Computer System Analysis

Mrunal Singh
Rahul Dhangar

What happens when you type in a URL?

How exactly do computers work?

Meant for beginners...

What will we cover today?

1. Computer Architecture
2. Command Line
3. Networking

Ready?

Computer Architecture

The main computer parts and the way they interact.

- Basic Parts of a Computer
- Hardware and Software
- Bits and Bytes
- CPU vs GPU
- Types of memory - RAM, Hard Drive, External
- Peripheral Devices

Basic Parts of a Computer

- Motherboard
  - Main Circuit board
  - Other parts plug into here
  - “Brain” of the computer

Basic Parts of a Computer

- CPU
  - “Central Processing Unit”
  - Computer chip
  - Executes instructions
  - Turns input into output

Basic Parts of a Computer

- GPU
  - “Graphics Processing Unit”
  - Computer chip
  - Dedicated to graphics
  - Helps CPU by rendering all graphics

Basic Parts of a Computer

- Hard Drive
  - Storage
  - You save the files on your computer here
  - Permanent storage

Basic Parts of a Computer

- RAM
  - Random Access Memory
  - Fast
  - Temporary storage

Basic Parts of a Computer

- System Unit
  - Aka “Case” or “Housing”
  - Stores all these parts of the computer

Basic Parts of a Computer

- Power Supply
  - Provides power to the computer

Basic Parts of a Computer

- Mouse
  - Peripheral device
  - User input
  - Many different types
    - two button
    - three button
    - trackpad
    - gaming mouse

Basic Parts of a Computer

- Keyboard
  - Peripheral device
  - User input

Basic Parts of a Computer

- Registers
  - Small holding places for memory
  - Most expensive form of memory
  - Fast accessibility

Basic Parts of a Computer

- Monitor
  - User output
  - Graphical display

Basic Parts of a Computer

- Fan
  - Aka “Cooling system”
  - Can also bb liquid cooling
  - Keeps the computer from overheating

Basic Parts of a Computer

- Video Card
  - Produces video output

Basic Parts of a Computer

- Sound Card
  - Produces sound output
  - Allows sound to be sent to the speakers

Basic Parts of a Computer

- Expansion slots
  - Let you plug in additional components
  - Extend the capabilities of the computer

Hardware and Software

2 Key Concepts in Technology

- Hardware
  - Any physical component of the computer
  - eg: keyboard, mouse, monitor
- Software
  - Any digital component of the computer
  - eg: Programs on your computer like MS Word, Paint, etc

Hardware

- All of the physical parts of the computer
- Motherboard, CPU, GPU, Registers, Fan, etc…
- 5 Types of Computers:
  - Microcontrollers or embedded computers
  - Microcomputers
  - Workstations
  - Mainframe Computers
  - Supercomputers

Software

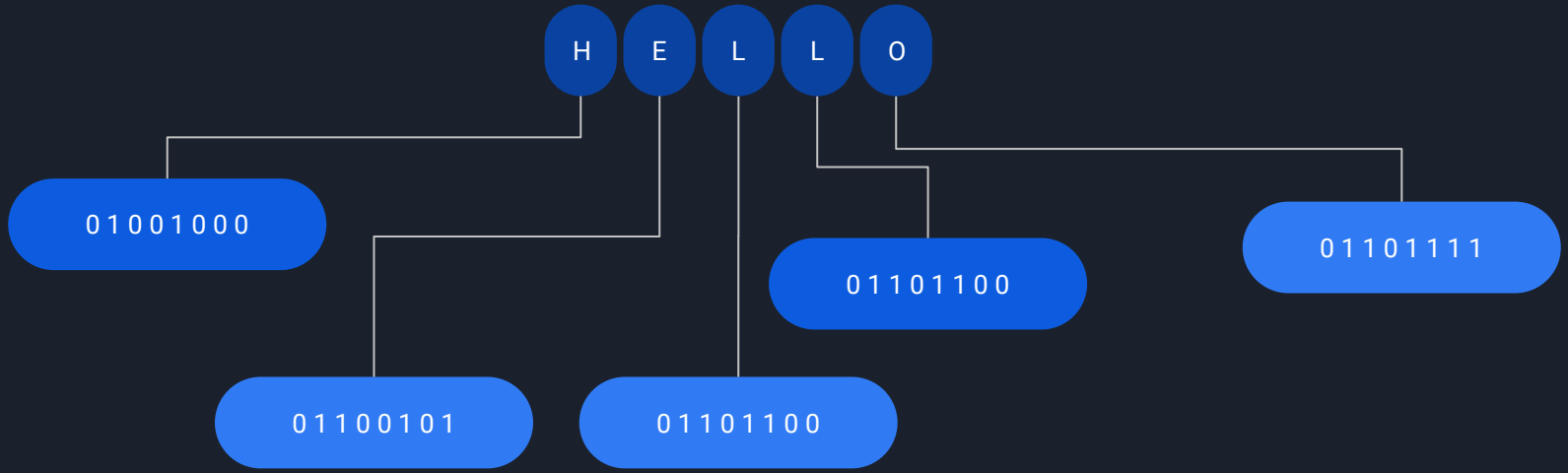
- All digital components of the computer
- Types of Software
  - **Application Software** - programs that do work
  - **Commercial Software** - copyrighted
  - **Public Domain Software** - not copyrighted
  - **Open Source** - users have access to source code

Bits and Bytes

- Units of measuring information
- A bit can have a value of either 0 or 1
- One byte is 8 bits
- One byte represents one character of text
- Any instructions sent to the computer boil down to bits and bytes before they are processed

Bits and Bytes

- Each character is one byte, or 8 bits



Binary

- Binary is the term for the notation of 0’s and 1’s that communicate with the computer – base of 2.
- Bits and bytes are technically binary code – sequences of 0’s and 1’s that are meaningful to the computer.

Why do we care about bits and bytes?

- Anything we do on the computer is all eventually translated to bits and bytes (binary code) which is then interpreted by the computer.

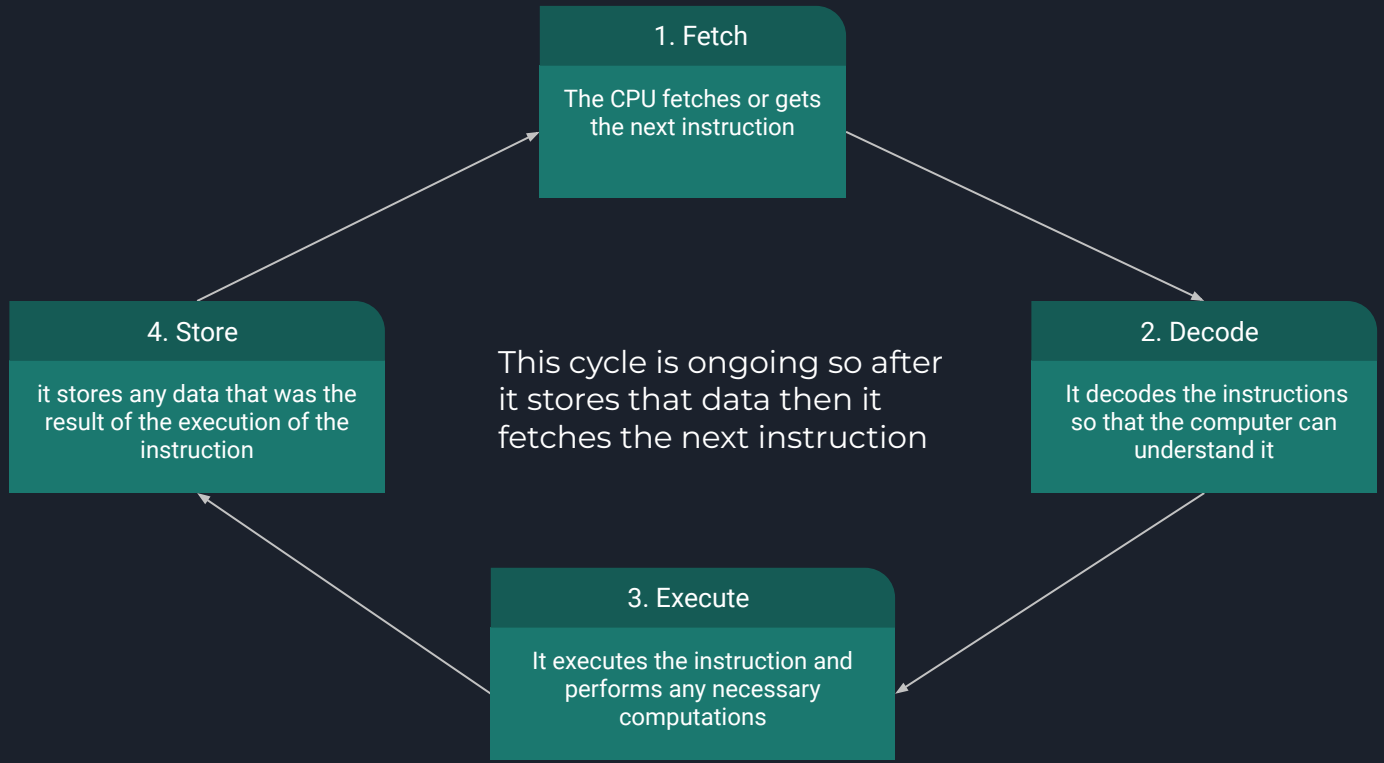
Summary – Bits and Bytes

- Computers process instructions to execute tasks.
- These tasks are sent as binary code - bits and bytes - the type of information that the computer understands.
- A byte is a sequence of 8 bits and represents 1 character. For example, Hello is made up of H-E-L-L-O and each of those letters, or characters, can be represented as 1 byte, or 8 bits.

CPU and GPU

- Computers have two main chips inside of them that do the work
- These are the CPU and GPU
- The CPU is the central processing unit
- The GPU is the graphics processing unit, a chip specifically designed to render graphics to the screen
- The CPU executes instructions. Each program on your computer is just a set of instructions for the computer to execute
- CPU processes these instructions sequentially.

CPU


1. Fetch
The CPU fetches or gets the next instruction
2. Decode
It decodes the instructions so that the computer can understand it
3. Execute
It executes the instruction and performs any necessary computations
4. Store
it stores any data that was the result of the execution of the instruction
This cycle is ongoing so after it stores that data then it fetches the next instruction

GPU

- Important so that the CPU can run at full speed.
- Renders 2D and 3D graphics to the screen/
- GPU uses parallel processing – executing multiple tasks at once.
- So if we are running a program on our computer the GPU will render all of the graphics and the CPU will perform all of the other calculations and execute all other instructions. The end result is that our program runs efficiently and we get a better end user experience. Thanks to the GPU taking some load off of the CPU.

Summary - CPU & GPU

- The CPU and GPU you are the two most important computer chips
- The CPU or central processing unit – handles carrying out all of the tasks of the computer.
- The GPU or graphics processing unit – handles rendering graphics to the screen.

Types of Memory

- Memory is important because it allows computers and users to store information.
- Each computer has a finite amount of memory.
- Two main types of memory:
  - Primary Storage – temporarily holds data to be processed
  - Secondary Storage – stores data permanently – this is the type of memory we are used to dealing with

Primary Storage

- The RAM and cache are two forms of primary storage – meaning that they temporarily hold data.
- Ram stands for random access memory – slower than cache but “cheaper” – meaning less taxing on the computer.
- The cache is very fast – faster than RAM – but it is more taxing on the computer aka “more expensive” and there's less of it on each computer.

Secondary Storage

- Stores data permanently.
- For example, computer’s hard drive, flash drives, external storage devices, etc…

Peripheral Devices

- Any device that expands a computer's ability in the following areas:
  - Input
  - Output
  - Storage
- Important for receiving input and displaying output.

Command Line Basics (Practical)

Basic Commands

Windows

- ***dir*** – list names of folders and files in directory
- ***cd _____*** – change directory
- ***cd ..*** – up one directory level
- ***cd*** – print path of current directory
- ***copy file1 file2*** – copies file 1 to file 2
- ***rmdir*** – deletes a file
- ***help*** – displays a list of commands
- ***up arrow key*** – previous command
- ***down arrow key*** – next command
- ***F7*** – displays the list of commands you typed

Mac

- ***ls*** – list names of folders and files in directory
- ***cd _____*** – change directory
- ***cd ..*** – up one directory level
- ***pwd*** – print path of current directory
- ***cp file1 file2*** – copies file 1 to file 2
- ***rm file*** – deletes a file
- ***help*** – displays a list of commands
- ***up arrow key*** – previous command
- ***down arrow key*** – next command
- ***history*** – displays the list of commands you typed