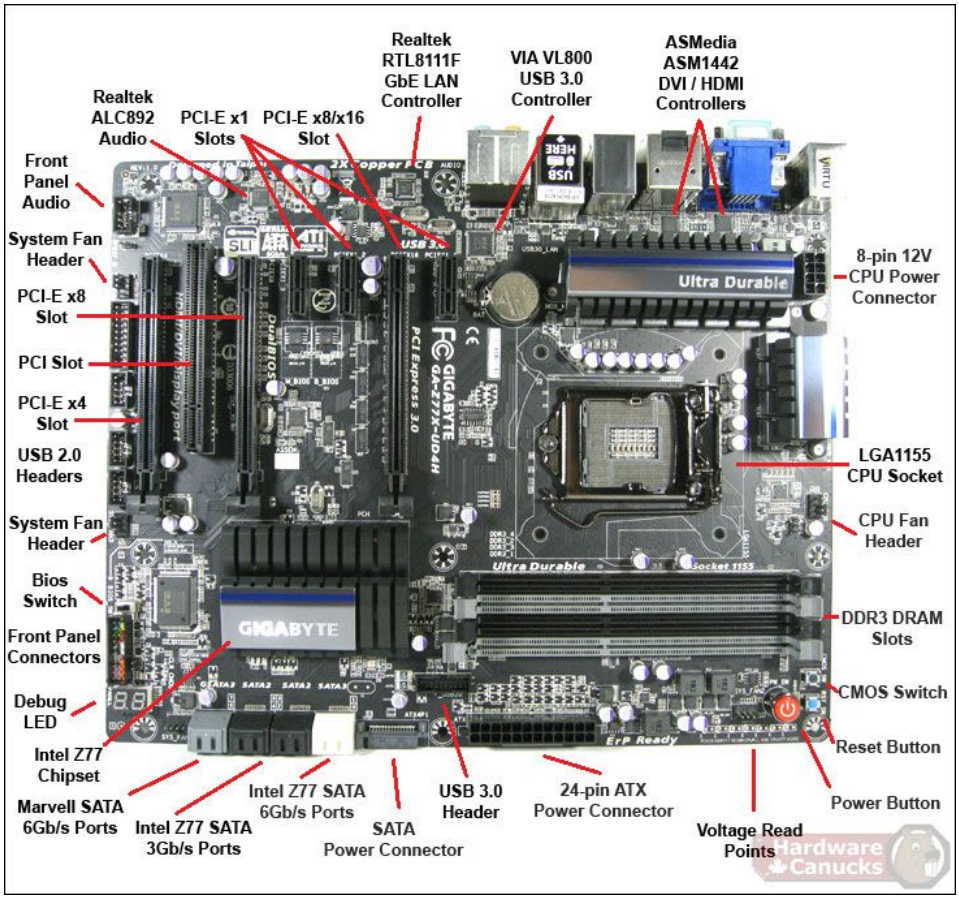


- 6/8-pin PCIe power connector



Motherboard

Motherboard is a printed circuit board (PCB) that contains bus, or electrical pathways, that interconnect electronic components.



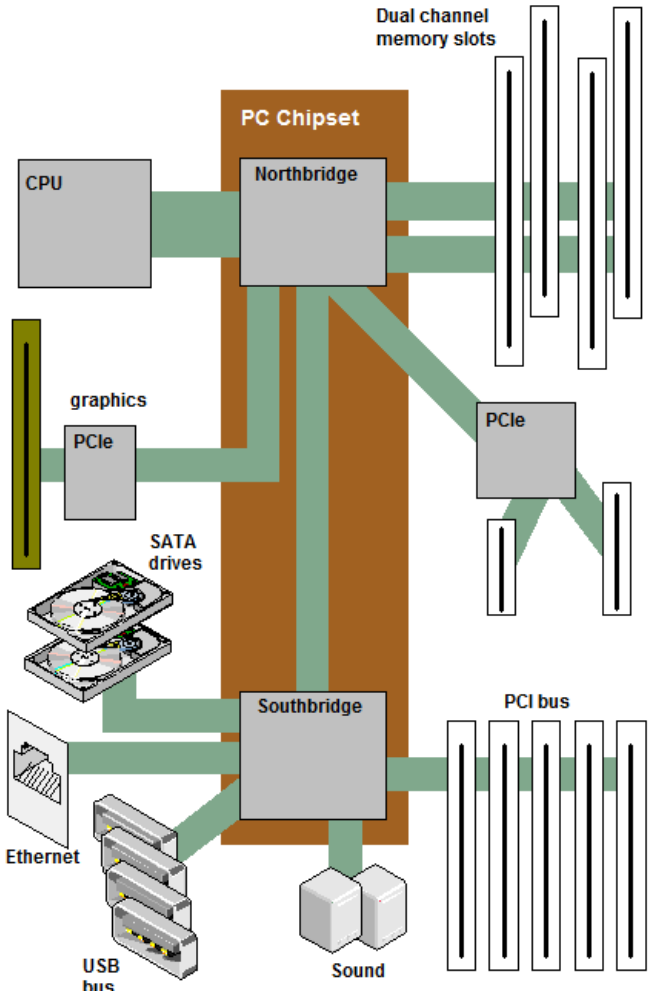
Motherboard components

1. Central Processing Unit (CPU)
2. Random Access Memory (RAM)
3. Expansion slots
4. Chipset

5. Basic Input/Output System (BIOS) and Unified Extensible Firmware Interface (UEFI) chip
    a. SATA (Serial Advanced Technology Attachment) connects optical drives, hard drives and SSD.
    b. IDE (Integrated drive electronics): 40-pin connector each IDE interface supports a max of two devices.
    c. Internal USB: 19-pin connector

Motherboard chipset

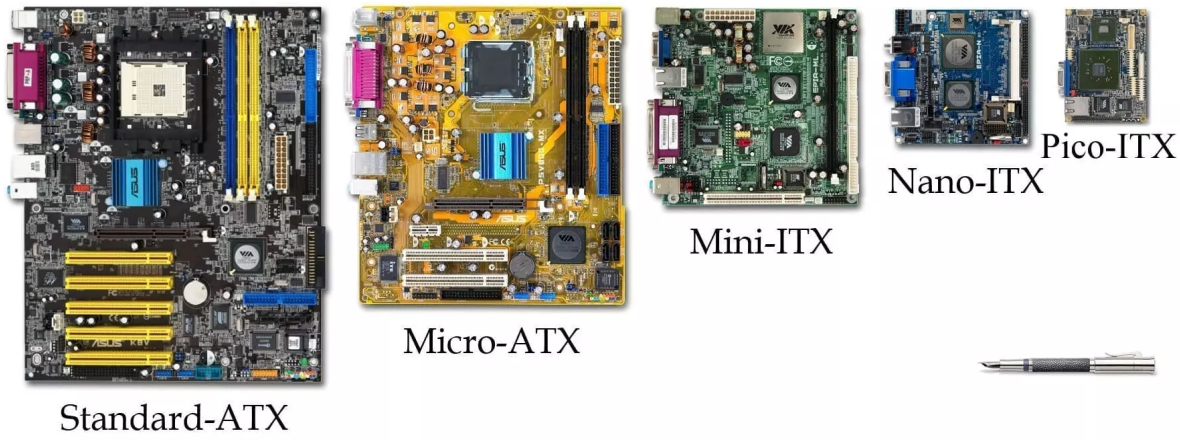
- **Northbridge controls high speed access to the RAM and video card. It also controls the speed at which the CPU communicates with all of the other components.**
- **Southbridge allows the CPU to communicate with slower speed devices, like hard drive.**



Motherboard chipset

Motherboard form factors

- ATX: advanced technology extended: most popular
- Micro-ATX: popular in desktop
- Mini-ATX: thin clients and set-top boxes (smallest)
- ITX: small-configured computer



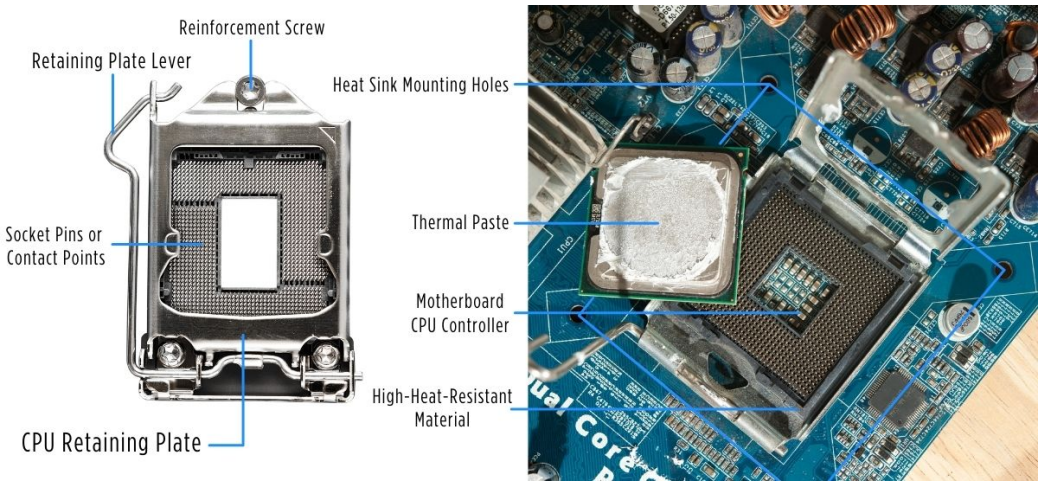
Motherboard form factors

Motherboard components

- SATA: Serial Advanced Technology Attachment is a disk drive interface used for connecting optical drives, hard drives, and SSD to the motherboard. Support hot swapping.
- IED: Integrated Drive Electronics is an older standard interface for connecting disk drives to the motherboard. It uses a 40-pin connections. Each IED interface supports a maximum of two devices.
- Internal USB: a 19-pin connector is used to connect the external USB 3 ports on the computer case to the motherboard.

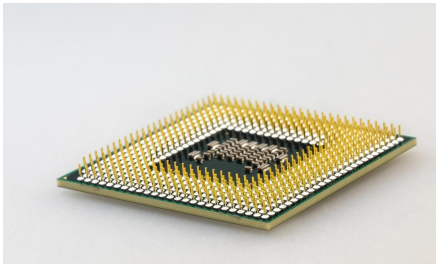
CPU

- The CPU socket is the connection between the motherboard and the processor.



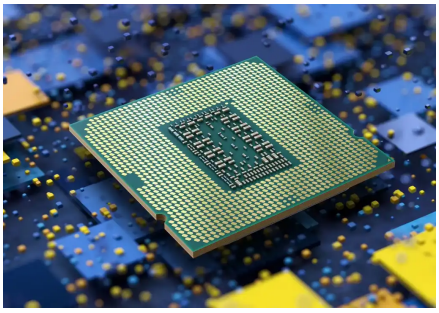
CPU socket

- Pin Grid Array (PGA): pins are on the underside of the processor



PGA

- Land Grid Array (LGA): pins are in the socket



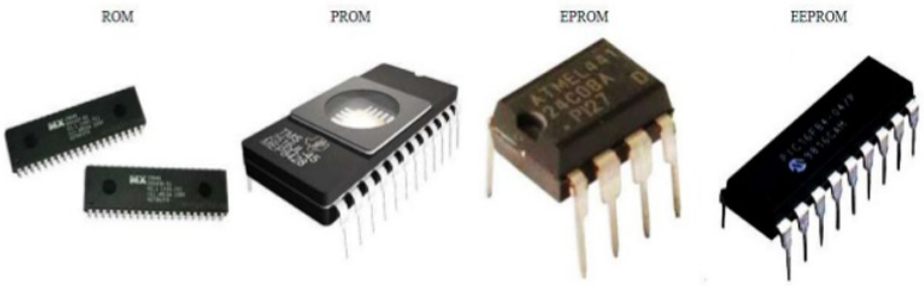
LGA

Colling systems

- Passive: heat sink
- Active: case fan

Types of memory

1. Read-Only Memory (ROM)
    a. ROM is located on the motherboard
    b. Nonvolatile
    c. Types of ROM
        i. ROM: cannot be erased or re-written (obsolete)
        ii. PROM: programmable ROM. Cannot be erased.
        iii. EPROM: erasable programmable ROM. Can be erased by exposing it to strong ultraviolet light.
        iv. EEPROM: electronically erasable programmable ROM, aka Flash ROM. It often used to store BIOS.



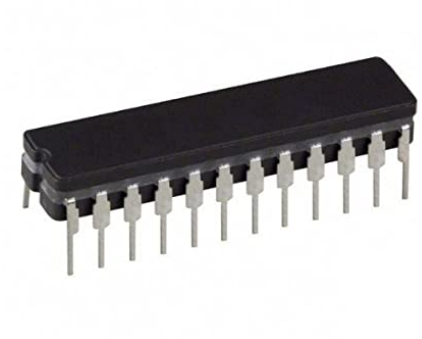
TIPOS DE MEMORIAS ROM

ROMs

2. Radom Access Memory (RAM)
    a. Temporary store data
    b. Volatile
    c. Types of RAM
        i. DRAM: Dynamic RAM: obsolete

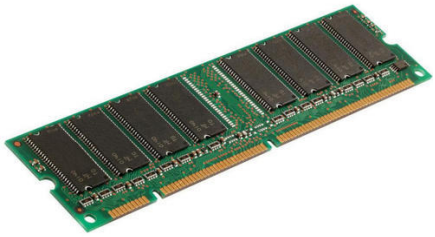
DRAM

2. SARM: Static RAM:
    a. Requires constant lower power
    b. Used for cache memory
    c. Faster than DRAM
    d. More expansive than DRAM



SARM

3. SDRAM: Synchronous Dynamic RAM
    a. Higher transfer rate



SDRAM

4. DDR SDRAM: Double Data Rate Synchronous Dynamic RAM
    a. 200 MHz

b. Twice faster than SDRAM

c. **184-pin connector and single notch**

d. 2.5V

5. DDR2 SDRAM

a. Higher clock speeds than DDR

b. 553 MHz

c. **240-pin connector**

d. 1.8V

6. DDR3 SDRAM

a. 800 MHz

b. **240-pin connector**

c. 1.5V

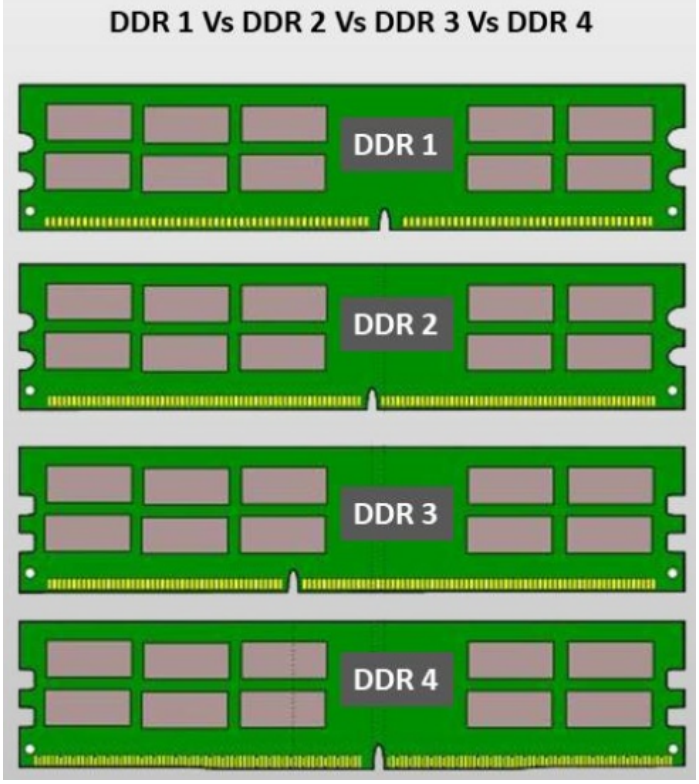
7. DDR4 SDRAM

a. 1600 MHz

b. **288-pin connector**

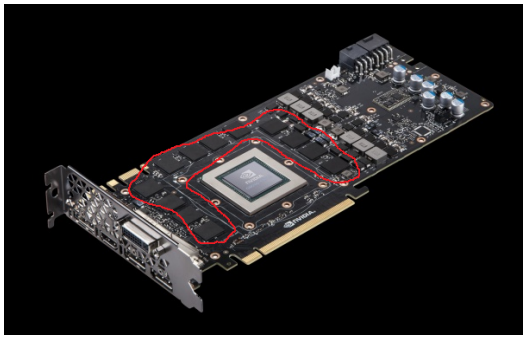
c. 1.2V

d. Available with advanced error correction (ECC memory)



DDRs

8. GDDR: Graphic DDR
    a. Processes massive amount of data



GDDR

Summary of Memory

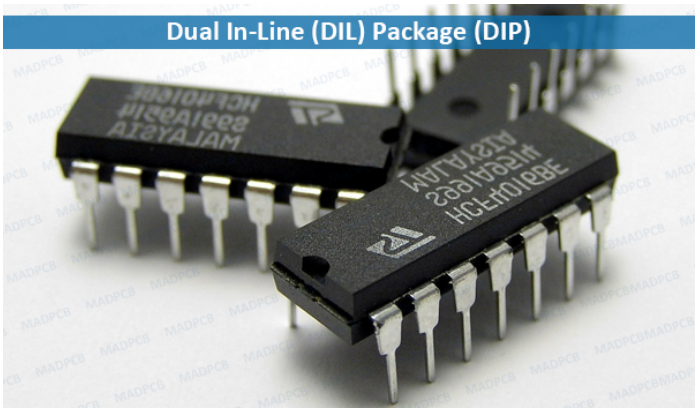
Type of memory	Full name	Description
DRAM	Dynamic RAM	Obsolete

Type of memory	Full name	Description
SRAM	Static RAM	Requires constant lower power Used for cache memory Faster than DRAM More expensive than DRAM
SDRAM	Synchronous Dynamic DRAM	Higher transfer rate
DDR SDRAM	Double Data Rate Synchronous Dynamic DRAM	Twice faster than SDRAM 200 MHz 184-pin connector Single notch 2.5V
DDR2 SDRAM	Double Data Rate 2 Synchronous Dynamic DRAM	Higher clock speeds than DDR 553 MHz 240-pin connector 1.8V
DDR3 SDRAM	Double Data Rate 3 Synchronous Dynamic DRAM	800 MHz 240-pin connector 1.5V
DDR4 SDRAM	Double Data Rate 4 Synchronous Dynamic DRAM	1600 MHz 288-pin connector 1.2V Available with advanced error corrections (ECC memory)
GDDR	Graphic Double Data Rate	Processes massive amount of data

Memory modules

- Single-sided
- Double-sided

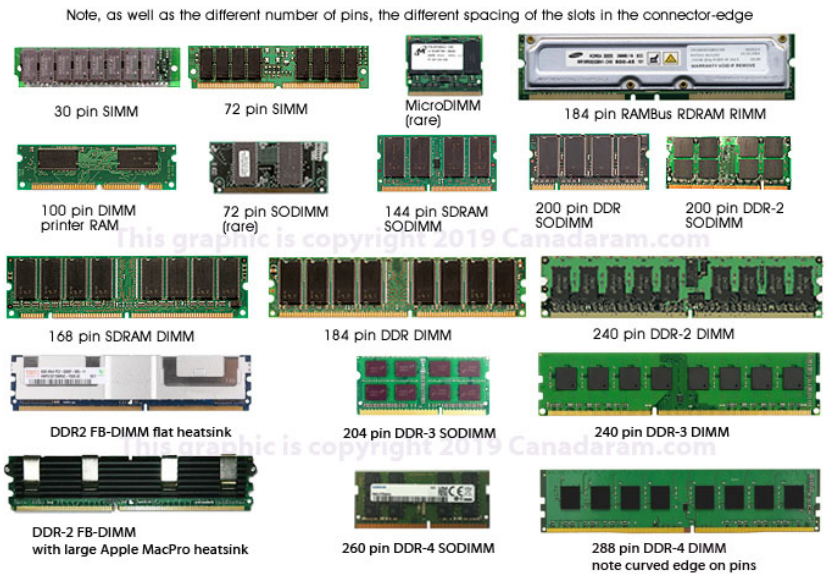
1. DIP: Dual inline package: individual memory chip with dual rows of pins.
2. SIMM: Single inline memory module is a small circuit board that holds several memory chips. It has 30-pin or 72-pin configurations.
3. DIMM: Dual inline memory module is a circuit board that holds **SDRAM, DDR, DDR2, DDR3, DDR4** chips. There are 168-pin SDRAM DIMMs, 184-pin DDR DIMMs, 240-pin DDR2 and DDR3



DIP

DIMMs, and 288-pin DDR4 DIMMs.

4. SODIMM: Small outline DIMM has a 72-pin and 100-pin configurations for support of 32-bit transfers or a 144-pin, 200-pin, 204-pin, and 260-pin configurations for support of 64-bit transfers. This is for **laptop** use.

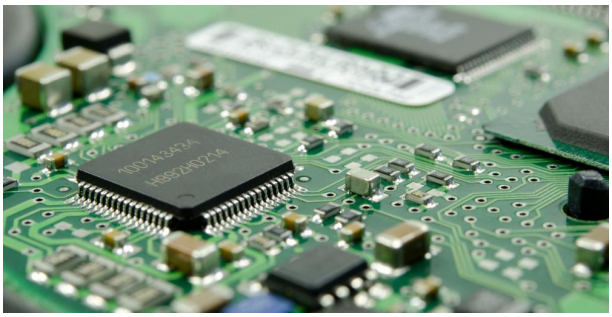


memory modules

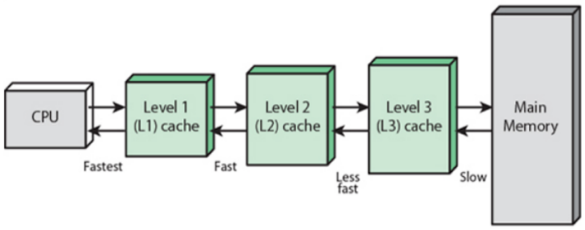
Cache memory

Cache memory store information very near the CPU (SDRAM)

- L1: on the CPU
- L2: external near the CPU
- L3: external



Cache memory



Types of Cache memory

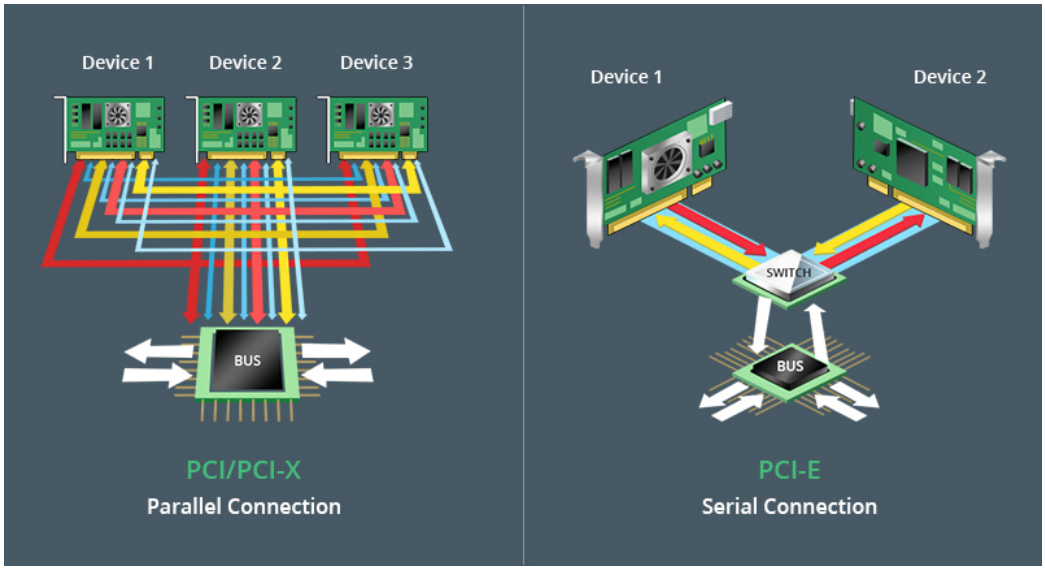
Adapter cards and Expansion slots

- Sound adapter
- NIC
- eSATA card

eSATA card

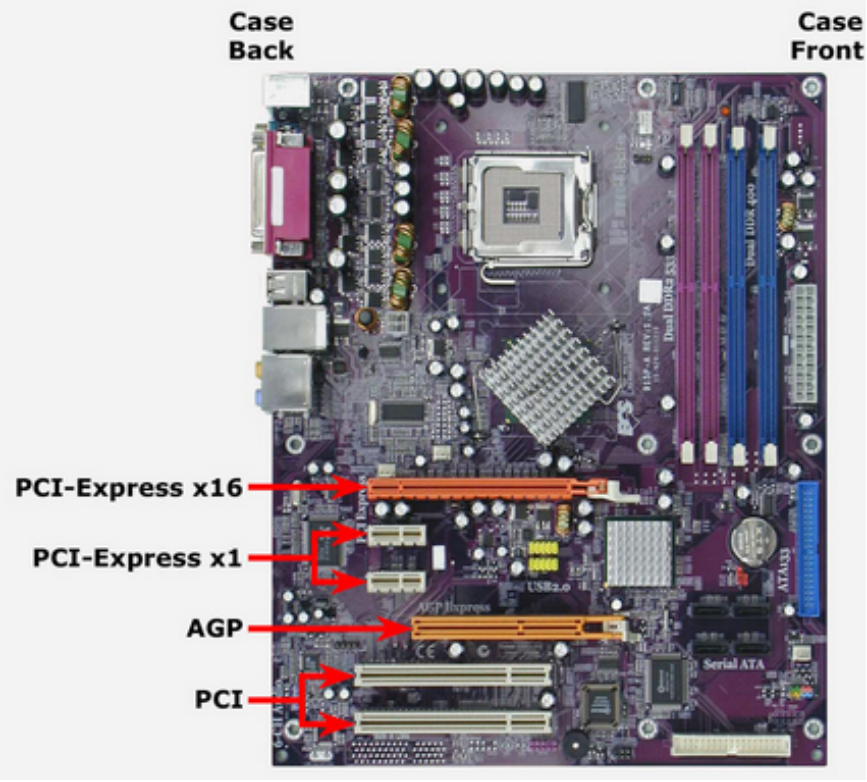
- Video adapter

- PCI: peripheral component interconnect: 32-bit or 64-bit expansion slot. (obsolete)
- Mini-PCI: Type I, Type II, Type III.
- PCI-X: PCI eXtended with 32-bit bus. It is 4 times faster than PCI (obsolete)
- PCI-e: PCI express is a serial bus. It has x1 (short), x4, x8, x16 (long and for video)



PCI/PCI-X vs. PCI-E

- Rister card
- AGP: accelerated graphics port. It's for video and replaced by PCI.



PCIs

Data storage drives

Storage device interface

ATA: Advanced Technology Attachment

- Parallel (PATA)
  - IDE: 8.3 Mb/s
  - EIDE: 16.6 Mb/s
- Serial (SATA)
  - SATA 1: 1.5 Gb/s
  - SATA 2: 3.0 Gb/s
  - SATA 3: 6.0 Gb/s

PATA	SATA
Parallel Advanced Technology Attachment	Serial Advanced Technology Attachment
40-pin connector	7-pin connector
High in cost	Cheaper in cost
Lower speed of data transfer	Higher speed of data transfer
Higher power consumption	Lower power consumption
Bigger cable size	Smaller cable size
No hot swapping	Hot swapping
No external hard drives	External hard drives

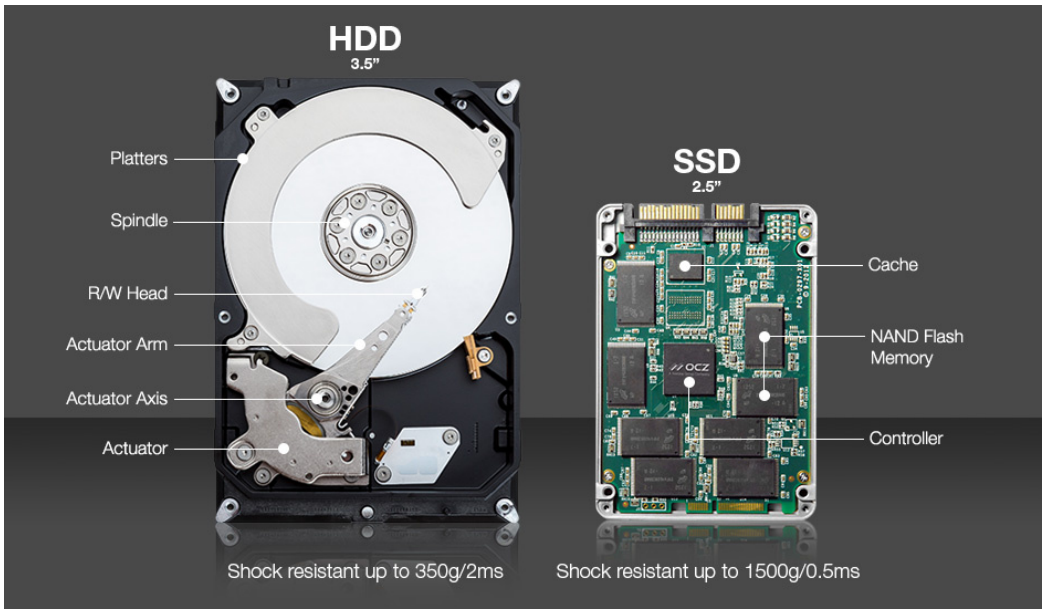
Magnetic Media Storage

- HDD: Hard disk drive
  - HDDs are the traditional magnetic disk devices that have been used for years.
- Tape Drive: magnetic tapes are most often used for archiving data.

Semiconductor storage

- SSD: solid-state drives store data as electrical charges in semiconductor flash memory.
- SSDs have no moving parts, make no noise, are more energy efficient, and produce less heat than HDDs.

- Disc drive form factor
- Expansion cards
- mSata or M.2 modules



HDD vs. SSD

Types of optical storage devices

- Compact disc (CD)
- Digital versatile disc (DVD)
- Blu-ray disc (BD)

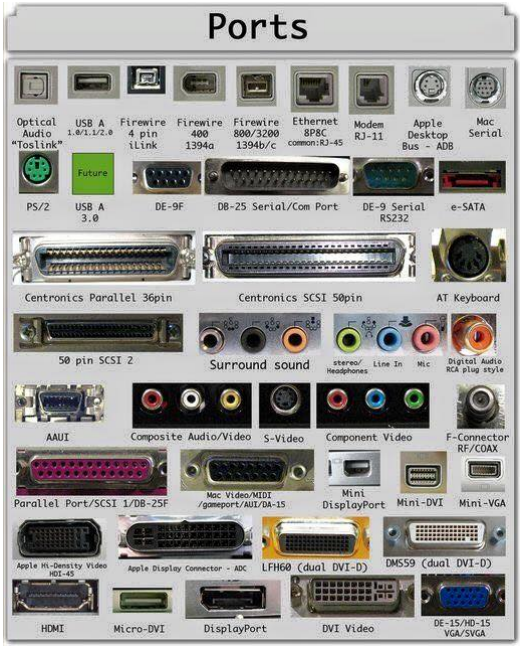
Optical media summary

Optical media	Description	Storage capacity
CD-ROM	CD read-only memory media that is pre-recorded	700 MB
CD-R	CD recordable media that can be recorded one time	700 MB
CD-RW	CD rewritable media that can be recorded, erased, and re-recorded	700 MB
DVD-ROM	DVD read-only memory media that is pre-recorded	4.7 GB (single layer) 8.5 GB (dual layer)
DVD-RAM	DVD rewritable media that can be recorded, erased, and re-recorded	4.7 GB (single layer) 8.5 GB (dual layer)

Optical media	Description	Storage capacity
DVD +/- R	DVD recordable media that can be recorded one time	4.7 GB (single layer) 8.5 GB (dual layer)
DVD +/- RW	DVD rewritable media that can be recorded, erased, and re-recorded	4.7 GB (single layer) 8.5 GB (dual layer)
BD-ROM	Blu-ray read-only media that is pre-recorded with movies, games, or software	25 GB (single layer) 50 GB (dual layer)
BD-R	Blu-ray recordable media that can be recorded one time	25 GB (single layer) 50 GB (dual layer)
BD-RE	Blu-ray rewritable media that can be recorded, erased, and re-recorded	25 GB (single layer) 50 GB (dual layer)

Video ports and cables

- DVI: Digital visual interface
- **Display port: connect high-end graphics-capable PCs and displays**
- HDMI: high-definition multimedia interface
- Thunderbolt1 and Thunderbolt 2
- Thunderbolt 3:
  - Twice the bandwidth of thunderbolt 2
  - Less power
  - Provide two 4K monitors with video
- VGA: Video graphics array
- RCA: Radio corporation of America



Ports

Other ports and cables

- PS/2: Personal system 2 connects a keyboard or a mouse to a computer. It is a 6-pin mini-DIN female connector. No hot swapping.
- Audio and game port
- Network
- SATA

- IDE
- USB: the universal serial bus

Adapters and converters

- Adapter is a component that physically connects one technology to another.
- Converter performs the same function as an adapter but also translates the signals from one technology to the other.

Input/Output devices

Input devices

Original input devices

- Keyboard and mouse
- ADF/Flatbed scanner
- Joystick and gamepad
- KVM Switch (Keyboard, video and mouse)

New input devices

- Touch screen
- Stylus
- Magnetic stripe reader
- Barcode scanner

More new input devices

- Digital camera
- Webcam
- Signature pad
- Smart card reader
- Microphone

Most recent input devices

- NFC devices and terminals
- Facial recognition scanners
- Fingerprint scanners
- Voice recognition scanners
- Virtual reality headset

Output devices

- Monitor
- Projector
- VR Headset uses computer technology to create a simulated, 3D environment.
- AR Headset uses similar technology but superimposes images and audio over the real world in real time.
- Printers
  - Inkjet printer
  - Impact printer
  - 3D printer
  - Thermal printer
- Speakers
- Headphones