

A Brief Overview of the Development of Computers

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ABSTRACT

From the very beginnings of the human species would need some assistance, using a device that would be recorded 01-the events, broadcast messages or exactly calculate important dates. What is the path travelled by computer Isango prehistoric bones over the IBM System 360 Models 75s - the unit that carried out a complex task to take people to the Moon and safely return back, to the personal computer with plasma screen. Initially, the computer is designed as an auxiliary device for performing the complex multi-figure calculation. Then used as a control device, which should enable the automation of industrial machines, the computer constantly evolved. The modern computer is a complex electronic device, such design, and architecture that can perform the multiplex operations. Interconnected in a very composite system, consists of a vast global network we call the Internet. Options such connected computers are almost limitless. We can safely conclude that there is no activity that largely not relies on the personal computer or the wiring in his system.

INTRODUCTION

Computer hardware has evolved from simple devices, purely mechanical, able to perform basic calculations, to modern devices able to store huge amounts of data. A peration of modern computers is almost equal magic. Clicking on the icon opens the new facilities, we can say the new worlds, to communication, can watch movies of any choice, listen to music and much more. We went to the study of the demonstration phase of development of computers, as pioneers in this field were great innovators, as they considered sizeable problems, initially on a purely mechanical level, then the application of electronics. Today, most young people do not know what to electronic tubes, which are actually built into the very foundation of the computer, the first generation of digital, programmable computer view based on tube technology.

AT THE BEGINNING

Earliest auxiliary devices for enrollment and data was animal bone. On it are carved certain symbols, to assist in the memorization of important events, or even for the registration and transfer of messages. The oldest bones found, dating back to the Paleolithic Lebombo bone discovered in North Africa in 1970. It is the femur of baboons with the 29 sharp points, it`s considered that is used for the lunar cycle tracking. It is estimated that approximately 35,000 years old. Similar bones in the function calendar still used by Bushmen in Namibia ^[1]. Identical technology has also been used in the Ishango bone. It is dark brown long bone /*baboon fibula*/ with a piece of quartz in focus attached to one side, probably intended for engraving. Here you can find records in the three columns. There are different interpretations of the notches on the bone, the interpretation of mathematicians that they are records that symbolize gathering, and to the fact that it's some kind of lunar calendar ^[2]. Isango bone, discovered in 1960, not far from Lake Edward /border between Uganda and Cong. She was found among the remains of a small fishing community, buried in ancient volcanic eruption. Initially it was believed that the artifact about 9000 years old, to newer research dated back to over 20,000 years old ^[3].

Ancient Calculation Devices

The first known portable calculator was the abacus. An early concept was realized with the help of gravel and sand, hence the name - the Phoenician word abacus, which means sand. There are claims that it was originally developed in China, but most scientists locate Babylon as a country of origin. The early Roman abacus solves the problem of the loss of gravel or sand so that

the material is placed in dedicated space on a clay table - like a shallow trough. The first portable unit receives its full function, when the clay balls down on the bar, and it is a form of calculating machine we know as the abacus. Today this educational tool made from different materials, usually plastic, bamboo timber box, while the balls made of plastic, glass and even metals ^[4].

Antikythera, ancient analog computer designed to provide the astronomical positions of the planets and eclipses. The device was discovered on the Greek island of Antikythera, after which it was named. This is a complex mechanism, the oldest known set of gears of different diameters and number of teeth, hence the name - the first analog computer. Time is located at the beginning of the first millennium BC. The original mechanism is made from bronze. The function is available by running the handle associated with the gear that activates the entire system smaller gear. Relations between the diameter and number of teeth, and are aligned to the launch of the main gear, the transmission system shows computations positions of Sun and Moon. In addition, they can be read any other information, such as lunar phases, eclipses cycles/eclipses/ Sun, but the positions of the five previously known planets of our system. The mechanism is an outstanding example of miniaturization and complexity of design and production, even by today's standards. The remains of the device, very damaged by time and sea water were studied gamma rays and knock, which greatly helped in the discovery and understanding of the internal configuration of the device. The Englishman Derek Price, using radiographic data, reconstructed the entire device, and its model has been carried out is a copy of Antikythera mechanism ^[5].

The Antikythera is actually a combination of ideas Planisphere and Dioptra, devices, effective analog calculator capable of solving a number of different types of problems of spherical astronomy. Claudius Ptolemy, the second-century BC, used this astrolabe for astronomical observations described in the book Tetrabiblos (Tetrabiblos-literally: four books, the Greek-Apotelesmatika-Effects, Latin variant-Quadripartitum). During the Middle Ages device adapted to the Islamic world, adding a circle with angular separation, which can be read azimuth as expanded use of devices in the marine navigation ^[6].

Mechanical Devices

It took almost 1,500 years to appear sufficiently ingenious device that bar closer shining achievement Antikythera ancient Greeks. In 1621 William Oughtred finds the Slide Rule - a slider, sunroof /in America known as Slipstick/. These are actually two boards, catches in so that one slides on the other, they are engraved on the values that are read by moving the movable rails and a small transparent, also moving part of the reticle, bringing in a position to obvious the desired value. Mainly used for multiplication and division, as well as calculating the roots, logarithms and trigonometric functions. Modified and upgraded devices remain in use until the seventies of the twentieth century ^[7]. French mathematician and philosopher Blaise Pascal, invented and built the first mechanical digital calculator, calling it Arithmetic Machine, later Pascaline. The innovator has done fifty prototypes of machinery to a final satisfactory variant, which he dedicated to the then state Chancellor Pierre Segulier. Manufactures two dozen machines for the French market, as the only authorized manufacturer of computer equipment, the Royal Privilege Charter, signed by hand, Louis XIV ^[8]. The unit particularly interesting in the successful solution known as a transmission mechanism, which allows the addition of 1-9 single dial /digit / replace nine zero, and pass one of the following dial, which makes each figure independent ^[9]. Pascal's machine was a big step forward, and will have the great impact on the subsequent development of devices for the same purposes. Gottfried Leibniz invented his Leibniz Wheels /Stepped Drums/1673 after he tried to add an automatic multiplication, characteristic of Pascaline device. Based on the idea makes the toothed cylinder, but the teeth of unequal length, are deployed incrementally, which would revolutionary concept. Leibniz developed the idea and in 1694, completed the Stepped Reckoner, / Germ. Staffelwalze/machine with nine toothed cylinders, naturally hand-operated. It was the first calculator that could completely automatic, that inspired all four arithmetic operations: addition, subtraction, multiplication and division ^[10].

The unit becomes known when Thomas de Colmar, used 150 years later, in making its arithmometers, the first mass-produced arithmetical machines ^[11].

The emergence of Jacquard loom, the inventor Joserh Marie Jacquard, a revolutionary simplifies the process of making fabric. Weaving loom was demonstrated in 1801, a newspaper in managing the process of weaving, was the concept of a series of punched cards, which were assigned program. This newspaper is allowed unlimited repeatability, and 25 times faster than the competition, no matter how complex the pattern, which is actually the basis of industrial production - work in large batches ^[12]. The use of substitute card is an extraordinary milestone in the history of process automation. The ability to change form patterns on the same machine, giving it universal, and is an important conceptual approach from which later developed a computer-programming can and data entry.

Charles Babbage, was known in London an attractive gathering - Babbage`s party. So Essinger in the introduction of his book says: "If you want to be part of the scientific and literary cream of London, in 1840 those years, you had to do something, to pray, steal or borrow an invitation to one of Charles Babbage famous soirees/fr Evenings/ ^[13] Charles Babbage was a scientist, philosopher, engineer, mathematician, and writer. Much of his life was devoted to an attempt to build two types of computers, using a toothed wheel called them the Difference Engine and Analytical Engine ^{[13]m}.

In the street Dorset's number one, known to gather up to three hundred guests, among others, Charles Darwin, Charles Dickens, astronomer Sir John Herschel, and others. Babbage showed them his idea, made of mahogany and glass, although the original parts for the Difference Engine, was completed only about one-sixth part of 8000 elements in the original project

demand. Based on the ideas of innovators was to operate multifigure numbers and be able to print the result. One Saturday night in 1842, a visit he had two great guests, Duke of Wellington and Prince Albert, husband of Queen Victoria. He showed them a portrait and asked them for their opinion on the technique by which an image is done. Like most others who asked the same question, Duke said the engraving, but Prince Albert knew the truth and answered - portrait of a woven fabric, but why it is so important? Babbage is explained with a smile, given the nature of his new calculator, Analytical Engine. Portrait represented Jacquard's brilliant innovator's management system looms over punch cards, which Babbage wanted to incorporate into his invention. Otherwise, portrait consisted of 24,000 lines of weaving, and every line is controlled by a punched card, which gave precise instructions loom^[14].

The story of Babbage and his computer goes back to 1821, during the execution of the budget for the Royal Astronomical Society, fixes and improvement of some important astronomical tables. Associate for this assignment was his friend Herschel, Babbage when he said during a tedious calculation, it would be good to have a computer that would drive the water vapor. The following year, through the Royal Astronomical Society, submitted a proposal for the development of computing machines that would be able to perform calculations of astronomical and mathematical tables. The British government was interested, especially as most of the tables in use at the time, was with quite a few errors. Innovator receives in 1823, a down payment in the amount of 1700 pounds, to begin construction of the unit. The abolition of the project in 1842, he was paid a total of 17,000 pounds, which was a huge amount of money at the time (The amount that could cover the value of 22 brand new Stephenson's steam locomotive) and the computer remains just not finished the idea. Why did not Babbage completed his invention? Year in 1980 Allan Bromley, the University of Sydney, studied original drawings for Difference and Analytical engine, the Science Museum - London. This work inspired by the Museum of Science to start making computers of the original ideas of innovators. The project was completed in 1991, in honor of the 200th anniversary of the birth of the genius designer. The conversion of the original design drawings for the computer-guided machine tools necessary in making about 8000 thousand elements of computing machines, they discovered an incredibly small number of errors, and it is assumed that Babbage was intended to protect the invention in the case of theft of drawings of the project. The complete machine showed excellent functionality. The same methodology is used in the manufacturing of the product of the printer. The printer is based on the ideas the author was a complex device, with 4000 parts. In 2000, the printer is finished and also worked smoothly, just as the inventor Babbage envisioned 150 years ago^[15].

General evaluation mechanic, especially after the preparation of the elements of your computer - the idea was great, but the engineering level of development of Victorian's Britain simply was not up to the challenge and required mechanical accuracy in the preparation of many elements. Most functional parts were done by hand. And a small mistake in the making, led by significant discrepancies in the calculation, just all the parts demanded significantly better preparation than the usual tolerances in the precision of the time.

We're done entirely completed two machines, one is in the Science Museum - London, while the other can be seen in Computer History Museum, Mountain View - California.

Electro-Mechanical Devices

In 1880, the United States is organized in ten regular censuses (According to the Constitution of the United States, Census in America is organized every 10 years. starting from 1790). Young engineer Herman Hollerith/bachelor's degree with 19 years/ for the census committee and he said it was a difficult, error liable operation, which begs the equipment. It took seven years to collect and analyze all information about the population of the then American. In preparation of the census foreseen for 1890, US Census Bureau announces a competition for a device that will help in faster and more accurate statistical analysis. On its website dedicated to the Hollerith to Columbia University points out: "After initial attempts with paper tape control problem is solved punched cards for data recording/inspired by the pioneering work in the field of Jacquard and his weaving looms/and was designed by special equipment - tab and sorter, that demonstrate results. His design won the competition for the 1890 US Census, selected because of the possibility that the combination adds up to the fact. This machine is reduced ten-year job in just three months, saved at 1890, taxpayers 5 million dollars, and at the same time bringing the innovator Columbia Ph.D. a doctorate^[16]". In assessing the significance and contribution to the development of computers for a device that was developed by Hollerith, James Essinger states "The connection between the Jacquard's share in the development of revolutionary looms and Hollerith's creations automatic counting machines, there is clear and demonstrable. It is crucially important connections and induces Herman Hollerith-'s work as an important point of connection Jacquard's loom and modern computers, such as Babbage. Babbage laid the conceptual basis between Jacquard's loom and modern computers but that Hollerith, who is this relationship turned into a practical reality^[13]".

Their superiority this device showed he has over the competition. In fact, the competition responded three contestants and commission them by the task: To process the data from the previous census in St. Louis area. Who first successfully complete the job, getting a contract for the census in 1890. The first two candidates have spent at 144.5 and 100.5 pm, while Hollerith ends tasked to 72.5 hours. That participants would prove that their design can prepare data for tabulation of results by age, gender, and other criteria, they had to show it. In this task, participants spent the first two are 55.5 and 44.5 hours, while Hollerith all done by a whopping 5.5 hours. This impressive record earned him a contract for the next census, the Census Bureau uses a modified version of the device all the years of the 1950s! It should be borne in mind that the processing of data from the previous

census was needed seven years, and they feared that the completion of the census results anticipated for 1890, take more time, and perhaps even remain the unfinished business to the list ^[17]. Otherwise, the unit is an electro-mechanical combination, as opposed to purely mechanical devices that preceded it, combines several sections: Pantograph, Card Reader, Hollerith Tabulator Dials, Hollerith device for sorting the tables - Sorting Table card. Work on the unit is started on the pantograph, the section that is actually part of the communication tools, the data were entered. For each data intended for entry in the table inventory committee, no pre-prepared cards with specific deployed holes - Template card. It is placed in the device and the operator manually applied to the needle hole in the pantograph/if there are more openings repeated procedure/and this position is the lever pantograph faithfully transferred to a paper card on which drill hole. Card capacity was 12 rows and 24 columns, which allowed accommodate approximately 80 variables to it. Such data has stored on punch cards that are more favorable to the reader. This unit was part of the electro-mechanical, namely the card is inserted into a space for reading, a series of needles gently rest on her, but only pins that have free passage or drilled holes, touching mercury, located in the tubs below, and thus generate electro contact, through which the relay activates a mechanical counter. Each tab machine was equipped with 40 readers, divided into 100 divisions. Upon completion of the reading, the bell would be rung to the machine is ready for the next cycle, and the operator would put off the card in a specific compartment of the sorting table. On the cards is usually either printed warning: Do not fold, spindle or mutilate ^[18]. A device developed by Hollerith was "The first successful information processing system that has replaced pen and paper. Hollerith machines were also successfully used for the census in Russia, Austria, Canada, France, Norway, Puerto Rico, Cuba and the Philippines, as well as in the United States Census 1900 In 1911, Hollerith company joins with several others to form Computing - Tabulating - Recording Company / CTR / that in 1924 changed its name to International Business Machines Corporation - IBM Corporation ^[16]".

The era of electro-mechanical calculators ends with two brilliant achievements, the analytical machine designed by Vannevar Bush, and devices that designed the Konrad Zuse, the first in a series Z1 computational machines. Vannaver design Bush Differential Analyzer is an extremely complex electro-mechanical device, which is used by a number of gears. The machine is able to handle 18 independent variables. Zuse Z1. The original name was the V1 - Versuchs Modell 1/Experimental Model 1/but after the Second World War renamed Z1, to label different from V1/Ger. Fau 1/Vergetungswaffe, flying bombs. Calculator, completed in 1938, it is celebrated some confidence in the work but remains recorded in the history of the development of computers, the first programmable computer, which is used Boolean logic, and the binary point to represent numbers, and instructions read from a moving punched tape. An interesting solution tape Zuse used a 35 mm film strip, which was perforated and thus ingested commands into the computer ^[19]. The original design was destroyed during the Allied bombing of Berlin in December 1943. The next project was the Z2 actually revision version Z1, modernized by using telephone relays. In 1941, Konrad Zuse completes Z3 computer, and this machine is the first fully functional programmable and fully automatic digital computer. Still basically an electro-mechanical computer, the relay 2000 is used, it is a 22-bit computer, operates at a frequency of 5-10 Hz. program code and data storage are performed on the drilled roll of film. Zuse completes its Z4 in 1945, also based on relay technology, and selling it to Swiss Federal Institute of Technology and it was the only computer in continental Europe at the time ^[20].

After the war, his reputation is growing, established the company, Zuse, and developed one of the earliest programming languages Plankakul. Konrad Zuse he lived until 1995, and had a good fortune and opportunity to see the achievements of modern computers, as well as replicas of their devices from Z1 to Z4, who with his help, rebuilt and exposed to German Museum of Technology in Berlin ^[21].

DIGITAL COMPUTING ERA

During this time, the British are making efforts to develop the computer, run the need for a device that will assist in breaking German codes during World War II. Colossus was the first electronic digital computer is fully programmable. Developed by British experts to crack encrypted messages, as well as help in cryptanalysis Lorenz Cipher. The British gave the codename Fish messages intercepted from the Lorenz SZ 40, SZ 42a, then the condition that developed by Siemens und Halske T52, for aviation, used the telegraph lines. It took two devices, one encrypts and sends the message, and the second receiver decoder-conditioning, as well as Siemens T43 whose encrypted messages allies had failed to break, German cipher device. The full form of Colossus Mark I grew up in December 1943 to Bletchley Park, where he was stationed Government Code and Cypher School/GC and CS/ was transferred and installed February 1944, which was supposed to help in cryptanalysis of Enigma machines ^[22]. Indeed, the electro-mechanical machine called the Bombe (Harold Keen, from British Tabulating Machine Company, has developed a solenoid-mechanical device, with many rotating cylinders for decryption. The whole unit is based on the concept that was designed by Polish Marian Rejewski, the unit commonly known as Cryptologic bomb), broke the Enigma code devices, and the British high command is largely clear reading posts by OKW /Oberkommando der Wehrmacht/ - German High Command, sent his troops. In general, the Colossus was a dedicated machine, specialized to decrypt messages that the Germans send out over Lorenz devices or to detect the initial position of the wheel on the machine encryption - the starting position Lorenz equipment /why she was nicknamed Wheel Setting . Colossus is a form scheduling wheel finding electronically, without physical simulation dial, like Bombe. The machine has been designed to automatically translates the text, although all operators were experts in the German language. Engineer Tommy Flowers was the creator of the device. About 1,500 vacuum tubes represented the brains of the machine. The first message in the center for decryption, Mark I read on February 5, 1944. Along with installation this computer, the British

began the development, other, faster versions. Soon the unit is outdated and replaced by Colossus Mark II computer. The new machine has had 2400 vacuum tubes-electronic valves, five times was faster, and most importantly, much easier to launch than its predecessor. Mark I had serious problems at startup, because the number of tubes burned out, for this reason, the unit is excluded until the task is completed. Mark II is optically read data, he was able to read about 5000 words per second. Paper tape, carrier information, moving at a speed of 12 m/sec. The operating speed of the computer is directly dependent on the speed of the reader. Experimentally, he was able to reach the 9700 words/sec but it was top speed, there was a shooting lane, because it is operational, safe speed reading reserved to 5000 characters/sec. The result is presented as a printer ^[22].

After the war, all computers are dismantled and most of the documentation was destroyed. Until the mid-seventies, the details regarding this project, were kept in the strictest confidence. In 1992 Tony Sale and his team have launched an ambitious project to rebuild the original version of Colossus Mark I. Almost fifteen years ago this team was supposed to be using parts of the draft, photographs and, as they said, half-memories of survivors, somehow reconstruct famous device and bring it to a functional state. Today once again be seen in its original place in the H-Block Bletchley Park's ^[23]. Unavoidable name in the history of computers is certainly Dr. John Vincent Atanasoff. During doctoral studies at Iowa State College, he spent hours trying to help us Monroe calculators perform cumbersome calculations. But then an idea and the desire to construct a better and faster computer. Fellow colleagues from universities, Glen Murphy - an atomic physicist, helping him to develop a small, analog calculators that are called Laplaciometer. Still obsessed with computers, saying that he could not overcome some design problems, one night he sat disappointed in the car and went. Driving aimlessly over two hundred miles, he stopped in a road tavern, drank bourbon - and experienced enlightenment. Since ABC /Atanasoff-Berry Computer/ he was born ^[24]. John Edwards for this creation says "The unit has two rotating drum using electrical charges and electrical pražnjnje capacitor to create a temporary memory. Data is entered using the already proven technology, the use of punch cards. Processor system uses vacuum electronic tubes arithmetical-logical functions, it is for the first time ^[25]." In general, this classification is that it is something in the field of computers done for the first time, it is quite malleable category. A turbulent time in which the device is developed, the necessary discretion, what more secrecy project, not publicly publish inventions, caused some disagreements and even judicial processes. Atanasoff-Berry Computer was developed before World War II, Professor Atanasoff went to the University of Iowa, doubts remain, although the university has hired a lawyer to protect the patent rights of the institution on the computer, for some reason it was not done. Epilog failure was a trial, initiated for cancellation of patent rights has been reported on June 26, 1947, by the creators of the ENIAC computer, John Mauchly and John Presper Eckert. Refraining from any comment, we just pass that on October 19, 1973. Judge Larson announces the verdict: "Eckert and Mauchly did not invent the first automatic electronic digital computer instead they did a derivative device that was developed by Dr. John Vincent Atanasoff ^[26]".

During 1946, John Mauchly and John Presper Eckert developed the ENIAC computing machines which stand for Electrical Numerical Integrator and Calculator. The project is sponsored by the American army, namely Ballistic Research Laboratory / The Ballistics Research Laboratory - BRL/, because of the need for a device that can do the artillery calculations and tables for different pieces of artillery, for their use in various weather conditions. For this project singled out the then 500,000 dollars. The computer contained 17,648 vacuum tubes, 70,000 resistors, 10,000 capacitors 1,500 relays and no moving, mechanical part, which makes this creation quite different from other devices. The unit has a large size, occupy a space of 160 m² weighs about 30 tons, with a power consumption of 160 kW. Eniac was a thousand times faster than any computer at that time. The use of electronic tubes accelerated the operation of the machine, but remained a problem handling or re-programming, requiring weeks of work and technical preparation ^[27]. The big problem is the vacuum tubes, which were subject to overheating and burning out, especially at the stage of starting the machine, even though the unit was water cooled.

That same year, the innovative pair founded his own company, Eckert-Mauchly Computer Corporation / EMCC /. Find a job, have commissioned a computer by US Census Bureau, receiving deposit \$ 300,000 but quickly penetrate the Fund and on the verge of bankruptcy. Is where the Remington Rand purchased EMCC, the contract is renewed but must be able to deliver the previously agreed price. Relieve the financial problems Eckert and Mauchly finalizing one's own design, cost nearly a million dollars, and the world saw a UNIVAC - Universal Automatic Computer. With its 5200 electronic tubes 1905 operations per second and work with the speed of 2.25 MHz, the computer was able to, among other things, provide for the winner of the upcoming presidential election, and with the analysis of only 1% of the electorate. That was a great propaganda effect. At that time the American market exists eight manufacturers of computers, as at that time used to say in IBM - are on the market IBM and the Seven Dwarfs. IBM, with over 60% share, while the rest cover the seven dwarfs ^[28].

The computer is no longer an exclusive product of a company, there is a competition, computers are already serious machine, it has become a large-scale business. This fully confirms the statements of leading people Sperry Rand and Westinghouse, on the occasion of the launch of the new generation UNIVAC III, who are behind the project, it is estimated that the volume of sales of new devices between 15 and 20 million annually over the next five years ^[29]. The emergence of Univac III in mid-1962, in addition to improvements in programming, data storage, the speed of operation, brings the big newspaper, which will bring a revolution in the production of computers of the future - the transistor. The invention that will soon completely replace vacuum tubes, which were significantly improved in the meantime, remain much more expensive, significantly larger consumers of electricity, and that is very important, take up a lot more space. Transistors have opened the way for reducing the footprint of the computer, and miniaturization era of devices began.

Notwithstanding all these improvements, it has been extremely complex device, with the highly complex management procedures such as programming. Communication with the machine is still over punch cards or punched tape, while the data is stored in the form of magnetic field, also on the tapes. It is important to note that the data is entered as a binary code, a combination of 1 and 0. Complete computer is still packed in several large metal box, takes up considerable space, and has a high price. The computer could be ordered at the manufacturer variant Minimal Marketable Systems and Maximal Systems, with expanded memory and a larger number of magnetic tape drives^[30]. The control console is more like the cockpit of a passenger plane, with an incredible number of switches and signal lights. It was really hard to use the computer at that time.

Computer in the Space

Computers are increasingly important, expanding the field of application. Almost every day improve and enhance the performance. This area becomes the area of the most tumultuous and fastest change of almost all the activities that a man does. More complicated industrial processes, machine tools for complex operations, requiring the assistance of a computer. Military technology is seriously relying on the computer, air traffic too, but the area that could not be imagined without computers is a journey into space. Around the globe are already circulating in numerous satellites for various purposes, the space race was in full swing, the Russians sent the first man into space, Americans want the first on the moon. The President John F. Kennedy in a speech before the American Congress is 1961 says "I believe that this nation should commit itself to achieving the goal, before this decade is out, of landing a man on the Moon and returning him safely to Earth". Then he added "No single space project in this period will be more impressive to mankind or more important for a longer period of space exploration, and none will be so difficult or expensive to accomplish." Costs are anticipated over the then 9 billion dollars. Congress accepted the challenge^[31].

The vision that Kennedy introduced to Congress, made on 20 July 1969, when the Columbia - Apollo 11 lunar module program, landed on the moon. The first-class media event, the whole world could see when Neill Armstrong and Buzz Aldrin set up the American flag on the surface of the moon. What could be seen only in sci-fi movies has become a reality this July. In order to achieve this historic venture, has considerable merit and computer IBM System / 360 Models 75s.

Cliff describes a computer by comparing it with today's devices and said "By today's standards, IT /Information Technology/ by NASA and used it during the lunar program is pretty basic. But, even though the power is not more than a pocket calculator, this ingenious computer system was able to take astronauts 356,000 km through space, from Earth to the Moon, and to safely back^[32]." An impressive achievement for all times and all standards. Over 3,500 IBM experts were employed in the Apollo program. Goddard Space Flight Center, used the IBM System / 360 75s, for communication between NASA and the spacecraft. IBM Huntsville, designed and programmed by Saturn Rocket Instrument Unit, which oversaw the departure Saturn-missile carrier. Another important element of a computer system was the lunar module, part of the rocket that landed on the moon. It was called Apollo guidance Computer / AGC /, which operates in real time and allowed the astronauts enter simple commands, which are able to key in via simple keyboard to control the aircraft. Cliff Saran wittily observes: It was a more fundamental than electronic communications, such as a modern toaster that is equipped with a computer and a control stop/start buttons^[32]". Notwithstanding the somewhat mocking remarks, they were the superior handling of his time. The main feature is the use of transistor technology, significantly reducing the footprint, heating devices, as well as a significant reduction in price compared to the previous generation of computers.

November 15. 1971, Intel's Electronic News, by an advertisement for its first integrated processor, which was labeled INTEL 4004 was the first CPU - Central Processing Unit, which gathered 2,300 transistors, wrapped in a piece of plastic no bigger than the nail. It was four-bits microprocessor, 16-pin, who worked on the mighty 740KHz, which allowed it to process 92 600 information in seconds^[33]. Microprocessor technology has set a new standard, and the only acceptable measure of computer's configuration were integrated circuits. This generation of computers is characterized by the fact that the technology of microprocessor unit cost dramatically breaks, while the speed of operation, reliability, memory capacity significantly improved. Communication with the machine is built to a much higher level, there are machine languages, Cobol, Fortran, Basic, Pascal and C Language. Begins to develop networking between computer systems! After the invention of integrated circuits, the next step was the designer's computer was the reduction the size of the machine. Bulky drilling units and reading cards, packed in large metal boxes, are becoming redundant, the memory unit is also integrated - complete unit is easy to install on the work table. Large scale integration / LSI / lets you store hundreds of components in a single chip. In the eighties of the last century, but is developing technology Very large scale integration / VLSI / a number of elements embedded in a small plastic chip is measured in hundreds of thousands of components. Developments in the field of electronics is extremely turbulent, and the next generation of chips can integrate millions of microelements - Ultra large scale integration / ULSI /^[34].

That was August 12, 1981, "At a press conference in the ballroom at the Waldorf Astoria in New York, Estridge (Don Estridge, Executive Director of the IBM labs) introduced the IBM Personal Computer, at a price of \$ 1.565. Two decades ago, IBM computer usually would cost over \$ 9 million, and requested air cooled, quarter morning room and a team of 60 people to full information^[35]". The computer is based on the Intel 8088 microprocessor was the size of a portable typewriter, with 40 K of ROM /Read Only Memory/ and 16 K operating, working memory. In addition, he had a built-in speaker system is OBD failures, Slaughter for upgrading, expansion memory, display, and printer. He was able to print 80 characters per second in 12 different styles of characters, has a color monitor, the memory can be expanded up to 256 K.

Public response to the presentation devices and propaganda that followed was beyond expectations. One vendor had 22 customers who have placed a deposit of \$ 1,000 per trader although he could not guarantee even close to the delivery date. Daily New York Times, in late 1982, commented: "The speed and scope of IBM success has surprised many, including people from IBM ^[36]."

Dave Bradley (Dr. Dave J. Bradley, one of the original 12 people who developed the software for the first IBM PC, written bios - Basic Input/Output System, designed by Three fingers help, command Ctrl + Alt + Delete), the man who wrote the interface with the new product recalls that a dozen people worked as a team and continues: "We met every morning to talk about what the machine should do and how, and in the afternoon we did realize the morning decision. For the prototype, which we have started building at the end of the year, we hired a then little-known company called Microsoft ^[36]".

CONCLUSION

How far and in what direction will develop the next generation of computers? Nano- technology has to be in the microchip package the size of a fingernail to several billion transistors, memory measures terabytes, processors run light speed. Back in 1968, there is a hit film, 2001: A Space Odyssey that so prophetically set the computer to complete the first plan of the space adventure. Spacecraft, the integration of manned, managed HAL 9000 /Heuristically Programmed Algorithmic Computer/, supercomputer soft and calm voice to communicate with them, and the audience could only see red, all-seeing eye of the computer's camera. Hal is able to recognize and understand emotional behavior, observed even facial expressions, lip-read, can think independently and combining facts, and of course, the ultimate game of chess. The creator of this amazing machine is fantasy science fiction writer named Arthur Clark. Clark fully understands the importance of the computing machines have in the space program, the conquest of the moon as early as next year, and even in the overall development of mankind. Is this visionary look into the future, the direction in which it will develop computer technology and cybernetics? Modern computers already have a good deal of the listed skills that had Hal 9000, and more than that, a XXI century just spent only 16 years - the odyssey continues.

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