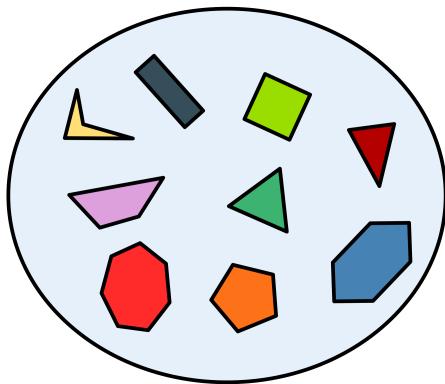


Introduction to Computer Systems

What is a Set?

A **set** is a collection of elements.



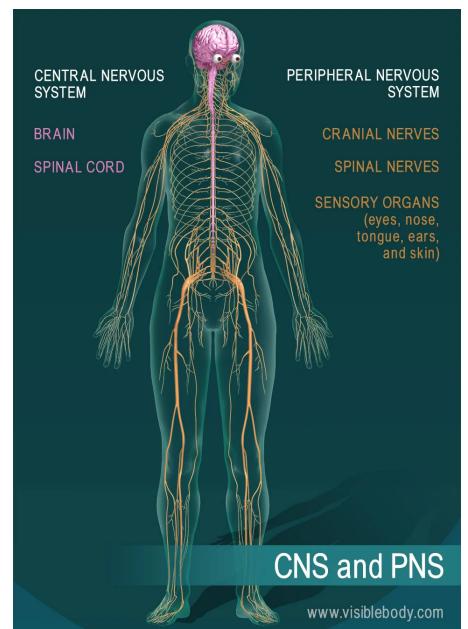
What is a system?

A **system** is a **goal-oriented** organized set including some related elements. each element has an impact on the main goal.

Solar system



Nervous system



What is a computer system?

A system with some hardware and software elements capable of doing computational tasks, for example PCs, Laptops, Smartphones, Smartwatches, Smart TVs, Video Game Consoles, Robot Vacuums, Smart Light Bulbs, Smart Washers and Dryers, Self-driving Cars, Engineering Calculators, Satellites, etc.

Different types of computer systems

- **Supercomputer:** A computer with a high level of performance used for scientific and engineering problems such as *weather forecasting, aerodynamic research, probabilistic analysis, radiation shielding modeling, brute force code breaking, 3D nuclear test simulations, molecular dynamics simulation, etc.*

The performance of a supercomputer is commonly measured in floating-point operations per second (FLOPS) instead of million instructions per second (MIPS).



The IBM Blue Gene/P supercomputer

- **Server:** A server is a centralized storage place for programs, data, and information that controls access to the hardware, software, and other resources on a network.



HPE ProLiant DL380 Gen10 server

- **PC (Personal Computer) / Mac (Macintosh):** Workstations for regular users. There are two types: Desktop and Laptop .



Apple Mac Studio



Apple MacBook Pro 14 2023

- **Mobile computers (Tablet, Smartphone):** A computer that is expected to be transported during normal usage and allow for the transmission of data, which can include voice and video transmissions.



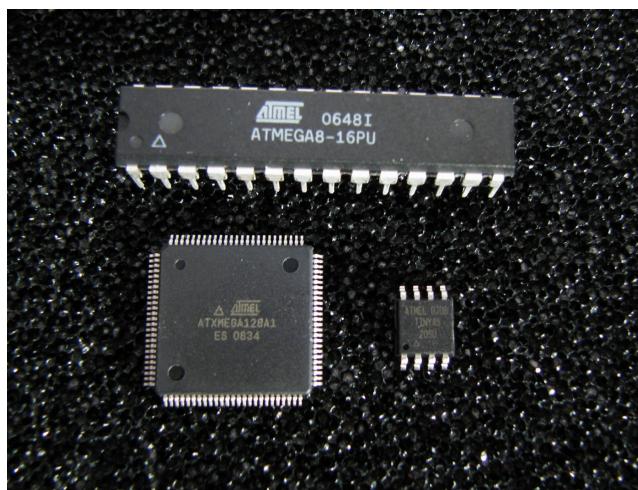
Apple iPhone and Apple iPad

- **Wearable computers (Smartwatch, Smartglasses):** A computing device worn on the body.



Apple Watch SE

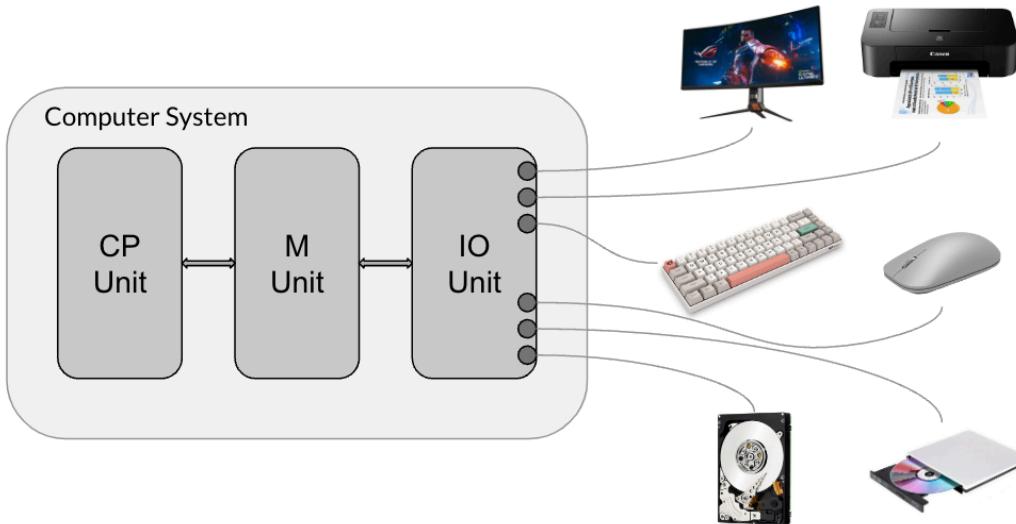
- **Microcontroller (MCU):** A small computer on a single VLSI integrated circuit (IC) chip designed for embedded applications such as *automobile engine control systems, implantable medical devices, remote controls, office machines, appliances, power tools, toys, etc.*



AVR microcontrollers: ATmega8, ATxmega128A1, ATTiny45

The architecture of a computer system

One of the most common architectures is the von Neumann (stored-program) architecture. Based on this architecture, a computer system is composed of 3 different units, CPU, MU, and IOU.



The von Neumann (stored-program) architecture and auxiliary devices

- **CPU (Central Processing Unit):** The elements of the system that are responsible for arithmetic, logic, and control operations. Microprocessors play the role of the CPU in most computer systems. Different processors have different instruction sets known as machine language .
- **MU (Memory Unit):** The instructions and data that are executed by the CPU should first be loaded into a fast and temporary main memory known as the Memory Unit (Main Memory). RAM modules play the role of the MU in most computer systems. This is just a temporary memory for the CPU to access the data and run the programs. The data in this memory will be lost after electrical power loss.
- **IOU (Input/Output Unit):** We need a lot of external devices connecting to a computer system. A keyboard, a mouse, or a touchscreen input data to the system, and a monitor or a printer output the data from the system. We also need Auxiliary Memory devices like Hard Disk Drives or USB Flash Drives to keep the data permanently. All the elements that let us connect external devices to a computer system are categorized under the IOU. For example, a Graphics Adapter is an IOU device connecting the monitor to the system, and a Network Interface Controller is an IOU device letting us connect other computer systems to the system and make a computer network .