CSC101
Introduction to ICT

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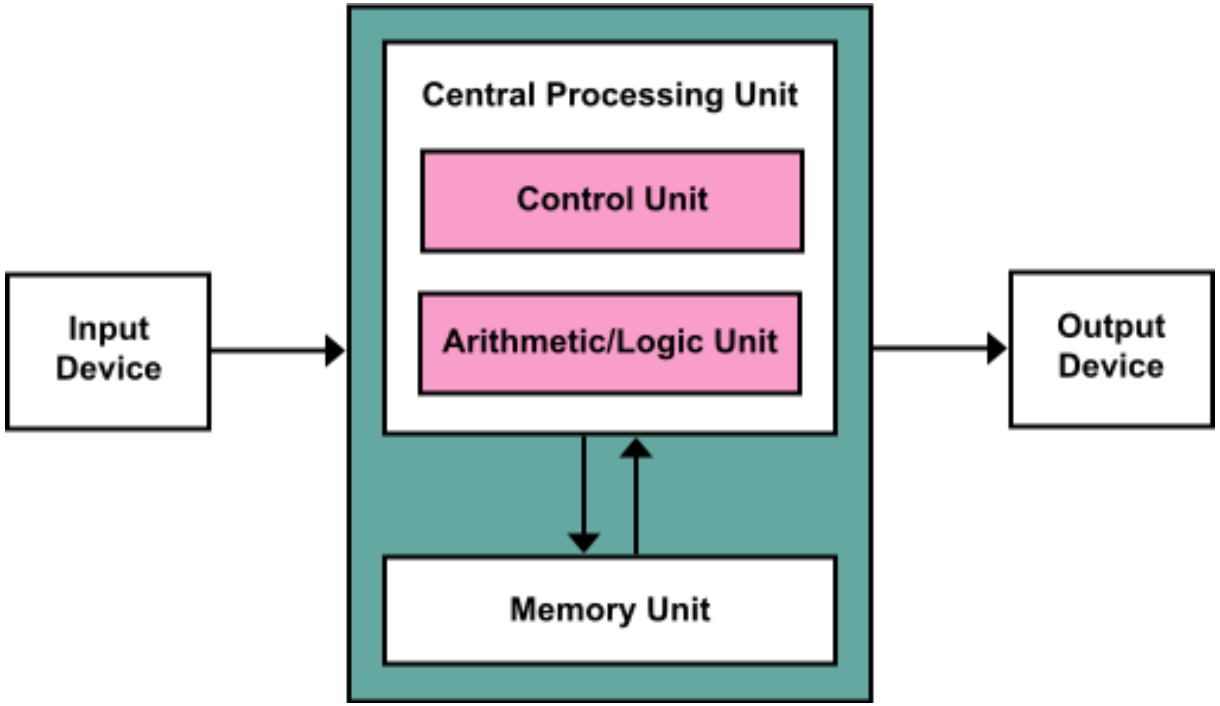
Lecture - 3

Computer Organization

Von Neumann Architecture

- The Von Neumann architecture (1945) describes a design architecture for an electronic digital computer



Ref: https://en.wikipedia.org/wiki/Von_Neumann_architecture

Von Neumann Architecture

- The computer architecture is problem-independent
- Universal Computer has the following components:
  - Arithmetic Logical Unit, Control Unit, Memory, Input Unit, Output Unit

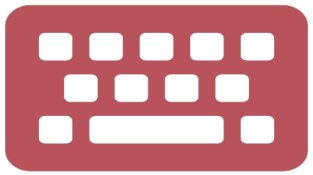
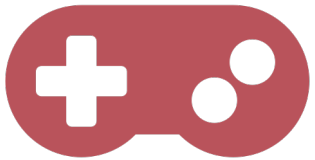
- Program and data both reside in memory
- Each memory location has an address, through which its contents can be accessed
  - In general, program commands are stored in consecutive memory locations

- Data comes through Input, the CPU processes the data based on a program which is in Memory, and the result is either returned to Memory or is presented to the user as Output

Input Unit

- An input unit of a computer perform the following functions
  - It accepts (or reads) instructions and data from outside world
  - It converts these instructions and data in computer acceptable form
  - It supplies the converted instructions and data to the computer for further processing

- Examples:
- Keyboard – Mouse – Stylus – Game controller – Microphone – Touch screens – Touch sensitive pad – Biometric device – Card reader – Barcode reader – Scanner – Webcam


Output Unit

- An output unit of a computer performs the following functions
  - It accepts the results produced by the computer, which are in coded form and hence, cannot be easily understood by us
  - It converts these coded results to human acceptable (readable) form
  - It supplies the converted results to outside world

- Examples:
- Monitors - LCD/LEDs - Touch screens – Printer – Speakers – Headphones – Projector - Force feedback controllers - Interactive whiteboards



Storage Unit

- A storage unit of a computer holds (or stores) the following
  - Data and instructions required for processing (received from input devices)
  - Intermediate results for processing
  - Final results of processing, before they are released to an output device

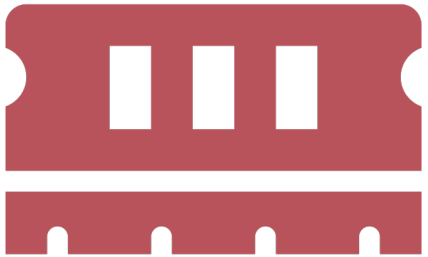
- There are two types of storage

  Primary storage Secondary storage

Storage Unit

Primary Storage

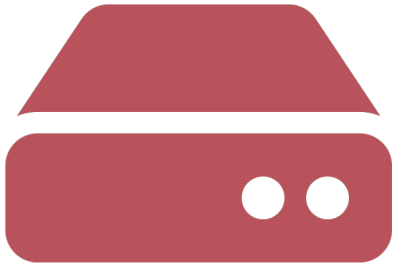
- Also called RAM (Random Access Memory)
- Used to hold running program instructions, data and intermediate results
- Fast in operation
- Small capacity
- Expensive
- Volatile (looses data on power dissipation)



Storage Unit

Secondary Storage

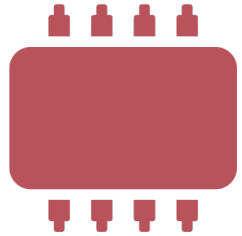
- Also called ROM (Read Only Memory)
- Used to hold stored program instructions and data
- Slower than primary storage
- Large capacity
- Lot cheaper that primary storage
- Retains data even without power



- Secondary Storage Devices
  - Magnetic Tape
  - Magnetic Disk
  - Optical Disk
  - Flash Drive and Memory Cards

Central Processing Unit

- CPU or Central Processing Unit is the brain of the computer
  - Made of silicon and copper
  - Carries out instructions from the program

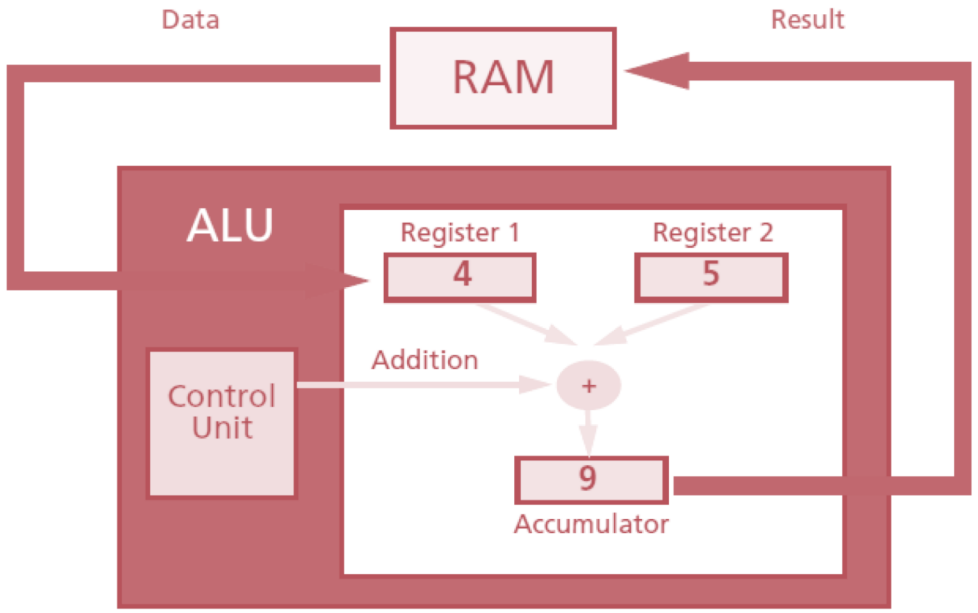


- CPU itself consists of
  - Arithmetic and Logic Unit (ALU), Control Unit (CU), Registers
- Arithmetic & Logic Unit is the place where the actual executions of instructions takes place
- Control Unit manages and coordinates the operations of all other components of the computer

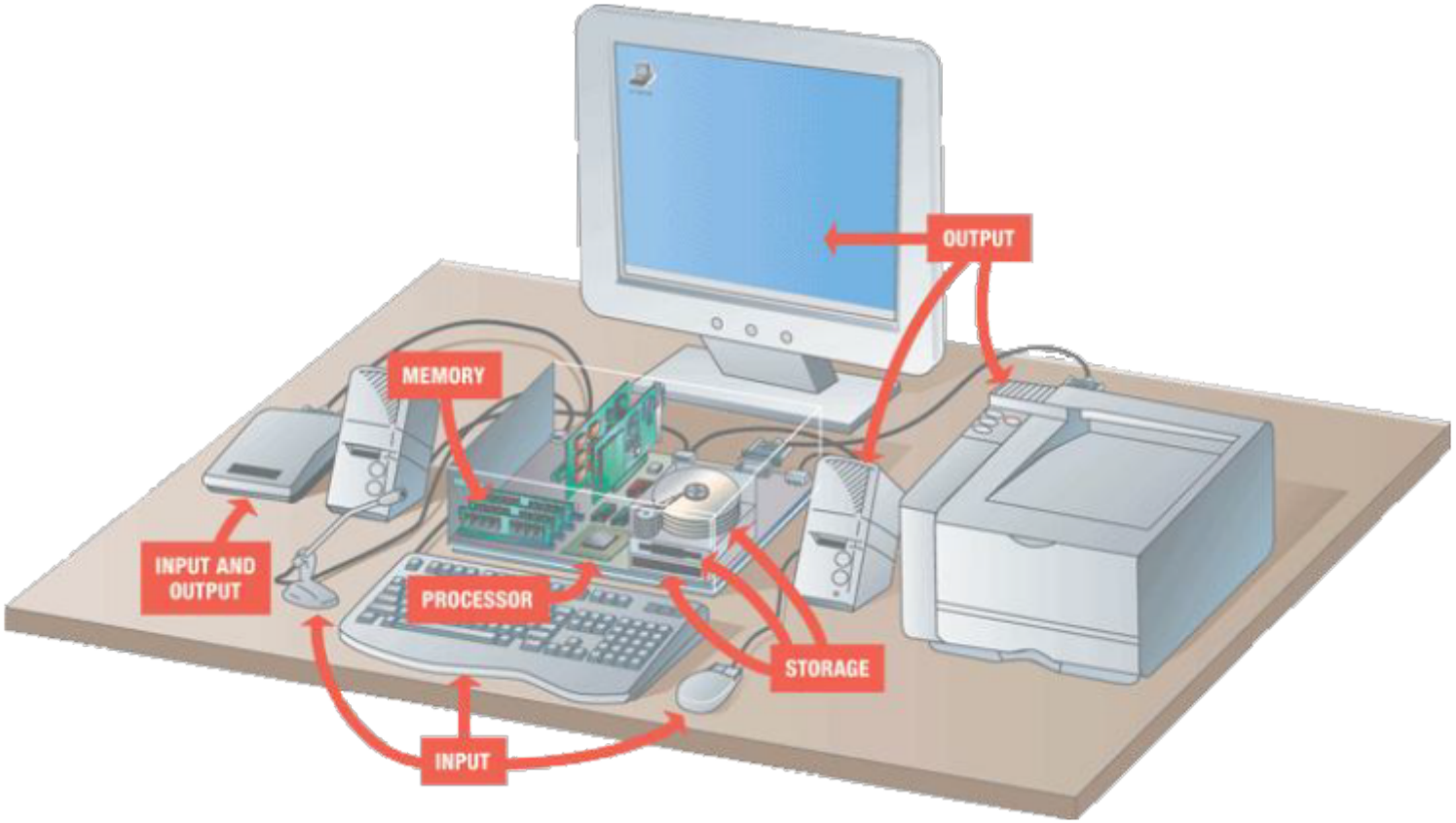
- Registers are devices that hold data inside the computer's memory long enough to execute a particular function, such as indexing, calculating, sorting or otherwise manipulating data
  - They are the CPU's own internal memory
  - It stores location from where instruction was fetched

CPU Instruction Cycle

- The CPU instruction cycle (machine cycle) has four steps
  1. Fetch – Retrieve an instruction from the memory
  2. Decode – Translate the retrieved instruction into a series of computer commands
  3. Execute – Execute the computer commands
  4. Store – Send and write the results back in memory



Different Parts of Computer Hardware



Different Parts of Computer Hardware

Parts of a Computer System

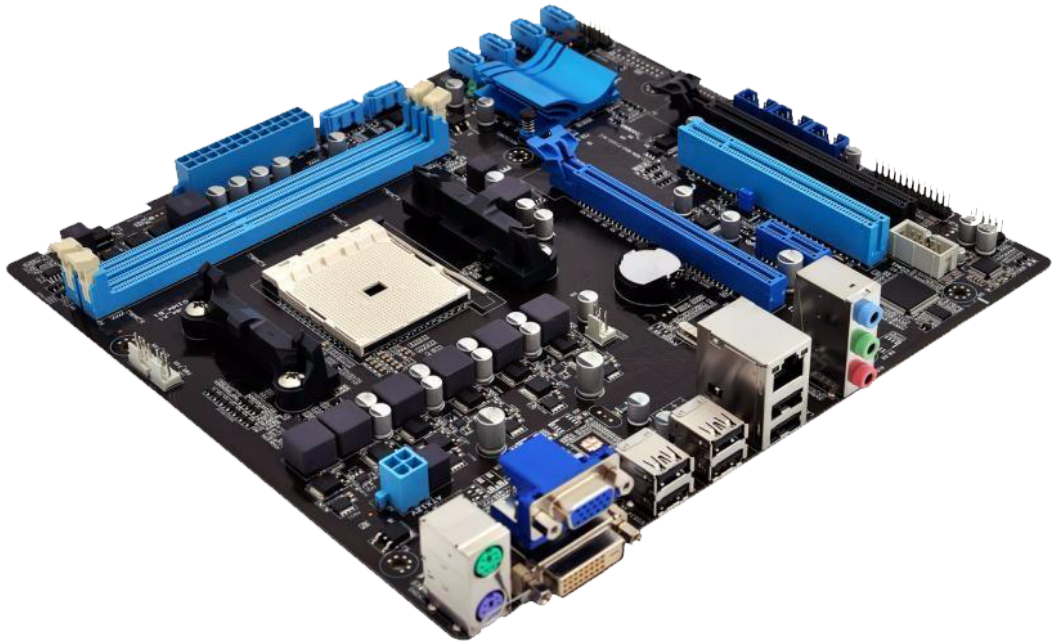
- Hardware
  - Mechanical devices in the computer
  - Anything that can be touched (tangible)

- Software
  - Series of instructions that tell the computer what to do, also called a program
  - Thousands of programs exist (intangible)

Computer Hardware

Motherboard

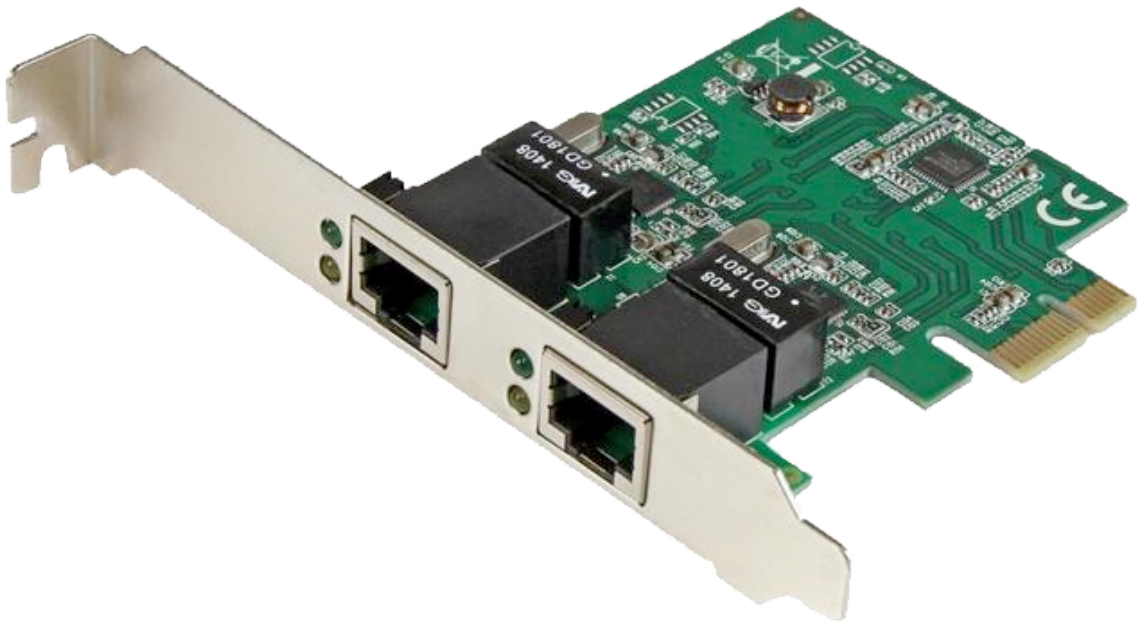
- Main circuit board in a system unit, also called system board
- It holds and allows communication between many of the crucial electronic components of a system, such as the central processing unit (CPU) and memory
- It also provides connectors for other peripherals (adapter cards, processor chips, and memory chips)



Computer Hardware

Adapter card

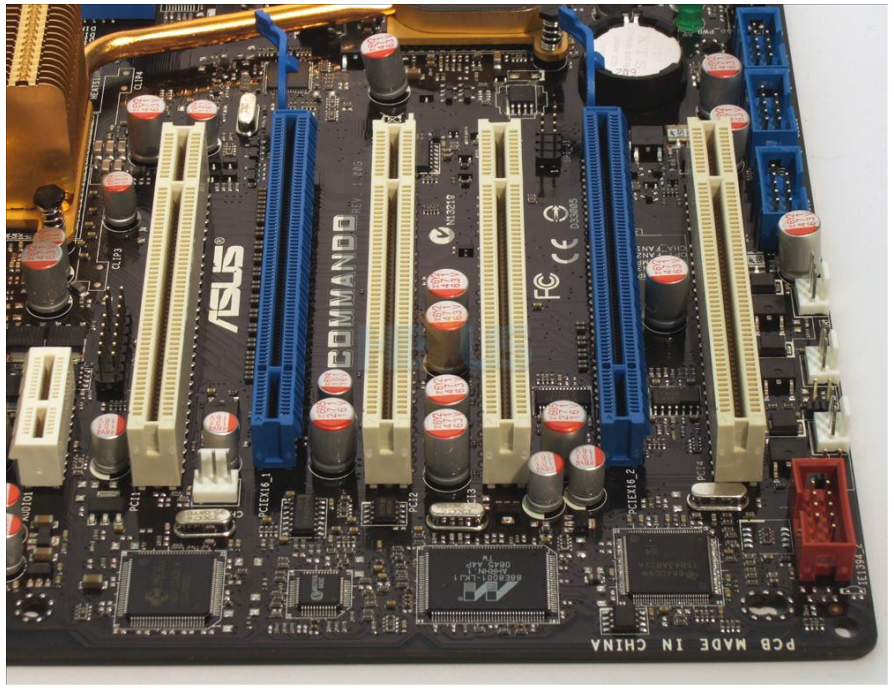
- Also called an expansion card or accessory card
- Enhances the functionality to a computer system or provides connections to external devices



Computer Hardware

Expansion slot

- Also called expansion port is an opening, or socket, on the motherboard where an expansion card can be inserted
- With Plug and Play, the computer automatically configures cards and other devices as you install them



Computer Hardware

Bus

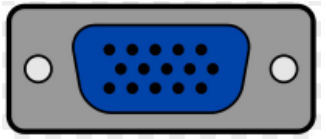
- Channel (wire) that allows devices inside computer to communicate with each other (system bus connects processor and RAM)
- Bus width determines number of bits transmitted at one time
- Word size is the number of bits processor can interpret and execute at a given time

Computer Hardware

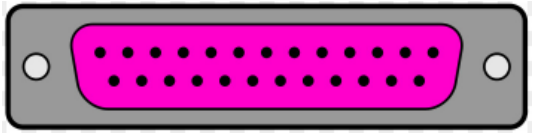
Ports and Connectors

- Port connects external devices to system unit
- Connector joins cable to peripheral
- Both male and female ports

- Serial port
  - Transmits one bit of data at a time, one after the other
  - Connects slow-speed devices, such as mouse, keyboard



- Parallel port
  - Can transfer more than one bit at a time
  - Connects devices such as a printer

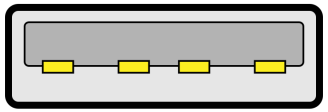


Computer Hardware

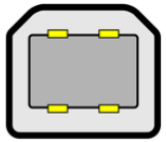
USB port

- USB (Universal Serial Bus) port is the most common port you find on a computer
- Used for data transfer between devices, attaching and charging peripherals and can connect up to 127 different peripherals together with a single connector type

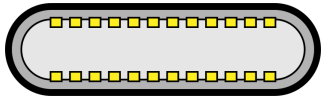
Type-A



Type-B



Type-C



Video: Dissecting a computer: https://www.youtube.com/watch?v=4GMCghYExZM

Ref: http://www.insidemylaptop.com

Computer Software

- Software runs the machine (computer)
- Tells the computer what to do
- It is the main reason people purchase computers

- There are two types of software available

System software

Application software

Computer Software

- System Software
  - A set of programs that control the operations of the computer
  - Serves as the interface between the user, the application software, and the computer's hardware
  - It is the most important software, a bridge between user and machine
  - Also called the Operating System
  - Windows 10, Ubuntu, MacOS

- Application software
  - Most common type of software that is designed to accomplish a specific task
  - Software that makes users more productive
  - Covers most common uses of computers
  - MS Word, Windows Media Player, Internet Explorer

Computer Software

- Software Distribution Methods
  - Packaged software, mass-produced by large organizations
  - Custom software, performs functions specific to a business or industry
  - Open source software, provided for use, modification, and redistribution
  - Shareware, distributed free for trial period
  - Freeware, copyrighted software provided at no cost
  - Public-domain software, freeware with no copyright restrictions

Computer Software

Types of Software

- Business software
  - Software that assists people in becoming more effective and efficient
  - Examples of business software are;
  - Microsoft Word, Microsoft Access, Oracle, Microsoft Project, QuickBooks, Peachtree, SAP

- Word processing software
  - Allows users to create and manipulate text and graphics
  - What is spreadsheet software?
  - Organizes data
  - Performs calculations and recalculates when data changes

Computer Software

Types of Software

- Database software
  - Allows you to create and manage data
  - Add, change, delete, sort, and retrieve data
- Presentation/graphics software
  - Used to create visual aids for presentations
  - A presentation is sometimes called a slide show
- Project management software
  - Allows you to plan, schedule, track, and analyze the events, resources, and costs of a project

Computer Software

Types of Software

- Accounting software
  - Helps companies record and report their financial transactions

- Enterprise computing software
  - Large organizations require special computing solutions
  - Each functional unit has specialized software requirements

THANK YOU