



Computer History

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1 Abstract

The evolutionary journey of computers throughout history showcases the remarkable progress and innovations that have transformed our world. From basic tools like the abacus to today's sophisticated electronic devices, computers have undergone incredible advancements.

Each generation of computers has brought significant changes. The first generation introduced vacuum tubes, paving the way for electronic computers like the Atanasoff-Berry Computer and the ENIAC. The second generation saw the rise of transistors, revolutionizing size, power consumption, and programming languages. The third generation brought integrated circuits, enabling smaller sizes and improved performance. The fourth generation brought microprocessors, leading to personal computers, laptops, gaming consoles, and mobile phones.

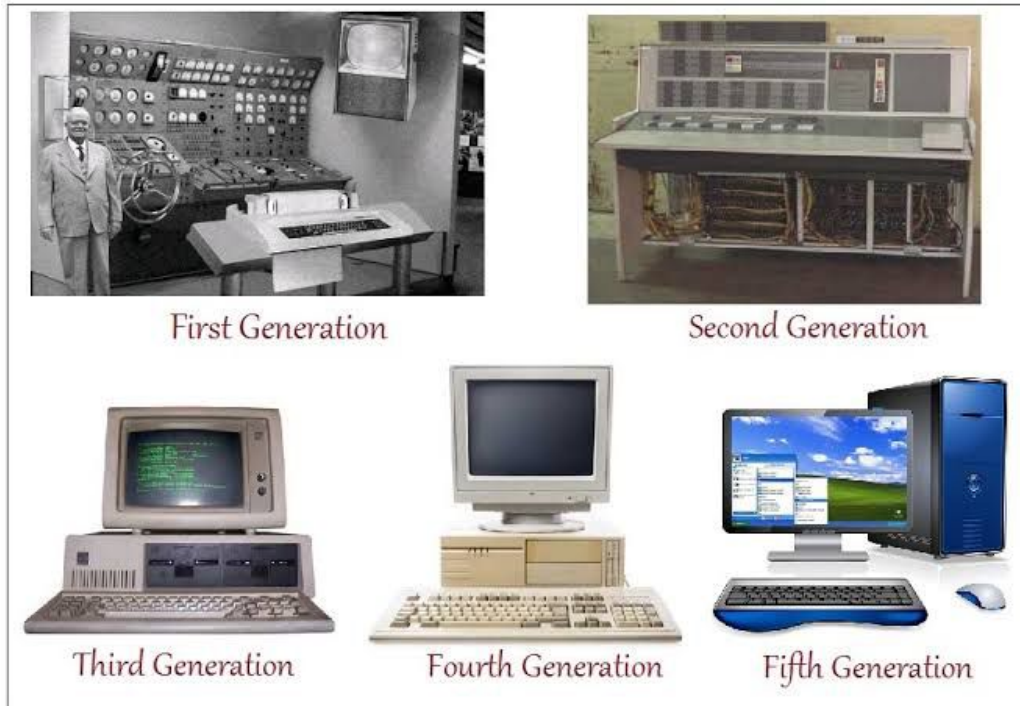
In the fifth generation, we have highly advanced devices like smartphones and tablets. Looking to the future, emerging technologies like nanotechnology, AI, and quantum computing hold tremendous potential.

However, as Moore's Law reaches its limits, new approaches

and technologies will be required for future advancements. Computers have become indispensable in our lives, enabling complex calculations, global connectivity, and enhancing productivity and entertainment.

As we anticipate the next chapter in computer evolution, driven by human curiosity and innovation, the possibilities are endless. The journey continues, shaping the way we live and interact with technology.

2 Introduction

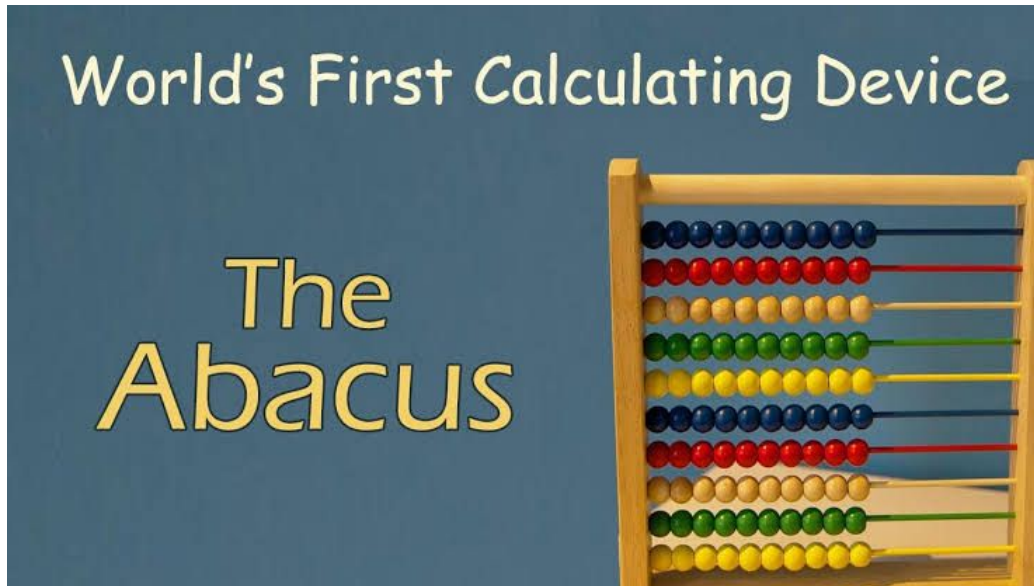


Computers have become an integral part of our daily lives, revolutionizing the way we communicate, work, and access information. The rapid advancements in computing over the past few decades have been remarkable, transforming the world in ways unimaginable just a few generations ago. Understanding the roots and evolution of computers allows us to appreciate the incredible ingenuity of human inventiveness and provide valuable insights into the foundations upon which our digital age is built. This article explores the stages of

computer evolution, tracing the remarkable breakthroughs and innovations that have shaped the modern computing landscape. From ancient calculating devices to complex supercomputers, humans have sought to automate tasks, solve problems, and process information more efficiently.

The most important details in this text are the origins and development of computers, the ingenuity and perseverance of inventors, engineers, and visionaries who pushed the boundaries of what was thought possible, the transition from mechanical calculators to vacuum tube-powered behemoths, the advent of transistors that revolutionized computing size and power, and the emergence of integrated circuits and microprocessors that made personal computers and portable devices a reality. The digital landscape continues to evolve rapidly, with new technologies and possibilities emerging on the horizon. We will explore the potential of nanotechnology, artificial intelligence, and quantum computing to shape the next generation of computers and grapple with the challenges and opportunities presented by shrinking transistor sizes and the potential limitations of Moore's Law.

3 Pre-Computer Devices



3.1 origin of word computer

To fully understand the concept of a computer, it is necessary to examine its original purpose and the origin of the word itself. In the Arabic language, the word (computer) is derived from (calculation). Similarly, in English, the word “computer” is the functional term for the act of computation. While modern-day technological devices may appear extremely advanced, they are essentially machines that perform numerous complex computational operations, which ultimately trace back to simpler arithmetic operations. Ultimately, all

these operations can be reduced to the fundamental arithmetic operation: addition.

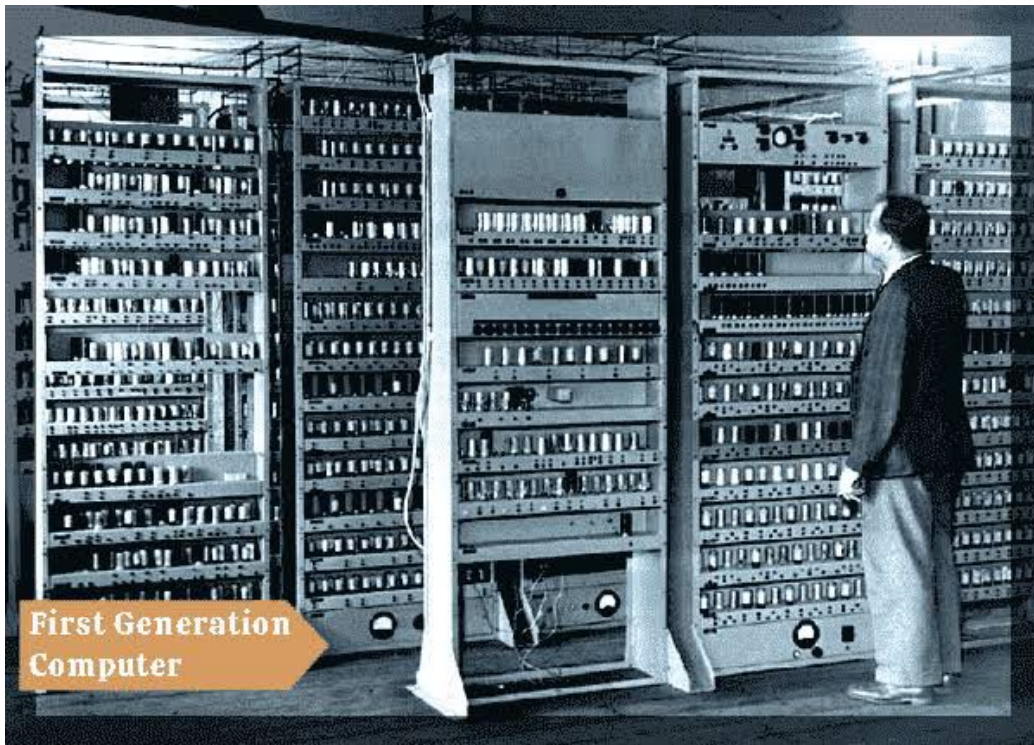
3.2 The Abacus: The First Calculating Device

The “abacus” is considered the first device invented to assist humans in performing calculations. This extremely simple tool was invented thousands of years ago and is still used today to help children learn basic arithmetic and computational operations.

3.3 Blaise Pascal’s Mechanical Calculator

The development of calculating machines throughout history was incredibly slow. The first significant change came with the mechanical calculator, which began to appear in the 16th and 17th centuries. One of the most famous and important of these calculators was invented by the French physicist and philosopher Blaise Pascal in the early 17th century. Its purpose was to assist his father, who worked as an accountant. However, it did not achieve commercial success due to its high cost and complexity, with only 50 copies ever manufactured.

4 The First Generation of Computers: Vacuum Tubes



4.1 The Components of First-Generation Computers

The first generation of computers spanned from 1940 to 1956, and these computers relied on vacuum tubes as their main components. Vacuum tubes were used as switches and amplifiers, while magnetic drums and capacitors served as memory. Additionally, punched cards were used for programming.

Furthermore, these computers were largely mechanical and extremely large. Each individual computer weighed around 5 tons and contained several kilometers of wires and connections, along with numerous gears and mechanical parts.

4.2 The Atanasoff-Berry Computer: The First Electronic Computer

The Atanasoff-Berry Computer (ABC), developed by Professor John Vincent Atanasoff and his assistant Clifford Berry in 1942, is considered the first electronic computer. It relied on 45 vacuum tubes for performing calculations and capacitors for memory. It was followed by the Colossus I computer, developed in England in 1943, which had a specific function of code-breaking during World War II and was not reprogrammable.

4.3 The Mark I Machine: The First Electromechanical Computer

By 1944, Professor Howard Aiken from Harvard University completed the construction of what was known as the “Automatic Sequence Controlled Calculator” or the Mark I machine. It relied on 3,000 mechanical switches and was the

first electromechanical computer capable of making logical decisions, such as conditional statements used in programming. The Mark I computer could be programmed using punched paper tape, and one of its notable programmers was computer scientist Grace Hopper.

4.4 The Origin of the Word "Bug" in Computers

One interesting aspect is the origin of the word "bug" in computers, which refers to a software error or problem. The word originated from an incident that occurred in 1945 with the Mark I computer. There was a problem that caused the computer to be unable to read the punched paper tape.

When investigated by Grace Hopper, it was discovered that the issue was caused by a literal "bug," a moth, that was stuck in the machinery.

Later on, the word "bug" became synonymous with programming errors, and "debug" became synonymous with fixing software issues.

4.5 The UNIVAC: The First Practical Electronic Computer

Two years later, in 1946, J. Prosper Eckert and John W. Mauchly from the University of Pennsylvania developed the first fully electronic computer and the first general-purpose computer called the "Electronic Numerical Integrator and Computer" (ENIAC). The ENIAC computer consisted of 18,000 vacuum tubes and occupied an area of 167 square meters. This was followed by the development of the first practical electronic computer, UNIVAC, in 1951, and the first business computer, IBM 650, in 1954."

5 The Second Generation of Computers: Transistors



5.1 The Invention of Transistors

Despite lasting only 7 years, from 1956 to 1963, the second generation of computers marked the most significant leap in the world of computing. This generation revolved primarily around the invention of transistors.

Transistors, which are electronic devices composed of semiconductor materials, replaced vacuum tubes as the primary component. They offered a perfect alternative, as they were more practical and easier to manufacture than vacuum tubes used in the first generation.

5.2 Advantages of Transistors Over Vacuum Tubes

Transistors provided numerous advantages over vacuum tubes. They were smaller in size, consumed less power, generated less heat, and were more reliable. These advancements allowed for the development of smaller and more efficient computers.

5.3 Magnetic Cores as a Form of Memory

Additionally, the second generation introduced magnetic cores as a form of memory, which offered faster and more reliable data storage.

5.4 High-Level Programming Languages

This period also witnessed the development of high-level programming languages like FORTRAN and COBOL, which made programming easier and more accessible.

5.5 Significance of Transistors in Computing Technology

Overall, the invention and utilization of transistors during the second generation of computers paved the way for significant advancements in computing technology.

5.6 Reduced Power Consumption and Smaller Size

Indeed, the transition to transistors was highly significant in terms of reducing power consumption and eliminating many moving parts in computers. As a result, computers based on transistors were smaller in size, consumed less power, and operated much faster, with reduced heat output. This advancement allowed for more efficient computing.

5.7 Limitations of Second-Generation Computers

However, computers of this generation were still limited to linear operations, meaning they could execute only one task at a time without any multitasking capabilities.

5.8 The IBM 704: The First Computer of the Second Generation

The IBM 704 is considered the first computer of this generation. It was introduced in 1954 and featured transistors in its design, offering improved performance and reliability compared to its predecessors.

6 The Third generation of computers: Integrated Circuits



6.1 The Advancement of Integrated Circuits

The third generation of computers introduced a groundbreaking advancement known as integrated circuits.

The development of transistors in the 1950s served as a significant milestone in the history of computing and the modern world.

6.2 Integrated Circuits as a Game-Changer in Computing Technology

However, Over the course of another 7 years, spanning from 1964 to 1971, integrated circuits dominated the world of computers, contributing to a significant reduction in size compared to previous generations, along with a substantial boost in performance and operational speed. These circuits were easier to mass-produce, leading to a significant decrease in computer prices compared to before. This paved the way for the emergence of personal desktop computers, laptops, and subsequently smartphones, tablets, and any device described as "smart" today, including digital cameras.

7 The Fourth generation of computers: Microprocessors

Fourth Generation of Computer (1971-1980)



Microprocessor



Fourth Generation Computer by IBM

7.1 The Advancement of Microprocessors

The fourth generation of computers, which spanned from 1971 to 2010, relied on microprocessors that employed the same approach as integrated circuits but with smaller transistors. This allowed a single chip to accommodate a large number of highly miniaturized transistors. This remarkable advancement facilitated the production of high-performance processors surpassing their predecessors while being much more cost-effective.

7.2 The Intel 4004 Processor: The First Commercially Available Microprocessor

It all began with the Intel 4004 processor, which was the first commercially available microprocessor in 1971, paving the way for the production of personal computers and the transition from computers being exclusive tools for large corporations, research centers, and governments to becoming everyday usable devices for everyone. This significant advancement positioned Intel as a leading company in the world of processor and semiconductor manufacturing, a position it has retained to this day.

7.3 Personal Computers and the Transition to Everyday Use

During the early days of the proliferation of microprocessors, personal computers such as the Apple I and Apple II started to emerge. Within a few years, laptops became available, followed by the widespread adoption of gaming consoles, mobile phones, and numerous other technological products that are difficult to enumerate today.

7.4 Microprocessors Progress

However, the significant progress achieved by microprocessors can be demonstrated by comparing the computer NASA used to navigate its missions to the moon 50 years ago with a personal computer from 2010. Many computers during that period operated with much greater power than the computer that was sufficient to guide six lunar missions.

8 The Fifth generation of computers and their future



8.1 Shrinking Transistor Sizes

The size of transistors continued to shrink to incredibly small scales, with a single chip now accommodating billions of them. For instance, the latest processors utilize transistors with sizes of only 10, 7, or 5 nanometers (a nanometer being one billionth of a meter, while the thickness of a human hair ranges from 40,000 to 100,000 nanometers). This development has

facilitated the advancement of high-performance computers, smartphones, tablets, smartwatches, and other smart devices belonging to the fifth generation, which began in 2010.

8.2 Multiple Areas of Advancement: Nanotechnology, AI, and Quantum Computing

It is not possible to definitively determine the nature of the upcoming future of computing, as technology is currently advancing in multiple areas simultaneously, and it is uncertain which one will lead to the next generation. From nanotechnology to artificial intelligence and quantum computing, the future appears to be highly unknown and tremendously exciting, considering that we may be just months or years away from a new technological revolution that will reshape computer systems and our interaction with them.

8.3 Moore's Law and Its Limitations

Ultimately, since the 1960s, Moore's Law, observed and predicted by Gordon Moore, stated that the number of transistors on a microchip would roughly double every two years. Over the past five decades, this law has held true, but we may soon reach the physical limitations. Therefore, many

experts believe that the future will inevitably involve new technologies.

9 conclusion

The journey through the evolutionary history of computers reveals an awe-inspiring progression of technological advancements and innovations that have shaped our world. From humble beginnings with simple tools like the abacus to the sophisticated electronic devices we use today, computers have undergone remarkable transformations. Each generation of computers has brought about groundbreaking changes, pushing the boundaries of what was previously thought possible. The first generation introduced vacuum tubes, revolutionizing the size, power consumption, and reliability of computers while introducing high-level programming languages. The third generation introduced integrated circuits, enabling smaller computer sizes, improved performance, and lower prices.

The fourth generation witnessed the emergence of microprocessors, which brought about the proliferation of personal computers, laptops, gaming consoles, and mobile

phones.

The fifth generation of computers, characterized by highly advanced devices like smartphones and tablets, remains uncertain and filled with exciting possibilities.

The shrinking transistor sizes and the potential of emerging technologies like nanotechnology, artificial intelligence, and quantum computing offer glimpses into the next technological revolution that will reshape computer systems and human-computer interaction.

However, it is important to acknowledge the potential limitations of Moore's Law,

10 References

- Computer History Museum Timeline
- History of Computer - Javatpoint