**Topic 1a**

* Basic functions of a computer:
  + Input – get data from input devices (keyboard, mouse, microphone etc.)
  + Process – processing unit (CPU, graphic processor etc.) process the data
  + Output – output data to output devices (display monitor, speaker/headphone, printer etc.)
* Storage components of computer:
  + Short-term storage
    - Main memory (RAM: Random Access Memory)
    - Volatile; when power is turned off, RAM’s content will be gone
    - Stores program code/instructions and data temporary during execution of programs, sometimes termed as working storage
    - CPU can only access program code/instructions and data that are in main memory (and not in the permanent storage such as hard disk)
    - Virtual memory – utilising part of hard disk storage to supplement the main memory, so that more programs/data can be loaded (but it does make programs run faster)
  + Long-term storage
    - Non-volatile; maintain contents stored even when there is no power
    - Used to store program and data permanently
    - Examples: hard disk, USB thumbdrive, CD/DVD
* Types of RAM: Static (SRAM) vs Dynamic (DRAM)

Static RAM (SRAM)Very Fast

* + But Costly
  + Use in Cache Memory
  + Do not need constant refresh of power to retain data/instructions stored in it

Dynamic RAM (DRAM)

* + Cost Effective
  + But Slow
  + Use in main memory
  + Need constant refresh of power to retain data/instructions stored in it

Diagram

Description automatically generated

How CPU (ALU and Control Unit), Memory (RAM) and Input/Output components are connected?

* By system bus – a collections of wires printed on the motherboard.
* System Bus (Interconnection Unit) comprises of:
  + Data bus (carries data to be stored or read) between RAM and CPU, and between RAM and input/output devices
  + Address bus (carries the address of location to where data should be stored or read)
  + Control bus (carries control signal like to read or write)
* CPU that contains multiple physical processors called cores
  + Allows computers to do multi-taskings
  + Executing multiple instructions simultaneously
* How CPU gives attention to devices?
  + Polling
    - CPU keeps checking on I/O devices at regular interval to see if needs the service of the CPU
  + Interrupt
    - I/O device interrupts the CPU to request for the service of the CPU
* How to make your program runs faster?
  + Get a faster CPU, with multiple cores and larger cache memory
  + Get more and faster RAM
  + Use SSD (Solid State Disk), these disks have no moving parts and hence faster than normal disk drives
* What is BIOS?
  + Basic input/output system
  + Set of instructions located in a ROM (read only memory) chip on the motherboard
  + Tells the CPU to perform certain tasks when power is first applied to the computer
  + This includes instructions to perform a power-on self-test (POST)
  + BIOS is a type of firmware (program instructions stored in hardware such as ROM)
* What is CMOS?
* Complementary Metal Oxide Semiconductor – a type of RAM
* Need constant power, provided by a cell button battery on the motherboard, to retain data stored in it
* Stores settings for BIOS such as date and time, boot sequence (priority) i.e. boot from which hard disk and password for BIOS
* UEFI (Unified Extensible Firmware Interface) – a newer replacement for BIOS (much easier to interact with than BIOS, as it has a graphical user interface
* Computer boot procedure:

1. Power is applied to the motherboard
2. The CPU starts
3. The CPU carries out the BIOS startup routines, including the POST ([Power-on self-test](https://en.wikipedia.org/wiki/Power-on_self-test))
4. Boot devices, as specified in the BIOS configuration, are searched for an OS (Windows, Linux etc.) to be loaded
5. The OS (Windows, Linux etc.) is loaded into RAM
6. OS (Windows, Linux etc.) is started and you can then use your computer.

How CPU works - Scott CPU?

<https://www.youtube.com/watch?v=cNN_tTXABUA>

CPU Cache Explained - What is Cache Memory?

<https://www.youtube.com/watch?v=yi0FhRqDJfo>

RAM Explained - Random Access Memory

<https://www.youtube.com/watch?v=PVad0c2cljo>

BIOS, CMOS, UEFI - What's the difference?

<https://www.youtube.com/watch?v=LGz0Io_dh_I>

32-bit vs 64-bit CPU

<https://www.youtube.com/watch?v=Wu2A4fpFzgs>

How do hard drive works?

<https://www.youtube.com/watch?v=wI0upu9eVcw>

Hyper-Threading (Multi-Core, Multi-Threading)

<https://www.youtube.com/watch?v=lrT9Bl0MCXQ&t=165s>



