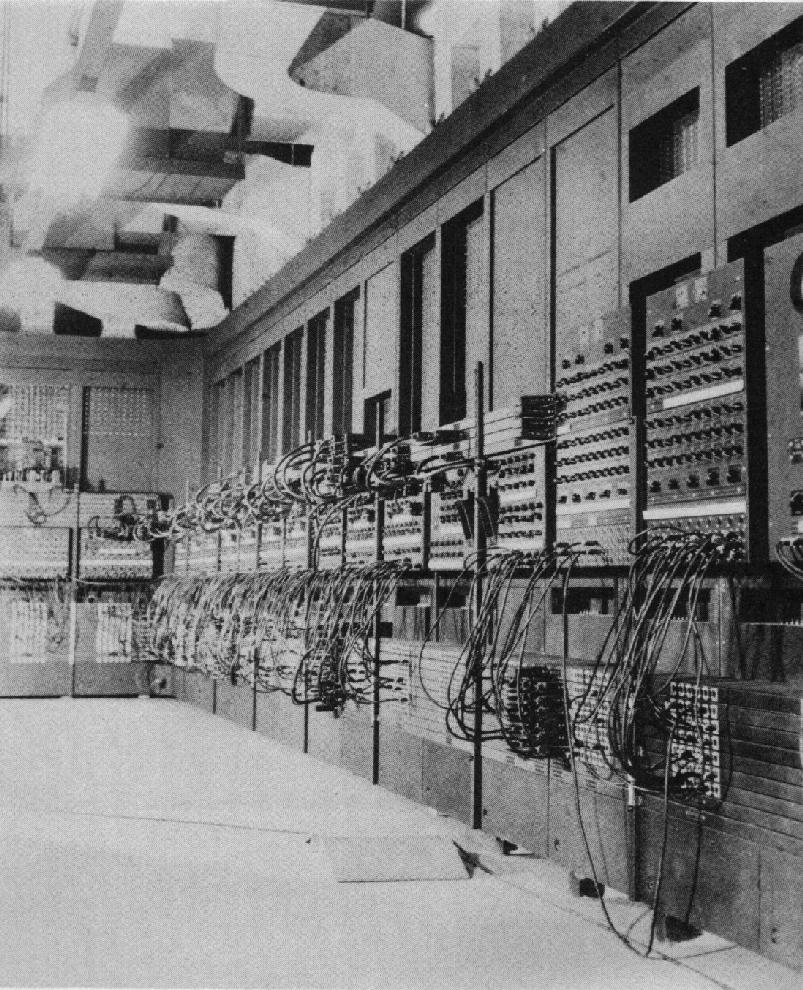
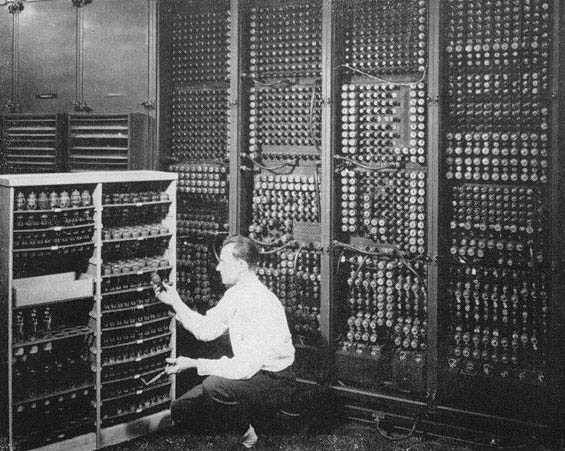
Generations of Computers

**1940-1956:** The First generation of computers. (The Vacuum Tube Years)

The first computers used vacuum tubes for circuitry and magnetic drums for memory, and were often enormous, taking up entire rooms. A magnetic drum, also referred to as drum, is a metal cylinder coated with magnetic iron-oxide material on which data and programs can be stored. Magnetic drums were once used as a primary storage device but have since been implemented as auxiliary storage devices.

The tracks on a magnetic drum are assigned to channels located around the circumference of the drum, forming adjacent circular bands that wind around the drum. A single drum can have up to 200 tracks. As the drum rotates at a speed of up to 3,000 rpm, the device’s read/write heads deposit magnetized spots on the drum during the write operation and sense these spots during a read operation. This action is similar to that of a magnetic tape or disk drive.

In 1944, IBM rolls out the multipurpose Mark 1. The world's first operational electronic digital computer, developed by Army Ordnance, was the ENIAC, acronym for Electronic Numerical Integrator and Computer. The ENIAC, weighing 30 tons, using 200 kilowatts of electric power and consisting of 18,000 vacuum tubes, 1,500 relays, and hundreds of thousands of resistors, capacitors, and inductors, was completed in 1945. The ENIAC soon became obsolete as the need arose for faster computing speeds.

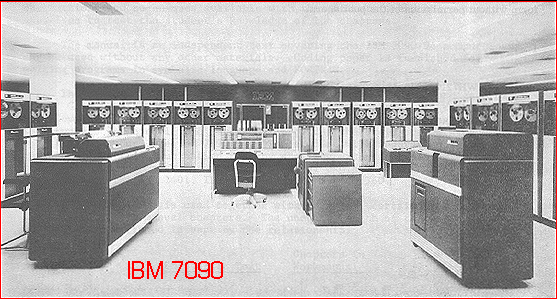


**Second Generation - 1956-1963:** Transistors

 Transistors replaced vacuum tubes and ushered in the second generation of computers. Transistor is a device composed of semiconductor material that amplifies signal or opens or closes a circuit. Invented in 1947at Bell Labs, transistors have become the key ingredient of all digital circuits, including computers. Today's microprocessors contain tens of millions of microscopic transistors.

The transistor was invented in 1947 but did not see widespread use in computers until the late 50s. The transistor was far superior to the vacuum tube, allowing computers to become smaller, faster, cheaper, more energy-efficient and more reliable than their first-generation predecessors. Though the transistor still generated a great deal of heat that subjected the computer to damage, it was a vast improvement over the vacuum tube. Second-generation computers still relied on punched cards for input and printouts for output.

Second-generation computers moved from cryptic binary machine language to symbolic, or assembly, languages, which allowed programmers to specify instructions in words. High-level programming languages were also being developed at this time, such as early versions of COBOL and FORTRAN. These were also the first computers that stored their instructions in their memory, which moved from a magnetic drum to magnetic core technology.

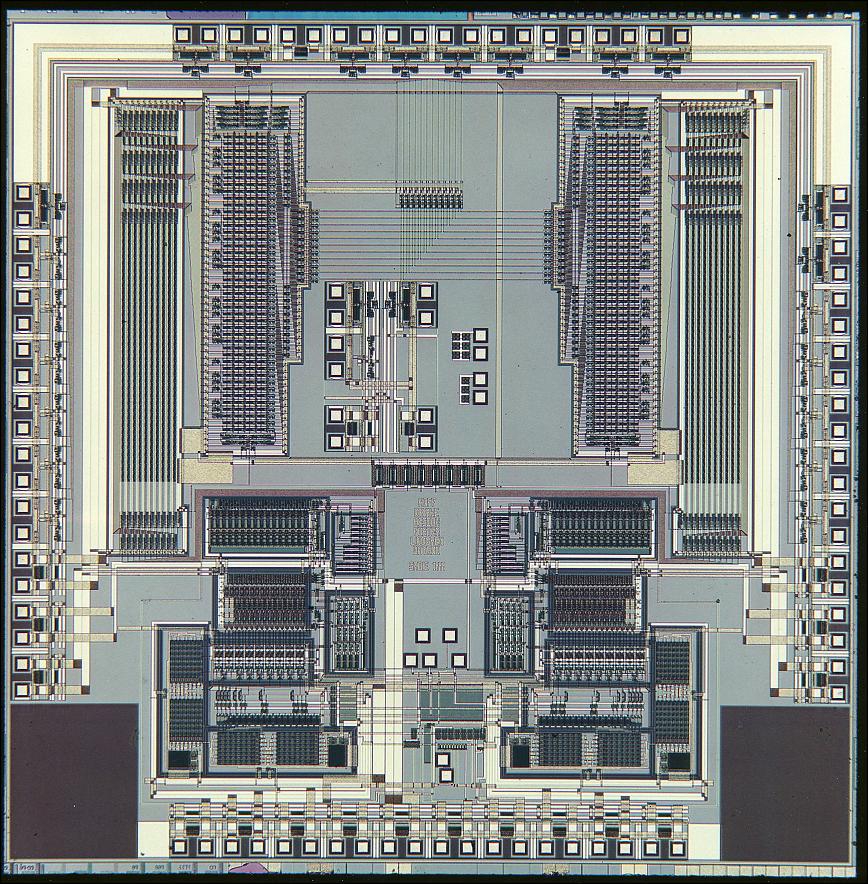


**Third Generation - 1964-1971:** Integrated Circuits

Silicon is the basic material used to make computer chips, transistors, silicon diodes and other electronic circuits and switching devices because its atomic structure makes the element an ideal semiconductor. Silicon is commonly doped, or mixed with other elements, such as boron, phosphorous and arsenic, to alter its conductive properties.

 A chip is a small piece of semiconducting material (usually silicon) on which an integrated circuit is embedded. A typical chip is less than ¼-square inches and can contain millions of electronic components (transistors). Computers consist of many chips placed on electronic boards called printed circuit boards. There are different types of chips. For example, CPU chips (also called microprocessors) contain an entire processing unit, whereas memory chips contain blank memory.

Semiconductor is a material that is neither a good conductor of electricity (like copper) nor a good insulator (like rubber). The most common semiconductor materials are silicon and germanium. These materials are then doped to create an excess or lack of electrons. Computer chips, both for CPU and memory, are composed of semiconductor materials. Semiconductors make it possible to miniaturize electronic components, such as transistors. Not only does miniaturization mean that the components take up less space, it also means that they are faster and require less energy.

 Instead of punched cards and printouts, users interacted with third generation computers through keyboards and monitors and interfaced with an operating system, which allowed the device to run many different applications at one time with a central program that monitored the memory. Computers for the first time became accessible to a mass audience because they were smaller and cheaper than their predecessors.

**Fourth Generation - 1971-Present:** Microprocessors

The microprocessor brought the fourth generation of computers, as thousands of integrated circuits were built onto a single silicon chip. A silicon chip that contains a CPU. In the world of personal computers, the terms microprocessor and CPU are used interchangeably. At the heart of all personal computers and most workstations sits a microprocessor. Microprocessors also control the logic of almost all digital devices, from clock radios to fuel-injection systems for automobiles.

Three basic characteristics differentiate microprocessors:

* **Instruction Set**: The set of instructions that the microprocessor can execute.
* **Bandwidth**: The number of bits processed in a single instruction.
* **Clock Speed**: Given in megahertz (MHz), the clock speed determines how many instructions per second the processor can execute.

What in the first generation filled an entire room could now fit in the palm of the hand. The Intel 4004chip, developed in 1971, located all the components of the computer - from the central processing unit and memory to input/output controls - on a single chip. Abbreviation of central processing unit, and pronounced as separate letters. The CPU is the brains of the computer. Sometimes referred to simply as the processor or central processor, the CPU is where most calculations take place. In terms of computing power, the CPU is the most important element of a computer system.

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