جامعة ألأنبار

كلية علوم الحاسوب وتكنولوجيا المعلومات

قسم أنظمة شبكات الحاسوب

المرحلة الثانيه

Computer Architecture

التدريسي: أ.م.د عمر منذر حسين

Standard Organization

- There are many organizations that set computer hardware standards-- to include the interoperability of computer components.
- Some of the most important standards setting groups are
- The Institute of Electrical and Electronic Engineers (IEEE): Promotes the interests of the worldwide electrical engineering community.
- The International Telecommunications Union (ITU): – Concerns itself with the interoperability of telecommunications systems, including data communications and telephony.
- The International Organization for Standardization (ISO): – Establishes worldwide standards for everything from screw threads to photographic film.

HISTORICAL DEVELOPMENT

Generations of Computer that reflect the evolution of computer:

- **Generation Zero**: Mechanical Calculating Machines (1642–1945)
- **The First Generation**: Vacuum Tube Computers (1945–1953)
    - The wired world that we know today was born from the invention of a single electronic device called a vacuum tube by Americans and—more accurately—a valve by the British.
- **The Second Generation**: Transistorized Computers (1954–1965)
- **The Third Generation**: Integrated Circuit Computers (1965 - 1980)
- **The Fourth Generation**: VLSI Computers (1980 - ????)

- Very large scale integrated circuits. (VLSI) have more than 10,000 components per chip.

THE COMPUTER LEVEL HIERARCHY

- Computers consist of many things besides chips.
- Before a computer can do anything worthwhile, it must also use software.
- Writing complex programs requires a “divide and conquer” approach, where each program module solves a smaller problem.
- Complex computer systems employ a similar technique through a series of virtual machine layers.
- Each virtual machine layer is an abstraction of the level below it.
- The machines at each level execute their own particular instructions, calling upon machines at lower levels to perform tasks as required.

- Computer circuits ultimately carry out the work.

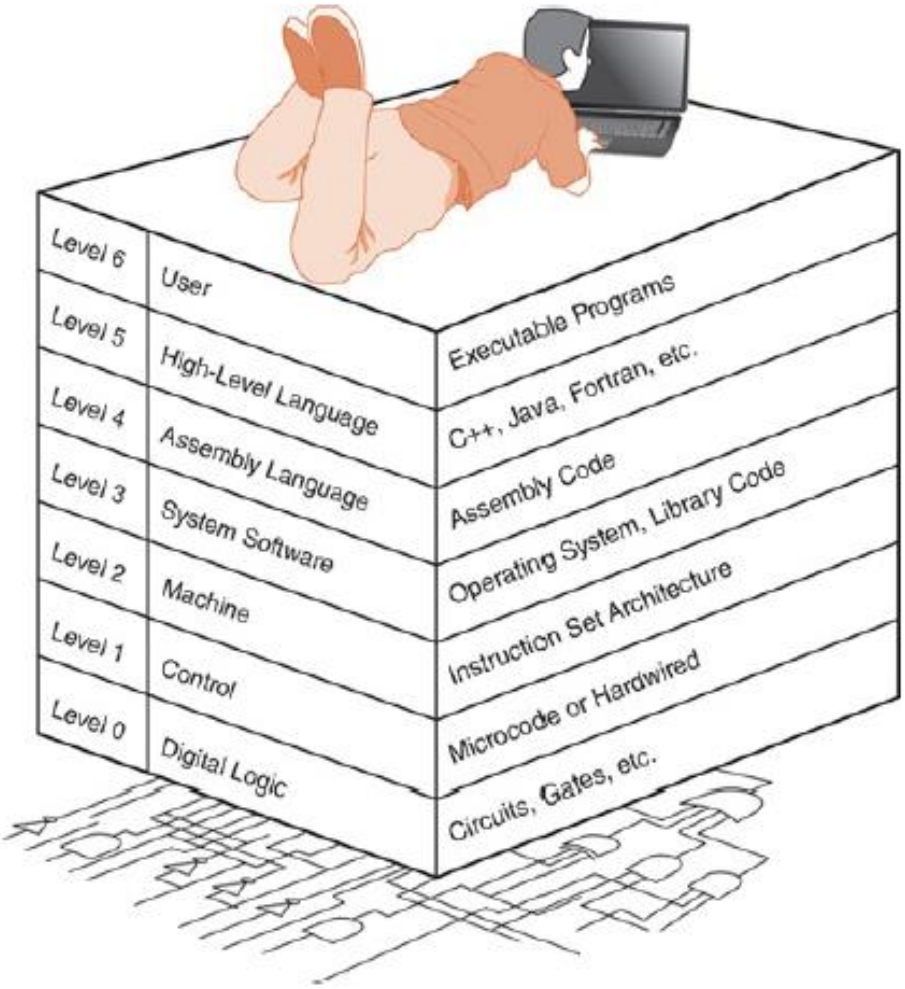

FIGURE 1.3 The Abstraction Levels of Modern Computing Systems

CLOUD COMPUTING: COMPUTING AS A SERVICE

- Cloud computing is the general term for any type of virtual computing platform provided over the internet that offers a set of shared resources, such as storage, networking, applications, and various other processes.
- A cloud computing platform is defined in terms of the services that it provides rather than its physical configuration.

THE VON NEUMANN MODEL

- Today's stored-program computers have the following characteristics:
- Three hardware systems:
  - A central processing unit (CPU)
  - A main memory system
  - An I/O system
- The capacity to carry out sequential instruction processing.
- A single data path between the CPU and main memory.
  - This single path is known as the von Neumann bottleneck.

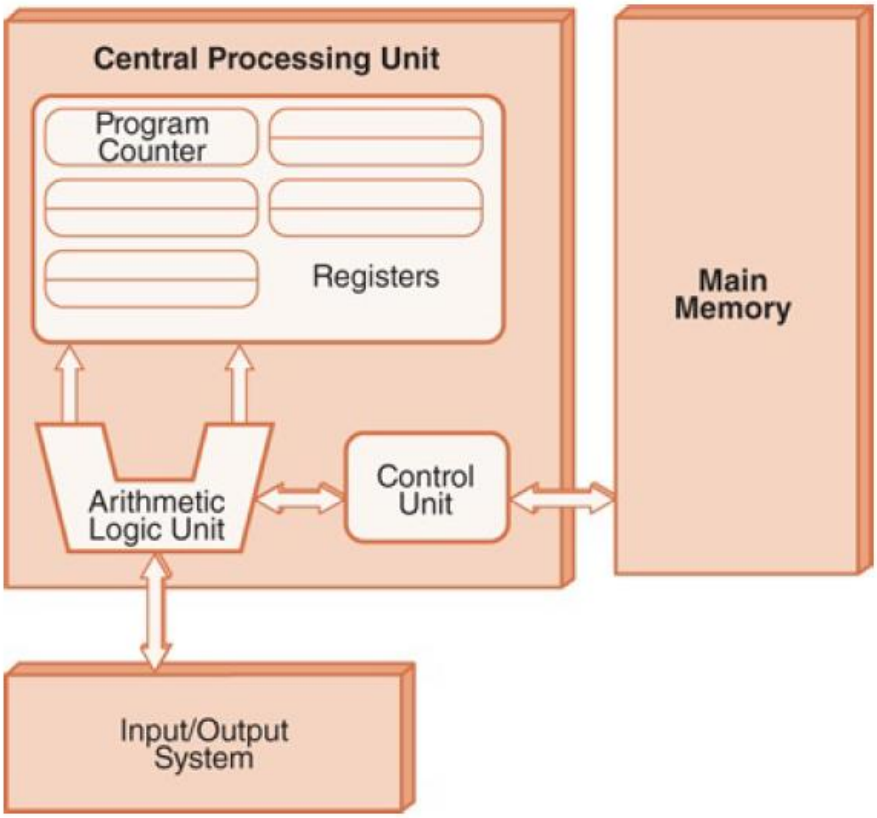

FIGURE 1.5 The von Neumann Architecture

- This architecture runs programs in what is known as the von Neumann execution cycle (also called the fetch-decode execute cycle), which describes how the machine works.
- One iteration of the cycle is as follows:

  1. The control unit fetches the next program instruction from the memory, using the program counter to determine where the instruction is located.

  2. The instruction is decoded into a language the ALU can understand.

  3. Any data operands required to execute the instruction are fetched from memory and placed in registers in the CPU.

4. The ALU executes the instruction and places the results in registers or memory.

QUANTUM LEAP FOR COMPUTERS: HOW SMALL CAN WE GO?

- VLSI technology has allowed us to put billions of transistors on a single chip, but there is a limit to how small we can go with current transistor technology.
- In May 2010, they announced the seven-atom transistor, a working transistor embedded in silicon that is only seven atoms in size.
- The transistor's tiny size means smaller but more powerful computers. Experts estimate it may shrink microchips by a factor of 100, while enabling an exponential speedup in processing.
- This means our computers could become one hundred times smaller, but at the same time, also one hundred times faster.
- Quantum computing is expected to be the next significant leap in computer technology.
- Small quantum computers now exist that perform calculations millions of times faster than conventional computers, but these computers are too small to be of much use.
- A large-scale, working quantum computer would enable us to perform calculations and solve problems that would take a conventional computer more than 13 billion years.
- That could change the way we view the world. For one thing, every encryption algorithm employed today would be useless against that kind of computing power.

- On the other hand, ultra-secure communications would be possible using new quantum technologies.