

How do computers work?

Will Leeson

Quick Review: Decimal and Binary

How do computers work?

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It's simple!

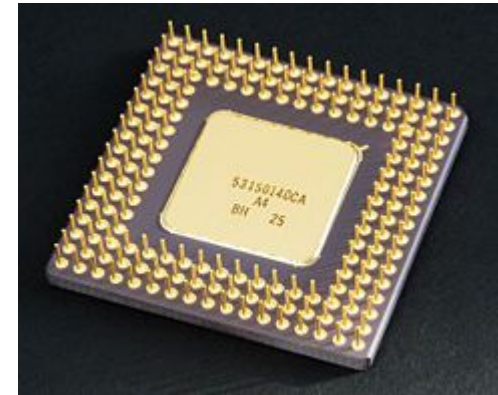
1. Plug in the computer
2. Click the power button

Core Components

- Central Processing Unit (CPU)
- Motherboard (MOBO)
- Storage (HDD, SSD, etc.)
- Random Access Memory (RAM)
- Power supply (PSU)
- Graphics Processing Unit (GPU)

Central Processing Unit (CPU)

- The brain of the computer
- Performs most calculations
- Consists of various “units”
 - Control Unit (CU)
 - Arithmetic Logic Unit (ALU)
 - Address Generation Unit (AGU)
 - Memory Management Unit (MMU)

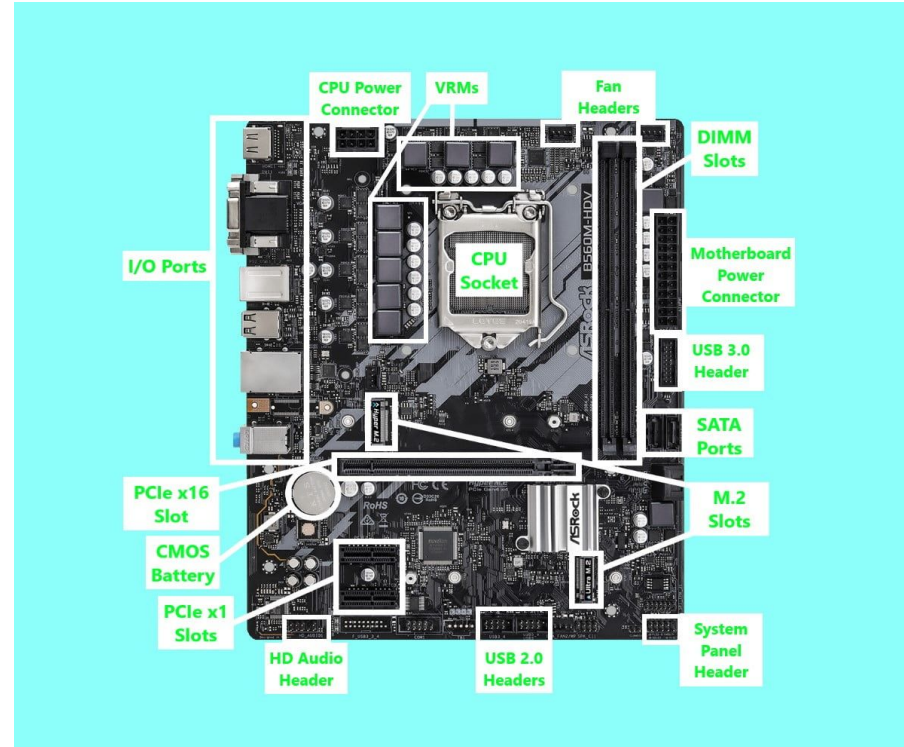


Multi-core CPU

- Core - The processing unit in a computer
 - Modern CPUs have multiple cores
 - Allows it to do several things at once
 - Typically range from 4-16 cores
- Thread - A “virtual” core
 - Typically 2 threads per core
- Clock-rate - The speed of the CPU
 - Determines how many things the CPU can do in a set time
 - Typical range between 2GHz - 5GHz
- Typically, more cores means lower clock speeds

Motherboard (MOBO)

- MOBO is the rest of the nervous system and skeleton
- Connects components together
 - Transports data
 - Transports power
 - Holds things in place
- Configurable
 - Typically more slots than you need
 - Gives options to connect different components and “cards”



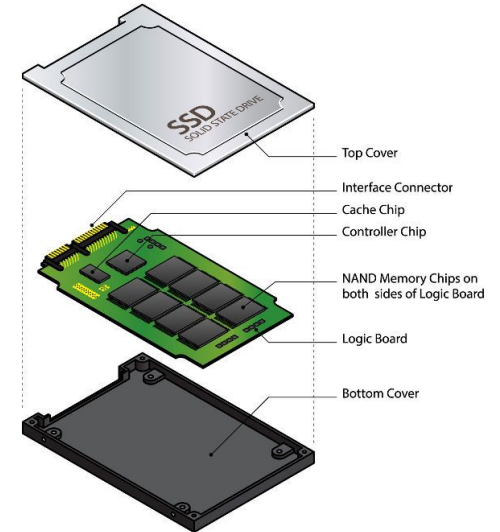
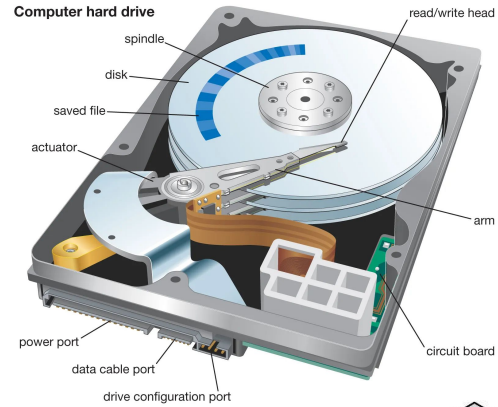
Random Access Memory (RAM)

- Short term memory
 - Keeps track of what your currently doing
 - Can pull from storage for task at hand
 - Empty when power is off
- Fits directly into the MOBO
- Much faster than Storage
- “Average” computers have 8GB
- Servers can have >512GB



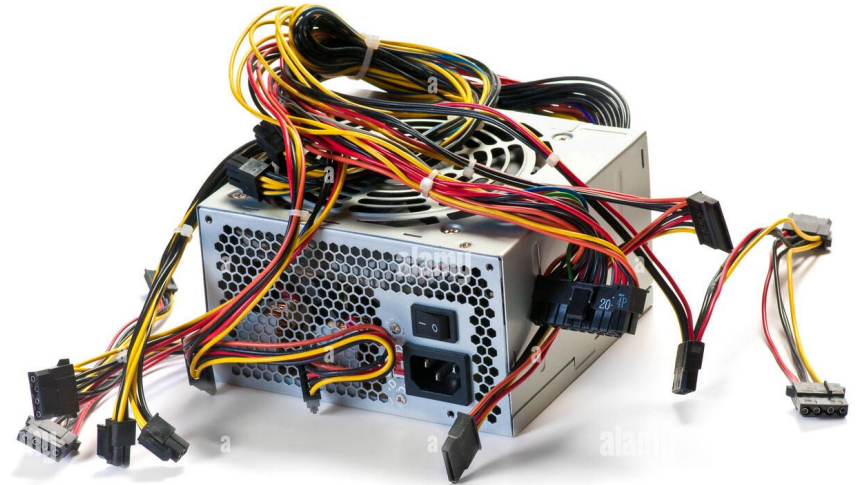
Storage

- **Hard Disk Drive (HDD)**
 - Data stored on disk
 - Disk spins
 - Reads or Writes data
 - Connects to MOBO via cable
 - \$16-30 per TB
- **Solid State Drive (SSD)**
 - Data stored on memory chips
 - Signal tells SSD where and/or what to write or read
 - Connects to MOBO via cable or directly
 - \$30-60 per TB



Power Supply (PSU)

- Provides power to the various components of the computer
 - Sometimes plugged directly into component
 - Typically indirectly powered through MOBO
- Converts electrical energy to meet computer's needs
- Rated by wattage
 - 450-1600W
 - Different amounts for different needs



Graphics Processing Unit (GPU)

- Specialized processor
 - Initially, dedicated to graphics
 - Now, also used in Artificial Intelligence
- Hundreds to thousands of Cores
 - Dedicated to specific tasks
 - Very Fast
- Can operate in parallel
 - Standard monitor has 2,073,600 pixels
 - Each can be calculated independently



Graphics Card vs Integrated Graphics

Graphics Card

- Dedicated component
- Expensive
 - Money
 - Power
- Focused on specific tasks
 - Graphics
 - Machine Learning
- Thousands of cores

Integrated Graphics

- CPU/GPU Hybrid
- Cheaper
 - Slightly more expensive than CPU
 - Far less power than Graphics Card
- Split tasks
 - Normal CPU responsibilities
 - Graphics Card responsibilities
- Hundreds of cores

Let's look inside a computer

What can I do with
this knowledge?

Upgrade Your Computer

- Easy ones:
 - More storage
 - Faster storage
- Medium ones:
 - More Memory
 - Faster Memory
 - Upgrade your GPU
- Hard ones:
 - Upgrade your CPU
- Basically building a new PC
 - Upgrade MOBO
 - Upgrade PSU



Upgrade Your Computer

- Should I upgrade my storage?
 - Are you running out of storage space?
 - Is your PC generally slow?
- Should I upgrade my memory?
 - Does your PC struggle with several apps open?
 - Does your PC stutter?
- Upgrading CPU/GPU?
 - Does your PC struggle with several apps open?
 - Are you doing ML/Gaming?
 - Do you have a desktop?
- Upgrading MOBO/PSU?
 - This is complicated

Changing Storage



Changing Storage

