A Proposal for a Virtual Museum

of Computer Science

Tesi di Laurea in Storia Dell'Iinformatica

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1 History of computers

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1.1 Introduction

- A computer is any electronic device that can remember, search and process data (Webster's dictionary)

- A computer is a programmed machine that accepts, stores and manages data in order to produce useful data (Wikipedia)

- The computers are helpful devices for fast and easy computation with small mistakes (short definition)

Computers today have exceeded their primary purpose and found their application in every field.

The idea for constructing a device for automation of the computation is few thousand years old. Their emergence is related to the secular desire of the human to facilitate the process of calculation, to accelerate it and to make it more exact. The development of science and technique, and primarily electronics were the condition for development of the computer.

Its historical development is used as an illustration of different stages of technological development and it is a good indicator of the total changes in the society. However, unlike the inventions whose inventor is known as well as the period when they were invented, in regard to computers, one person only can hardly be mentioned as an inventor.

With the emergence of one more machine, called a computer, the world started to change. For many people the development of the computer is the most important technological achievement in the 20th century. It initiated the Computer revolution which, according to the effects, can be compared to the industrial revolution of the past century.

The influence of the computer revolution on the society and the industry is enormous. With the increasing desire to control destiny we also want to understand the current technology, but also to return in the past in order to recognize the trends that could help us predict new elements in the future. By observing the past and by revealing a parallel with modern technology it is possible to increase the human intellectual capacities and even greater development of the technological development.

However, we should all have a feeling of responsibility to preserve the achievements of our ancestors, by establishing archives and museums where we will often and gladly return.

1.2 Historical development of computers

The development of information technology can be divided, depending on the level of technology that is used for resolving the problems for input, processing, output and communication into four periods:

1. The manual age

2. The mechanical age

3. The electromechanical age

4. The computer age

1.2.1 The manual age (? -1642)

To ancient civilizations, numbers were necessary in agriculture, farming, construction works, and later on in trade and astronomy. The human from the Neolithic Era mostly used stones in order to facilitate the addition and subtraction processes and for lower quantities the person's fingers were used. The human in this period grouped the selected objects depending on the operation that he was supposed to perform and in the end he counted the elements from the group where the result was found. This technique is applied today as well, by some primitive tribes, as well as by children. .

The first computation boards were called **abaci** and they used a concept for position marking, which is used today as well.

The next step is the creation of the first "personal calculator" – ABACUS – which uses the same concept, one collection of objects is replaced by another, but also one object replaces a collection of objects – position marking. The use of this relation of one to one continued for many centuries from then on.

ABACUS is the first primitive calculator and it is considered to have originated from China. It was created as a result of the great need of the traders in China to calculate efficiently while concluding agreements. The standard abacus can be used for addition, subtraction, division and multiplication. It consists of different types of wood and it can have different dimensions. Its frame has vertical rods on which the wooden beads can freely move. The horizontal beam divides the frame into two parts, upper and lower.
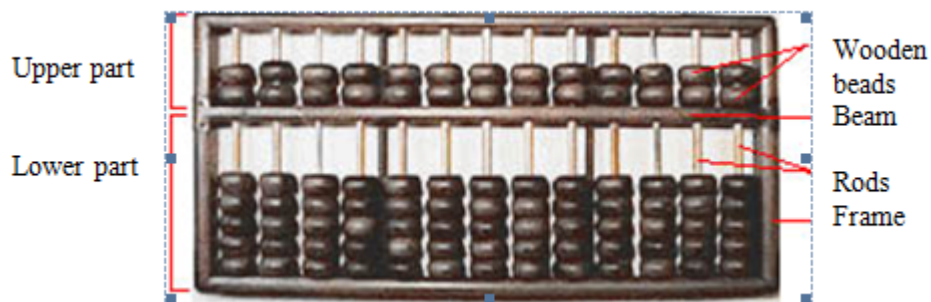
Figura 1.1

The calculation is performed by moving the wooden beams with the fingers of one hand. Every wooden beam in the upper part has a value of 5 and every beam in the lower part has a value of 1. The ending right column is a column of units, the next column to the left is a column of tens, then comes the column of hundreds etc. When 5 beams are calculated in the lower part, the result is "transferred to the upper part". When the two beams in the upper part are calculated, the result 10 is transferred in the next column at left. The calculation with the mobile comma is performed by marking the position between two columns, so all the rows from the right represent decimals and all the rows from the left are integers.

Every rod from the classic Chinese Abacus (suan-pan) has two beams in the upper part, and five in the lower part and such abacus is called 2/5. The style of 2/5 did not change until 1850 when abacus 1/5 was made (one beam in the upper part and five in the lower part). The abacus 1/4 (soroban) was made in the thirties and it has priority today, and it is produced in Japan. Models 1/5 are rare today, as well as 2/5, except in China.

For calculation with the abacus it is necessary to have the skill and proper functioning of the fingers. For manipulation with the beams the Chinese abacus uses the thumb, the index finger and the middle finger. The beams in the lower part are moved with the thumb upwards and with the index finger downwards. Sometimes the middle finger is used in the upper part as well.
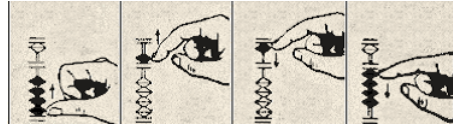
Figura 1.2

The abacus is also used today in the shops in Asia, and its application is taught in the schools. One of the practical uses of the abacus is for the children to learn mathematics in a simple way, especially multiplication. It's an excellent learning tool of other basic number systems.

In 1612 John Napier used a printed decimal point for the first time and he invented the logarithms and few multiplication machines. His most famous machine was the so called "bones" which was used for multiplication..
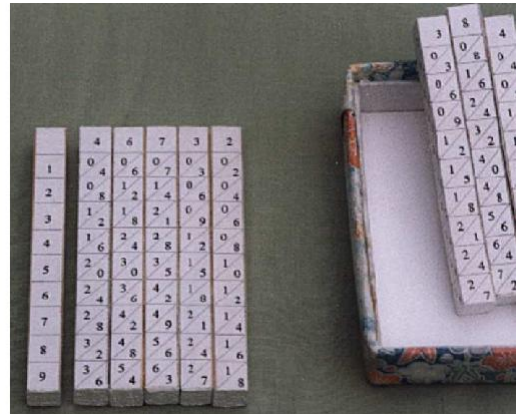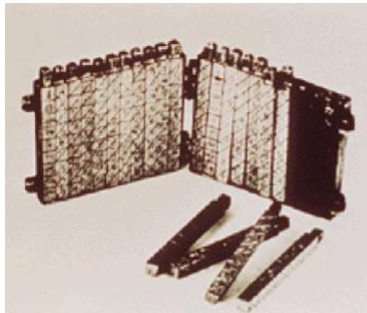
Figura 1.3: Napier's bones

In 1622 William Oughtred invented a device based on the logarithms of Napier and it became the main calculator for the engineers at the end of the nineteenth and the beginning of the twentieth century with a precision of only three numbers.

William Schickard described a machine that was a combination of John Napier's machine (in a cylindrical shape) and a simple add-on that can help the user to perform multiplication with few numbers more easily. However the original copy of the machi-
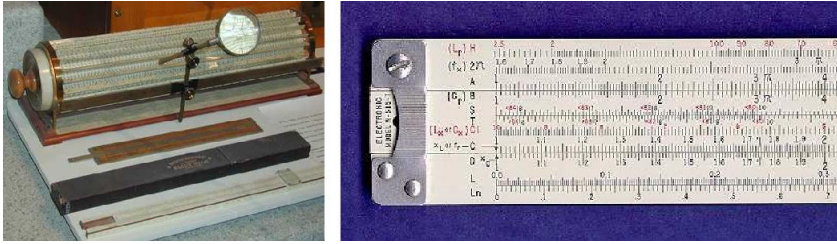
Figura 1.4: Oughtred's logarithm

ne was not found, so the credit for add-on with automatic transfer belonged to Blaise Pascal.

Figura 1.5: Schickard's machine

1.2.2 The mechanical age (1642 - 1890)

In 1642, while he was still a teenager, Blaise Pascal started a pioneering job to make machines and after three years of effort and after 50 prototypes he invented the mechanical calculator. He made a machine for addition with an automatic transfer from one position to another. The addition was performed by using gears in the foundation, which moved for every number, so the final sum was shown in the frame above the "keyboard".

He constructed twenty of these machines (called a Pascal calculator or Pascaline) in the next ten years. Nine of those machines still exist, most of which are exhibited in the European museums.

In 1673 Gottfried Wilhelm von Leibniz made the first automatic calculator that performed all four arithmetic operations called Staffelwalze (literal translation from German – a drum that makes steps).

It multiplied by means of multiple automatic addition that was realized by using a toothed cylinder. This machine was able to perform addition, subtraction, multiplication and division of numbers that had between 5 and 12 numbers, while their product
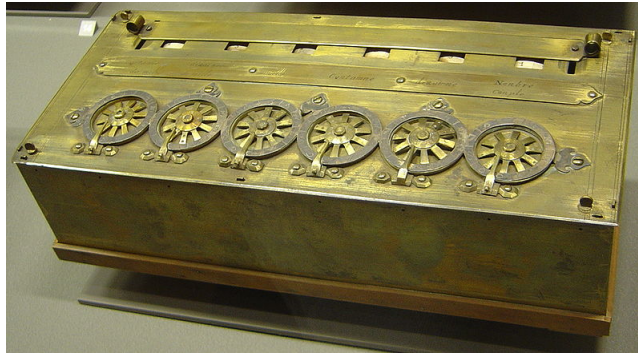
Figura 1.6: Pascal's calculating machine

could have up to 16 numbers. Except for these operations, also a square root could be calculated.

Leibniz was the first to represent the idea of the binary numerical system.

Leibniz's machine was not entirely correct, however the concept of the toothed cylinder became the foundation of all mechanical calculators until the emergence of the electronic calculators.

Figura 1.7: Leibniz's machine

In France in 1801 Joseph-Marie Jacguard invented an automatic loom that used perforated cards for control of the patterns in the fabrics. The use of these looms caused unrests because of the replacement of the people with machines.

Figura 1.8: Jacguard's weaving machine

About 1820, Charles Xavier Thomas created the first successful massively produced mechanical calculator, the arithmometer that could do addition, subtraction, multiplication and division.
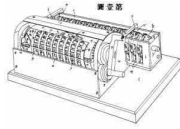
Figura 1.9: Arithmometer

In 1833, Charles Babbage started the project for his differential machine (for navigation calculations). Although he didn't manage to finish it, he gave many ideas which have been implemented in modern computers.
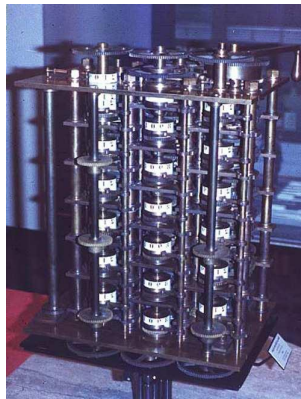
Figura 1.10: Differential machine

In 1837, Babbage represented his analytical machine. As an input it used two sequences of perforated cards, one for the flow of operations, and the second one for the input data. It was supposed to write out the output or print it on perforated cards.

The data were supposed to be placed in the memory (the store), and the operands that define the operations which are supposed to be performed and their sequence were supposed to be placed in a managing unit. The most important part of the analytical machine is the arithmetic unit which Babbage called the Mill. The initial idea was for the mill to perform all four arithmetic operations (addition, subtraction, multiplication and division) and to calculate the square root for which there is an equal numerical algorithm.

Since the machine did not reach its glory at the time, a reconstruction of the machine was performed and it worked exactly as Babbage imagined it.

On the two-hundredth anniversary of his birth, the scientific museum in Kensington, England, made a copy of his drawings where only few mistakes have been found. In

order to avoid the claim that Babbage did not manage to finish his machine due to the undeveloped technology, the museum carefully used only the technology that existed in his time and made a copy that worked properly.

Upon the death of Babbage, his son Henry Prevost made few samples of the simple arithmetic part of Difference Engine and sent them to different locations throughout the world, as well as to Harvard University, so that they can be preserved
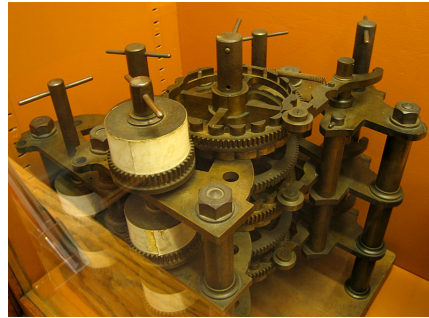
Figura 1.11: Babbage's machine

Ada Byron Lovelace (1815-1852) was the first woman programmer in the world. She was inspired by the work of Babbage and the great possibilities of his analytical machine. She wrote a work about his "Analytical machine" and this represents the first text that describes a process, which is known as computer programming today.

Figura 1.12: Ada Byron Lovelace (1815-1852)

She personally knew Charles Babbage and cooperated with him. She made the notes of an Italian mathematician about Babbage's analytical machine and she added some personal notes where she described in detail the method for calculation of Bernoulli numbers by using this machine. For this reason, for many historians her notes are the first computer program.

Bernoulli numbers

For her credits the Ministry of Defense of USA in 1977 titled one of the program languages according her name ADA.

$$B_n = \frac{n!}{2\pi i} \oint \frac{z}{e^z - 1} \frac{dz}{z^{n+1}},$$

$B_0 = 1$
$B_1 = -\frac{1}{2}$
$B_2 = \frac{1}{6}$
$B_4 = -\frac{1}{30}$
$B_6 = \frac{1}{42}$
$B_8 = -\frac{1}{30}$
$B_{10} = \frac{5}{66}$
$B_{12} = -\frac{691}{2730}$
$B_{14} = \frac{7}{6}$
$B_{16} = -\frac{3617}{510}$
$B_{18} = \frac{43867}{798}$
$B_{20} = -\frac{174611}{330}$
$B_{22} = \frac{854513}{138}$

Figura 1.13

1.2.3 The electromechanical age(1890-1946)

In the late 1880 the American Herman Hollerith invented storage of data that could be read by a machine later on. The previous uses of machine readable media were for the purpose of control and not for reading of data.

The idea for the use of perforated cards was used for the needs of the voting desk. His machine automatically read the voting information that was "inscribed" on the perforated cards, thereby reducing mistakes during the counting of the votes and the calculation of the results. .

In 1890 in USA a census of the population was made that covered numerous data. It was estimated that they would have to be manually processed for a period of ten years. Herman Hollrith solved the problem in six weeks and then he applied the invention called the tabulator for processing of census in many other countries.

In 1914 Herman Hollerit formed the company Calculating-Tabulating- Recording (C-T-R), which was renamed IBM in 1924.

IBM developed the technology of perforated cards into a powerful tool for business processing of data. For many years the perforated cards represented a fundamental medium for memorizing information (programs and data) in the computers. Up to 1950 the cards of IBM became present everywhere in the industry and in the government.
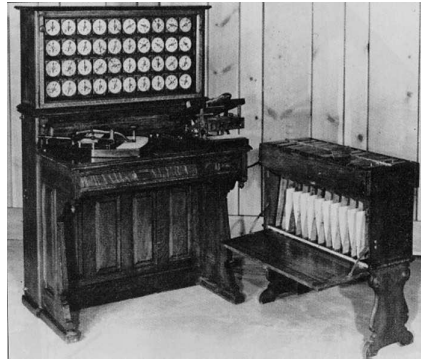
Figura 1.14: Hollerith's tabulator
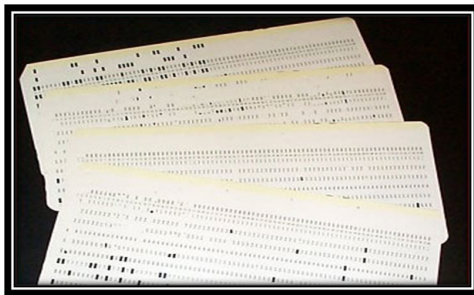
Figura 1.15: Perforated card's

Figura 1.16: IBM machine SORTER which operated according to the priciple of perforated cards

In 1925 Vannever Bush and his associates constructed a machine for computations in the Institute of Technology MIT. Although it had an electrical motor, it still represented a mechanical machine. The model was completed in 1942 and it was used for the purposes of the army.

Characteristics of the model:

- weight 100 tons

- 2000 cathode tubes

- more than 360km wire

- 150 motors

- the input data are entered through perforated stripes

- more accurate than the initial differential analyzer

Figura 1.17: Differential analyzer

In 1934 Conrad Zuse in Germany started the construction of calculating machines. He constructed four machines: Z-1-mechanical, Z-2-electro-mechanical, Z-3-electro-mechanical with programing in 1941 and an improved version Z-4 which was used in the development of the German flying bombs.

Figura 1.18: Conard Zuse

Zuse implemented the binary system as an appropriate one for simple representation of a perforated stripe. Since then the binary system is in the foundation of the operation of computer systems.

Creator of the first programming language Plankalkul.

The German museum reconstructed his machine Z-1 and it was in the central part of the exhibition.

Howard N.Aiken in 1937 started preparing his doctoral dissertation at the Harward University. Due to the long calculations he started to construct the machine for calculations titled Harvard Mark 1. For this project he got professional and financial assistance by the company IBM.

This machine could work with numbers with 23 positions and it had automatic operations of + , - , . , : .Additionally programs for calculation of logarithmic and trigonometric operations were embedded. MARK 1 was the first of the series of computers made by the engineers of IBM.

Figura 1.19: Aiken's calculator

Characteristics of MARK 1 :

- length of about 17 meters, height of 2,5 meters

- 800 km wire

- 750 000 parts

- about 3 million electrical connections

- 72 accumulators with separate arithmetic units as well as mechanical registers with a capacity of 23 numbers plus a sign.

- the arithmetic operations were performed with a fixed comma-addition for 1/3 of a second, and multiplication in 1 second..

- the instructions for the execution (a program) were read on a paper stripe and the data from another paper stripe, perforated cards or registers.

- the output was obtained on the perforated cards or on paper.

In 1936-1939 John Vincet Atanasoff together with John Berry constructed a machine which is called ABC (Atanasoff-Berry Computer) toady, at the university in Iowa, USA.

- 16 –bit calculator with 300 vacuum tubes

- addition is performed in 1 second

- calculator for resolving systems of simultaneous linear equations

ABC developed the basic concepts that later on appear in the modern computers – the electronic arithmetic unit and the regenerative cyclic memory.

During World War II in the period from 1940 to 1944, a need arose to encrypt and decrypt messages. For the decryption in the first years, the ENIGMA was used designed in USA. A team from Bletchley Park, which is located halfway between the universities Oxford and Cambridge, where Alan Turing was present as well, made a series of machines that reached their top in 1943 with Colos:

- it was used for decryption of the German encrypted messages

- 2.400 cathode tubes

- five readers with a paper stripe

- 10 such machines were made, which were destroyed after the war

- first programmed electronic computer in the world

The Colossus was used for decryption of messages and it had significant role in the victory over Germany. Its existence was hidden until 1970 and the algorithms for decoding are a secret today as well. Alan Turing and the others from the team had only a small influence on the development of the calculation in England after the war.

A copy of the Colossus can be found today in the museum in Bletchley Park in England. A similar program was made in America in the United Naval Computing Machine Laboratory (USNCML) in the state of Ohio. Except for the assistance in the detection of the German codes, the USNCML was also working on the Japanese codes. After the war the members of this group formed a company called Electronic Research Associates (ERA) in Minneapolis.

The method "bomba (bomb)" was developed for attacking the German encryption machines – Enigma.

Figura 1.20: Reconstructed version of the Colossus
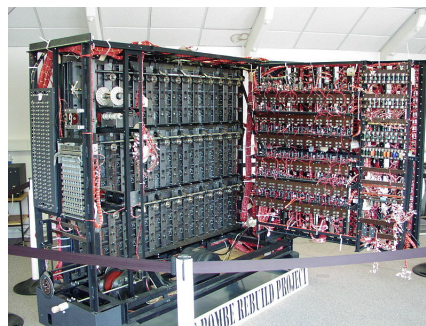
Figura 1.21: "bomba (bomb)"

1.2.4 Computer age

1.2.4.1 The first generation (1946-58)

Characteristics:

- cathode tubes

- 2000 calculations in a second

- memorized programs

- they use a binary numerical system

- vast size

- they often "fell"

- high heating level of the electronic pipes

- very expensive

- high level of training for their use

- use of perforated cards, paper and magnetic stripes

- internal memory – postponed lines, magnetic stripes

- a machine language is used for programming, and at the end of the period an assembler as well

- at the end of the period there were about 2.500 computers in use

- first global computer network in the world – project SAGE

- Semi Automatic Ground Environment - 1958

- they were available for the large companies and the state agencies.

FAMOUS COMPUTERS/DEVELOPMENTS

ENIAC –Electronic Numerical Integrator and Computer (1946)
The first electronic programmable computer which was discovered in Philadelphia. Its construction was completed by Eckert and Mauchly. The computer was functioning with a decimal system – a base of 10 numbers.
Characteristics:

- approximately 18.000 cathode tubes were used

- electric energy consumption – from 130 to 174 kw electric energy

- weight 30 tons

- length of more than 30 meters, height of 3 meters and a width of less than 1m

- 5.000 additions in a second, the multiplication process was with a duration of about 3 millisecondsi

- memory of 20 accumulators that were able to store 10 digit numbers

Having these characteristics, the computer took a space of about 167 square meters. It was working with perforated cards for input and output of data. The executive programs were created by means of connections between the different subroutines, recorded in different location.
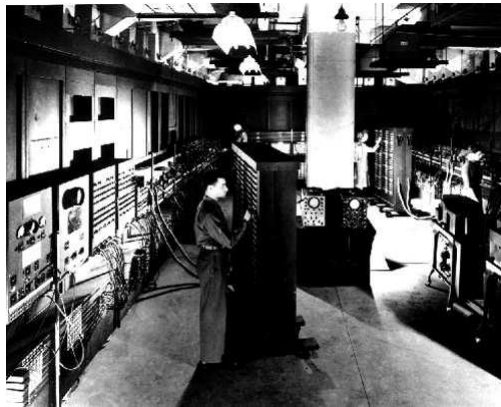
Figura 1.22: ENIK

The programming was performed in such a manner that the engineer physically connected the different locations in a group in order to solve a particular problem and the procedure had to be repeated for every new problem.

The programming was performed in such a manner that the engineer physically connected the different locations in a group in order to solve a particular problem and the procedure had to be repeated for every new problem.

ENIAC - corresponds to today's simple programmed calculators

EDVAC - Electronic Discrete Variable Automatic Computer (1947)

John Von Neumann, one of the participants in the project ENIAC, in the Princeton Institute for Advanced Study started his own version of EDVAC. In that period he was one of the greatest mathematicians.
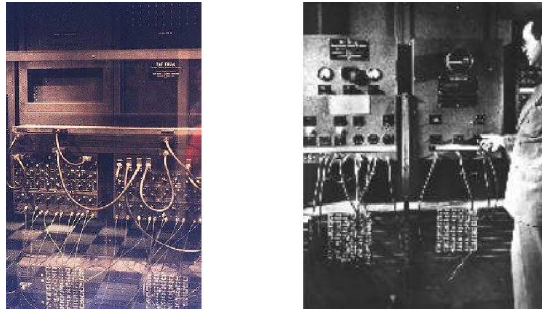
Figura 1.23: Programming of Eniac

John Von Neumann, one of the participants in the project ENIAC, in the Princeton Institute for Advanced Study started his own version of EDVAC. In that period he was one of the greatest mathematicians.

His architectural principle, known as the Neumann machine was used in the first computer with a memorized program EDSAC and it still represents the foundation for all computers to date.

This architecture, as well as the IAS machine that he made together with Herman Goldstine had great impact on the further development of computers.

The Neumann machine had five basic parts:i:

- memory (composed of 4096 words, each of which had 40 bits)

- arithmetic logical unit (special internal 40-bit registry called accumulator)

- unit for program management

- input equipment

- output equipment
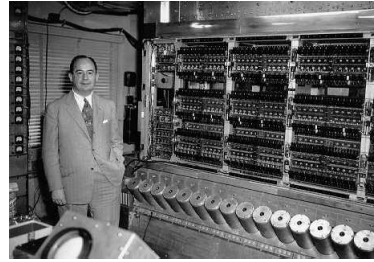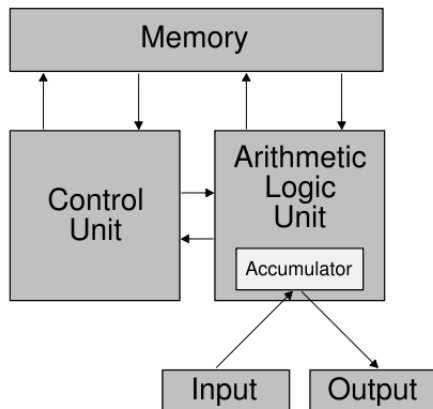
Figura 1.24: John Von Neumann next to the IAS computer

EDSAC (Electronic Delay Storage Automatic Computer)

The first operating computer that was able to store the program in the memory. (Moris Vilkis – England). The memory with a constant content was used for initial operation of the computer. The execution of most of the operations had a duration of about 1500 ms.
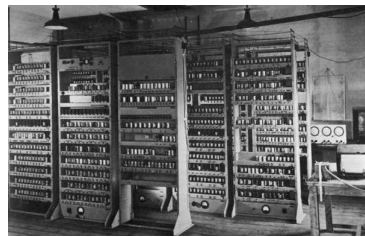
Figura 1.25: EDSAC

TRANSISTOR (1947)

William Shockley, John Bardeen and Walter Brattain invented a device – portable resistor, later on known as a transistor that will enable greater safety of computers that was not able to be achieved with the cathode tubes.

In 1947 the transistors were made of germanium.

BINAC (Binary Automatic Computer), Eckert and Mauchly 1949:

- the first computer with a double processor

- the second processor was used if the first one failed

- 700 cathode pipe

- 512 word length 31 bit

- 3.500 additions or 1.000 multiplications in a second

VIHOR (Jay Forrester) - 1950

- the first computer intended for work in real time

- constructed for the research institute of the navy in USA and it was released for use in stages since 1949

- the original version had 3.300 cathode tubes and 8.900 crystal diodes

- 500.000 additions and 50.000 multiplications in a second

UNIVAC (1951) - Universal Automatic Computer
It was used to predict the results of the presidential elections in America in 1952. Its constructors were John Mauchly and John Eckert:

- first commercial computer for general purpose

- created for administrative application

- it used magnetic stripe as a storage medium instead of perforated cards

Figura 1.26: UNIVAC

1953 IBM 701

For the needs of the United Nations in Korea, IBM started the production of the first operating computer and thereby they made the first step in the computer business.

1955 IBM 704

The architect of this computer is Gene Amdahl and it represents the first commercial machine with hardware for work in a so called mobile comma, capable to work with a speed of 5 Kflops.

1957 FORTRAN

The first computers had an internal and slow external memory because of the magnetic stripe. As time went by, the internal memory was improved by using magnetic cores. The next step was a disc memory with movable heads for reading and writing.

After three years of work Backus and his associates delivered FORTRAN –program translator for IBM 704. It is the first popular program language, Fortran 77 and Fortran 90 are still used.
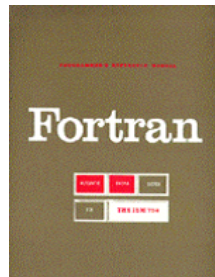
Figura 1.27: FORTAN

1.2.4.2 Second generation (1959-64)

Characteristics:

- 100.000 calculations in a second

- developed assemblers and other program languages

- magnetic primary memory

- magnetic discs and stripes for secondary memory

- faster

- the size started to reduce

- greater safety

- the warming was reduced

- the price was still high

- transistors are used

- 1947 made of germanium

- 1954 made of silicon

- since 1959 all computers use transistors
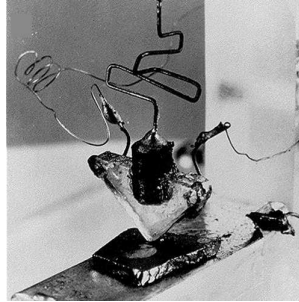
Figura 1.28: Transistor

KNOWN COMPUTERS/DEVELOPMENTS

1958

Two exceptionally important and influential program languages, LISP and ALGOL 58 appeared on the marker, and COBOL appeared the following year.

LIST is the language of the artificial intelligence, one of the key areas of informatics. The founders of this science that started in 1956 were Marvin Minsky and John McCarthy.

ALGOL 58 is the first imperative program language, a language that contains operators which change the states of a process

1959

IBM promoted two machines with the size of two chairs for the smaller users, IBM 1401 for the business and IBM 1620 for the scientists. The machine 1401 became the most popular machine for data processing, and the machine 1620 was the first computer experience for many students.

This same year General Electric Corporation delivered 32 ERMA (Electronic Recording Machine-Accounting), a computational system for the banks from America in California. This facilitated the work of the banking industry that was being automatized and roads were open for new manners of work (ATMs and electronic personal banking).

1960

The new version ALGOL 60 was promoted in 1960, which is the foundation of many modern programming languages. The most important of all these programming

languages is the COBOL (Common Bussiness Oriented Language), first standardized language for business purposes. Large research team participated in its preparation, led by the doyen of informatics, Grace Hopper and Joe Wegstein.

It is considered that until 1980, most programs were written on COBOL, and the language is massively used today in Great Britain and in the United States.
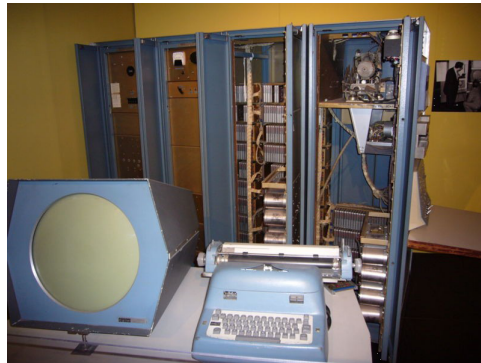
Figura 1.29: PDP 1

This same year the DEC (Digital Electronic Computer) constructed PDP 1 intended for the research laboratories.

It is known as the first mini-computer where the first computer game called Spacewar was played.

1961

Jack Kilbya and Robert Noyce successfully completed the work of the integral circuits and this year the first commercial integrated circuits emerged whose production started by Fairchild Corporation. Starting from this date the computers have built-in integrated circuits instead of the individual transistors or other components.

1962

In England at the university of Manchester, there was an operating computer called Atlas which was the first machine that used virtual memory. The instructions were executed on a circulatory architecture composed of separate arithmetic units for fixed comma and arithmetics of mobile comma capable for about 200Kflop.

1964

The programming language BASIC (abbreviation of Beginner's Allpurpose Symbolic Instruction Code) became the main language for the student's programming language. It was developed by John Kemeny and Tom Kurzi, together with many postgraduates.

1 History of computers

Its direct successors are the different versions of Visual Basic, one of the most popular languages today.

This was the year of radical change for the world of computers. IBM constructed System/360, the first family of compatible machines. The principle of compatibility of the new computer from the family with the previous, as well as the connection of the operating and the scientific processing, both had an important effect in the development of computers. IBM developed a very successful line of computers, in many different versions, all compatible.

IBM System / 360

- constructed in 1964

- 5 billion dollars were invested for its construction

- first family of computers that was planned in advance

- all computers were identical or similar

- all computers had identical or similar operating system

- every new model for a higher price offered:

    - greater speed

    - more channels for connection

    - more U/I units

    - larger internal memory
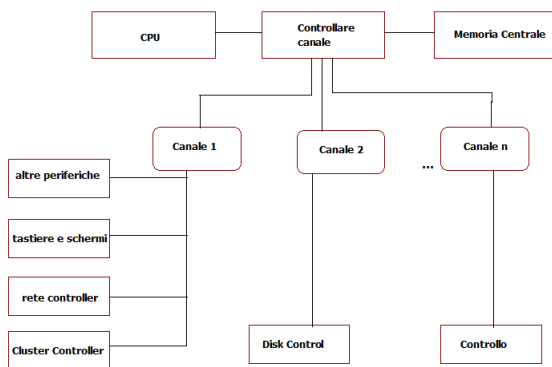
Figura 1.30: Architecture of S/360 and the first models of S/370
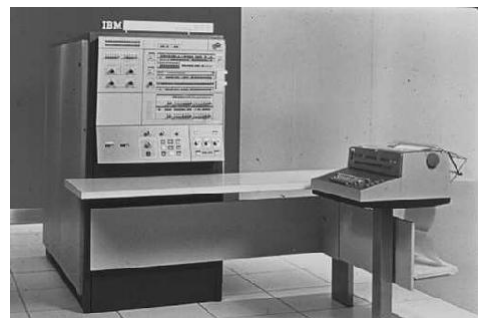
Figura 1.31: IBM System 360

Project STRETCH (1955-1961)

- it introduced the terms byte and system architecture

- word of 64 bits for arithmetics and 8 bits for U/I operations

- word in a memory of 72 bits, out of which 8 bits for ECC

- it uses magnetic discs

- division of the internal memory thereby providing execution of many programs simultaneously

- stage of decryption and execution of instructions.

Figura 1.32: Stretch computer

1.2.4.3 The third generation (1965-70)

Characteristics:

- integrated circuits as a replacement for individual transistors (CIP):
  - the chip can replace thousand transistors with one small silicone plate
  - the chip is embedded on printed plates made of glass wool or Bakelite called motherboards.

- faster

- smaller

- safer

- cheaper

- SSI chips emerge (small-scale-integration-circuits)

- new programming languages with different characteristics

- further development of the operating systems

- keyboard and a monitor

- development of telecommunications – launching of telecommunicating satellites

- at the end of this period floppy discs emerge with a size of 8 inches

Figura 1.33: Disc
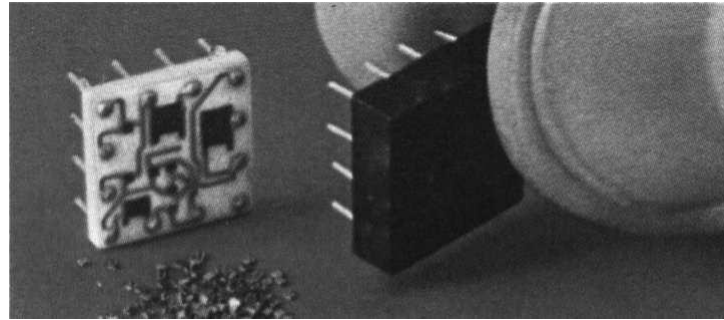
Figura 1.34: SSI chip with needles

FAMOUS COMPUTERS/DEVELOPMENTS

1965

The company Digital Equipment Corporation constructed the PDP-8 which is the first real minicomputer. It has a collection of instructions and a simple micro-language as an incredible interface. For this reason PDP-8 was being used as a processing control system.

- relatively cheap – about 16.000 dollars

- professional computer

Digital Equipment Corporation PDP-8

Manufacturer	Digital Equipment Corporation
Type	Professional computer
Memory	4 K 12-bit words
Origin	United States of America
Year	1965
Keyboard	ASR-33 teleprinter
Processor	the central processor consisted of 12 register panels
Frequency of the processor	1 MHz (0.5 MIPS)
RAM	4 K 12-bit words
ROM	
Text	depending on the video terminal
Graphics	
Color	
Sound	FM-PAC (OPLL YM-2413) - 9 channel FM synthesizer
Dimensions	48 (width) x 55 (depth) x 84 (height) cm / 150 Kg
Ports	
Operating system	

1966

Hewlett Pascard entered the computer business with the computational machine HP -2155, with much greater power which in the past could be found only in bigger computers. It was supported by BASIC, FORTRAN and ALGOL.
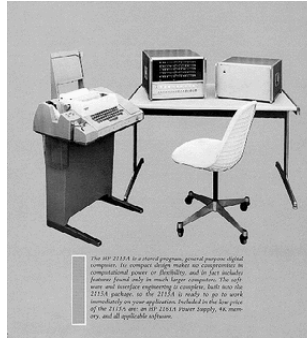
The term hypertext was described for the first time implying text related to multi-medial content and other texts.

1967

The structural programming language PASCAL was presented.

1968

Edsger Dijkstra laid the foundation of the programming languages and the development of the secure software started to progress.

1969

ARPANET (Advanced Research Projects Agency Network)

It starts as a project-communication between many computers. Participants in this communication were the universities of California: Santa Barbara and UCLA, Stanford Research Institute and the University UTAH.

The goal of this project was:

- direct application and use of the hardware

- direct access to the distant databases

- sharing and use of software packages that were not available to the user due to the incompatibility of the hardware

ARPANET consists of small computers named Interface Message Processors (IMP). The computers stored and calculated data and were interconnected with modems that communicated between themselves with a bit – serial connection with a speed of 50 kbit/sec.

1.2.4.4 The fourth generation (1970-1985)

Characteristics:

- microprocessor (CPU – Central Processing Unit)
    - replaces thousands of integrated circuits
    - unites all of the functions in a single computer

- floppy disc

- faster

- safer

- cheaper

- more powerful

- new programming languages

- first personal computer

- emergence of mini and supercomputers

FAMOUS COMPUTERS/DEVELOPMENTS

1970/71

The corporation INTEL produced the microprocessor Intel 4004 for the company Busicom. It was the beginning of the family "chip processor".

Ted Hoff constructed the first microprocessor for the computer Intel 4004. (4-bit microprocessor made of 2.300 transistors).
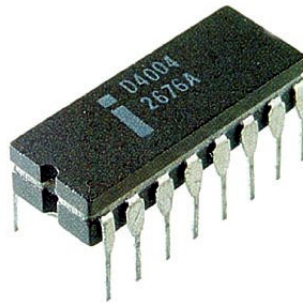
Figura 1.35: Microprocessor Intel 4004

Alan Shugart from IBM constructed the first 8-inch floppy disc for regular use primarily for Displaywriter.

1972

MITS 816 (Micro Instrumentation and Telemetry Systems) – the first digital microcomputer available for personal use. This computer was not equipped with a display and a keyboard. It had four functions and it was sold for 425 dollars. New C programming language

Ray Tomlinson, a computer engineer in the company Bolt, Beranek and Newman sends the first e-mail message.

1973

Don Knuht wrote a volume of twelve books titled "The art of programming", which became the "bible" for the software development. They contained many basic algorithmic field known as "structure of data" and many programming techniques that will become the foundation of the "software engineering".

The FTP (File Transfer Protocol) was developed – a protocol for sending files to distant computers.

1974

The newspaper QST published the first formal commercial for the personal computer Scelbi (Scientific Electronic and Biological), constructed by the company Scelbi Consulting.

Simultaneously Jonatan Titus constructed the personal computer called Mark-8 .

The world of personal computers was getting bigger, and this same year Intel launched the computer 8080 for control of traffic lights and this model later on became famous as a processor for Altair.

Gary Kildall launched the first operating system CP/M

John Cocke for IBM designed the first RISC machine.

1975

The first personal computer was produced. The constructors of MITS Altair 8800 included E.Roberts, W. Yates and J.Bybee. Its price was 375 dollars, it did not have a display and a keyboard, it contained 256 bytes memory, it did not have a software and it was programmed in a mechanical language.

For ALTAIR the programming language Basic (Beginners All-Purpose Language Instruction Code) was developed by Bill Gates and Paul Allen.

They formed the company Microsoft, small at the beginning, however with a great vision, to have a computer for every workplace and in every home.

This same year the company IBM produced its first personal computer 5100, however its price and the software were not acceptable.

Xerox patented the Ethenet – the foundation for all networks today.

The first computer game Encounter was promoted, which was delivered to the buyer in an assembler, written on paper stripes.

IBM presents the first laser printer.

1976

Computers with a great power were constructed, called supercomputers for the purposes of complex scientific research. Seymour Cray for the company CDC (Control Data Computers) constructed the most famous computer of this type.

Figura 1.36: Supercomputer

Steve Jobs and Steve Wozniak produced APPLE which was assembled and completed with its own keyboard and a display. Great success was immediately achieved, and the price was affordable for the enthusiasts. In a short period it was implemented in schools and colleges.

Figura 1.37: Apple

Figura 1.38: Steve J. and Steve W.

This is the year when the companies Microsoft and Apple were formed.

1977

The first computer fair was open in San Francisco where the visitors for the first time were able to see the computers Apple (1298 dollars) and Commodore Pet (795 dollars).

Figura 1.39: Comodore Pet

Appearance of memory chips of 16K (over 20.000 transistors).

1978

Don Bricklin and Bob Frankston made the first program for tabular computations Visi-Cale, thereby the computer became a working tool and not only a machine for writing and playing.

The first edition of the book "The C programming language" by Kernighan and Ritchie.

Epson America represented the first cheap dot matrix printer MX-80.
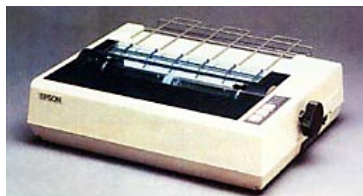
Figura 1.40: Epson MX-80

1979

Micro Pro issued WordStar for CP/M, the first important program for processing of text on personal computers.

Dan Brickhin and Bob Frankston represent VisiCalc, tabular calculator that created an entire industry.

The video games Space Invaders and Pac Man became a great success in the world.

1980

Comodore opened the door for the computer for use at home with VIC-20 with a price of 299 dollars and it quickly sold million computers.

Integrated circuits with 200.000 transistors emerge.

The ZX80 and ZX81 were introduced (predecessors of the legendary Spectrum), with 1KB RAM and 4KB ROM in which the Basic was encrypted. The best of all was the price of about 200 dollars that encouraged the information boom. The author of the computer was Clive Sinclar.

The first Winchester i.e. hard discs with a format of 5,25 inches and a capacity that varied between 5 and 10 MB.

1981

Adam Osbourne launched the first portable computer that had the size of a suitcase, it had CP/M, pair of 5,25" discrete devices and a small 5" monitor. This computer was being sold for a price of 1899 dollars.

This same year the first laptop Epson HX-20 emerged with dimensions 8,5" x 11" x 1,5-2" and it was using microcassette for storage of data. It was showing 4 rows with 40 signs each on the LCD screen. The first acknowledged microcomputer IBM PC

Figura 1.41: Epson HX-20

was represented. IBM attracted their users by using the caricature of Charlie Chaplin as a user who can take the personal computer out of the box and use it immediately. The first IBM PC computer has a processor speed of 4,7 MHz, an internal memory of 128KB, a discrete unit of 5,25", and the disc which was not compulsory had a capacity
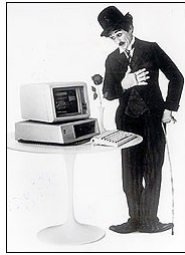
of 10 MB. The screens of these computers were monochromatic and they didn't support graphics. Only the operating system MS-DOS was used, which doesn't have a graphical interface (only textual), and the movement of applications and the insertion of orders in the system is performed with a keyboard.

MS-DOS (Microsoft Disk Operating System) is a product of the company Microsoft.

1982

Time Magazine declared the personal computer as the man of the year. For the first time then (and later on as well), one inanimate object was declared as the "man of the year".

Figura 1.42: Il Time Magazin

At the end of this year the computer was the basic tool in the film industry and Dysney Studios ended the film with characters which are in the computer with special computer effects – Tron.

1983

The development of the software was accelerated with the introduction of the personal computers, so the standard applications besides the board for cross-calculation and the text processors, have graphical packages and systems for communication. Mitch Kapor introduced the Lotus 1-2-3 and exceeded the Visicalc.

This is the year when Microsoft Word 1.0 was implemented, however Windows was dominant. The IBM personal computers were named according to the embed-

ded processor. Hence, in 1983 the Intel 80286 was constructed, with the following characteristics:

- 16 bits

- RAM MG 16

- 6 Mz - 12,5 Mz

- - 134 000 transistors

1984

The first consumers' computer emerged, with a mouse and a graphical interface called Lisa. The price was about 10.000 dollars and many users were not able to use it.

With a much lower price on the market, the Apple Macintosh was launched and therefrom the mouse and the icons became the main tool.

This year Steve Jobs applied:

- GUI icons

- Desktop – the working surface

- Application of a mouse and other "pointing devices"

- Double click" and "Click-and-drag" as a support of the pointing devices.

Figura 1.43: Macintosh Computer

Figura 1.44: Mac GUI

1.2.4.5 The fifth generation (1985-1990)

Characteristics:

- The computers from this generation are constructed on the initiative of:
    - the Japanese Ministry of Trade and Industry (MTI)
    - in USA – MCC (Microelectronics and Computer Technology Corporation)
    - in England – ALVEY
    - in Europe – ESPIRIT (European Strategic Program on Research in Information Technology)

- the number of CPUs increased

- R/St (workstations) very quickly exceeded the speed of the computers with parallel architecture

- parallel architecture – enables many computers to work simultaneously on the same task

- the semiconductive memory is becoming a standard

- bigger application of individual R/St

- RISC architecture of the processor

- application of the computer networks LAN (collection of personal computers and peripheral units connected at one location) and

- WAN (collection of local networks at different locations, connected to different WAN technologies)

- many projects did not succeed

- the computer power with cheap servers and R/St increases

- the scientific visualization increases in terms of quality and quantity.

Famous computers/developments

1985

Microsoft announces Windows 1985. Aldus invented the most important category of
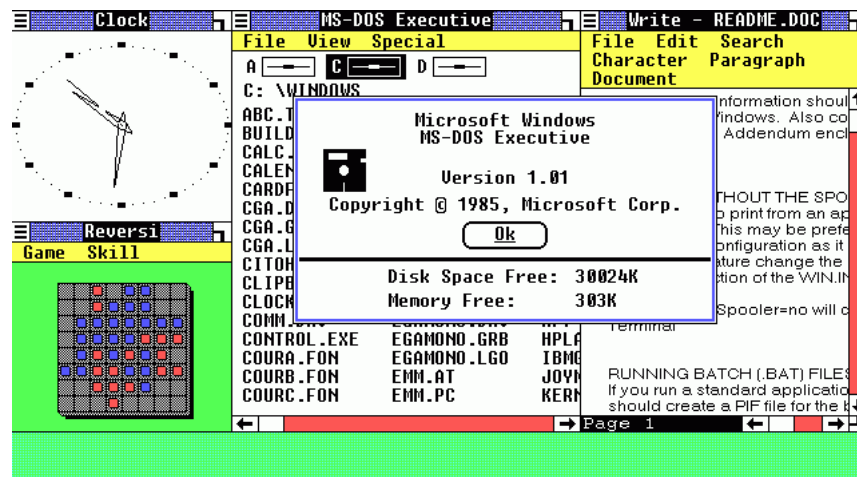
software with the announcement of Page Maker.

Apple established trade network for Macintosh and Laser Writer.

IBM develops the next model of personal computers 80386

- 32 bit

- 16 Mz-40 Mz

- RAM di 4 GB

- 275 000 transistors

Figura 1.45: Intel 80386
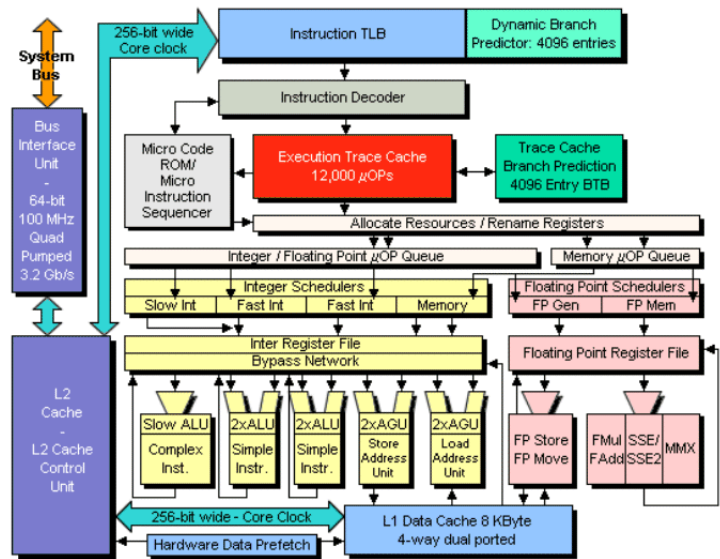
A CD-ROM (Compact Disc Read Only Memory) was represented on the market, invented in Phillips and produced in cooperation with Sony.
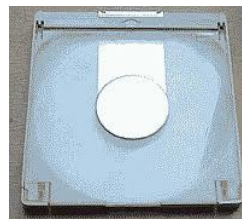
1986

Compaq Computer Corporation announced the first PC based on the processor 80386. It introduced some new operating systems thereby making the Windows version even stronger.

1987

Apple introduced slots of Macintosh in the computer Mac.

Release date	March 2, 1987
Introductory price	US $5500
Discontinued	January 15 1990
Operating system	4.1-7.1.1 (Pro), 7.5-7.5.5 or with 68030 32-bit upgrade Mac OS 7.6.1
CPU	Motorola 68020 @ 16 MHz
Memory	1 MB, expandable to 20 MB (68 MB via FDHD upgrade kit)

Sun introduced the first RISC processor (with reduced number of orders).
    The first fax card was presented.
    IBM introduced Micro Channel Architecture in the computer PS/2.

    Microsoft and IBM together developed OS/2 – an operating system for the personal computers, as a graphical replacement so that PC DOS can be used for the computers from the series PS/2.

1988

The twenty year old Robert Morris, son of the computer expert in the US National

Security Agency, sent a non-destructive worm through Arpanet and caused problems in 6.000 computers that were connected in a network.

Microsoft updated Windows 2 – the successor of Windows 1.

Windows 2.0	Website:	microsoft.com
	Developer:	Microsoft
	Families OS	MS-DOS
	Source code of the model:	Closed source
	Latest stable version:	2.03 / 1988
	License:	MS-EULA

Estimation that there were about 30 million users of DOS.

The first optical chip was produced, which was using light instead of electricity in order to increase the speed of processing.

1989

This year in America there were about 54 million personal computers that most commonly worked with MS-DOS.

Apple produced the first portable computer Mac Portable, the first "laptop" computer with a weight of 7kg, with an embedded ball for pointing and with the first active matrix display.

Release date	September 20, 1989 (Original)...February 11, 1991 (Backlit)
Introductory price	US $6,500
Discontinued	February 11, 1991 (Original)..October 21, 1991 (Backlit)
Operating system	6.0.4 (Original) 6.0.7 (Backlit) -7.5.5
CPU	Motorola 68000 @ 16 MHz
Memory	1 MiB, expandable to 9 MiB, 8 MiB backlit version (SRAM)

The next model of personal computers of the company IBM was Intel 80486 with the following characteristics:

Register width	32-bits
Manufacturer	Intel, IBM
Started in	1989
Terminated	2007
Clock	16 - 133 MHz
Front side bus	16 - 50 MHz
Scala	1 - 0,6 µm
Education	IA-32 (x86-32)
Level-1 cache	8 kB
Co-processors	integrato (non in SX-modelli)
Number of cores	1
Sockets	Socket 1, Socket 2, Socket 3
Provide	3.3 of 5 volt
Number of Pins	168
Transistors aantal	1.185.000 - 1.600.000
Address bus width	32 bits
Width of the data bus	32 bits
Address Space	4 GB
Pipelines	1

1.2.4.6 The sixth generation (1990 - today)

Characteristics:

- the technology is closely related to parallel processing

- better understanding of the algorithms for full use of the parallel architecture

- speed – TFlops 10 to 12 operations in a second (>1 000 CPU)

- the vectorial system is still in use

- it is estimated that the parallel system will dominate in future

- solutions emerge for combination of parallel and vectorial architecture

- the modern processors are constructed as a combination of the RISC architecture, pipelining and parallel processing

- the technology of the networks spreads very quickly, especially of WAN and WLAN wireless local artificial intelligence

- cloud computing

- use of quantum physics and nanotechnology

Famous computers/developments

1990

Windows reached the version 3,00 and was ready for general use.

Apple constructed the first personal computer Macintosh II fx with an accelerated video card.

A system for data storage and processing was discovered in the European Laboratory for Physics CERN. Its use enabled to find files in any computer, in any place in the world with a special protocol called Hypertext Transfer Protocol (HTTP). The name of this concept was Word Wide Web (WWW) promoted by the scientist Tim Berners-Lee. This service quickly becomes the most famous and mostly used service.

The Web makes a transformation of the Internet – from transfer of textual messages only to multimedia applications for transfer of images, animations, sound and video together with textual content.

1991

In August this year, Linus Torvalds made his own version of Unix and called it Linux, which later became the most important operating system for the Wintel computers and a leading example for free software.

Apple promoted its first portable computer PowerBook 100. The processor was running with 16 MHz, RAM of 8 MB, hard disc of 40 MB, the LCD display had a resolution of 640 x 400 pixels.

1992

Microsoft Windows 3,10. Windows became the operating system that was delivered with the new personal computers.

1993

This year Inter introduced the original Pentium. This is the first processor that increased the FSB speed from 33 to 60 and 66 MHz.

P54 – the first original version with 16 KB L1 cache memory, FSB of 50,60 and 66 MHz.

Microsoft announced that Windows had 25 million users.

Apple made the 10 millionth Macintosh.

The program Mosaic X was launched which quickly became a global hit with the improvement of graphics cards.

1994

Intel announced a new version of Pentium P 54C with an increased number of transistors in the processor from 3,1 to 3,3 million.

Apple constructed the first Macintosh with a DOS card which was factory-installed – Quadra 610 DOS Compatible. The production of Power Macintosh models started, they were expensive but very good and secure.

The World Wide Web became the most popular and most widely used service. The business world and the media noticed the opportunities of the Internet and started its commercialization. More and more companies were placing their web sites on the Internet and this was the year when the first on-line shops appeared, where it was possible to purchase on the Internet.

1995

The World Wide Web reached its first proper affirmation. Every day millions of users connected to Web through Web browsers.

Windows 95 was presented as a product of Bill Gates and Microsoft.

In November this year Intel presented the processor Pentium Pro which was not used for computers for home purposes, it was rather intended for major companies. Soon it was replaced with Pentium II Xeon.

The programming language Java was presented.

1997

Pentium MMX was presented, with an increased number of transistors, about 4,1 million. The size of the L1 cache memory was increased to 32 KB. A special collection of instructions MMX was embedded, intended for work with multimedia data – sound, video and other graphical data.

This same year the Pentium II was presented, intended for many users and with few improvements (less consumption of electricity and less creation of heat), as well as improvement of the operation with L2 cache memory.

Figura 1.46: Un Pentium II Slot 1 (anteriore)

PENTIUM II– microprocessore

Production	half of 1997 - early 1999
Manufacturer (s)	Intel
Clock frequency of the CPU	233 MHz a 450 MHz
FSB speed	66 MHz a 100 MHz
Length of channel MOSFET	0,35 µm a 0,25 µm
Instruction Seti	x86
Microarchitecture	P6
Punch (s)	Slot 1,MMC-1,MMC-2,Mini-Cartridge
Kernel (s)	Klamath,Tounga,Deuschutes,Dixon

Apple promotes the Power Macintosh and Power Book models with a G3 processor. In that period the processors of these computers exceeded the speed of 250 MHz. The computers got open hardware architecture, so there was a possibility to embed the standard components compatible with an X86 platform: hard discs, CS devices, RAM memory etc.

1998

Windows presented Windows 98.

This year Intel presented its cheap processor Celeron with a clear intention to bring the processors of the sixth generation massively in the market, in domestic computers and in companies.

Apple provides a USB to be used as a successor of the parallel and the serial ports from the personal computers by Windows.

Another important moment this year in the history of Apple is the emergence of the iMac computers that take the concept into one and from that point the company started to offer professional (business) and consumer line of computers. Professional (business) models included the Power Macintosh and the portable PowerBook, while cheaper models included: the iMac and iBook.

1999

Apparisce il Pentium III.

Brand	Intel
Processor Model	Pentium III-M
MPN	BXM80530B100GD
UPC	0735858148566
KEY FEATURES	
Clock Speed	1 GHz
CPU Socket Type	PGA478
Multi-Core Technology	Single-Core
TDP	20.5 W
Processor Quantity	1
Product Type	Processor
CACHE MEMORY	
Level 1 Size	32 KB
Installed Size	512 KB
Type	Advanced Transfer Cache
EXPANSION / CONNECTIVITY	
Compatible Slots	1 x processor
OTHER FEATURES	
Bus Speed	FSB Speed - 133 MHz
Architecture Features	Deeper Sleep, Enhanced SpeedStep technology
Platform Compatibility	PC
Packaging Type	478-pin Micro FCPGA
MISCELLANEOUS	
Package Type	Intel Boxed

Figura 1.47: Intel Pentium III microprocesor

As a competition of the Intel company, AMD (Advanced Micro Devices) represented the processor **Athlon**:

- » K7 microarchitecture

- » Desctop CPU

- » Up to 1,4 GHz

- » 256 KB L2 cache

- » 200 and 266 MHz FSB

- » 32-bit
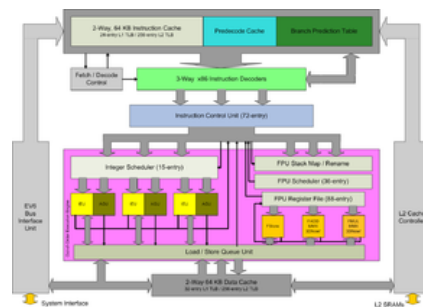
Figura 1.48: Internal architecture of Athlon Classic

Apple promoted models of iMac computers in different colors. They had a G3 processor on 400 MHz, a bus of 100 MHz, they were using PC 100 type of operating memory, 1 GB-RAM maximum, 15″ displays, ATI rage 128 graphics cards, hard discs of 10 GB or more, USB and Fire Wire ports.

2000

Microsoft stops the improvement of Windows 98 in order to make a new version Windows Me (Millennium Edition) Schematic representation of the development of Windows in years:

DATA	Sistema Operativo
August 1981	**MS-DOS 1.0**
Mart 1983	**MS-DOS 2.0**
November 1983	**Microsoft Windows**
November 1984	**MS-DOS 3.1**
November 1985	**Microsoft Windows 1.0**
April 1986	**MS-DOS 3.2**
April 1987	**MS-DOS 3.3, Windows 2.0**
July 1988	**MS-DOS 4.0**
November 1988	**MS-DOS 4.01**
May 1990	**Microsoft Windows 3.0**
October 1991	**Windows 3.0**
June 1991	**MS-DOS 5.0**
April 1992	**Windows 3.1**
October 1992	**Windows for Workgroups 3.1**
Mart 1993	**MS-DOS 6.0**
Avgust 1993	**Windows NT 3.1**
November 1993	**MS-DOS 6.2**
February 1994	**Windows for Workgroups 3.11**
Mart 1994	**MS-DOS 6.21**
April 1994	**MS-DOS 6.22**
September 1994	**Windows NT 3.5**
June 1995	**Windows NT 3.51**
Avgust 1995	**Windows 95**
Avgust 1996	**Windows NT 4.0**
November 1996	**Windows CE 1.0**
September 1997	**Windows NT 5.0 Codenamed Cairo Beta 1***
November 1997	**Windows CE 2.0**
Decembar 1997	**Windows NT 4.0 Option Pack**
Mart 1998	**Windows 98 Crashes At Spring COMDEX**
June 1998	**Windows 98**
July 1998	**Windows CE 2.1**
Avgust 1998	**Windows NT 5.0 Codenamed Cairo Beta 2**
April 1999	**Windows 2000 Beta 3**
May 1999	**Windows 98 Second Edition**
July 1999	**Windows 2000 Release Candidate 1**
September 1999	**Windows 2000 Release Candidate 2**
November 1999	**Windows 2000 Release Candidate 3**
February 2000	**Windows 2000 Released**
April 2000	**Windows Millenium Released**
October 2000	**Windows Codenamed Whistler Beta 1**
Mart 2001	**Windows XP Beta 2**
April 2001	**Windows XP RC1**
May 2001	**Windows XP RC2**
June 2001	**Windows XP RTM**
25. October 2001	**Windows XP retail release**

2001

Apple established an important progress with the models PowerBook which have G4 processors and a titanium computer case. The first PowerBook G4 had a processor of 500MHz, a bus of 100MHz, RAMPC 100 type with 1 GB, 15,2" TFT display, ATI Rage 128 Mobility graphics with 8MB video memory, 6X DVD reader, 20GB hard disc, USB and Fire Wire ports, VGA and S video outputs.

Apple promoted the iPod – a digital music player with a hard disc, a capacity of 10, 15, 30 and 40 GB. These players became great success, they were very popular also between the users of Windows since support for this operating system was provided as well. Steve Jobs returns to the company Apple and promotes the first version of

the new operating system, the predecessor of the revolutionary Mac OS X operating system, entirely based on UNIX.

Windows XP was presented and the server option Windows Server2000, produced in Home and Professional versions.

Windows CE/ Pocket PC – popular version of the Windows operating systems intended for pocket and handheld computers.

Figura 1.49: Pocket PC

Intel presents Pentium 4 – the first representative of the seventh generation of processors. By applying new technology, an opportunity was created for fastest communication with the memory and creation of the version on 2 and 3 GHz.Table for the

51

historical development of the processors according to years.

2002

Apple promoted the first iMac computer with an LCD screen that quickly became very popular.

The first biological computer was demonstrated, which uses DNA molecules.

WLan (Wireless or wireless Lan) became commercially used.

2003

Windows Server 2003 emerges on the market in many versions: Standard, Enterprise, Datacenter, Web and Small Business Server. The features of XP are embedded inside it, however it is much safer. NEC Earth Simulator was promoted – the fastest

Figura 1.50: Windows Server 2003 programming package

supercomputer in the world with a speed of 35,86 TeraFLOPS.

Athlon 64 was represented, the first 64-bit processor for PC computers.

|	
Produced	From 2003 to present
Common manufacturer(s)	AMD
Max. CPU clock rate	1.0 GHz to 3.2 GHz
HyperTransportspeeds	800 MT/s to 1000 MT/s
Min. feature size	0.13µm to 65nm
Instruction seti	MMX, SSE, SSE2, SSE3, x86-64, 3DNow!
Microarchitecture	K8 Microarchitecture
Cores	1
Socket(s)	Socket 754, Socket 939, Socket 940, Socket AM2, Socket AM2+

2004

This year the company Apple presented the first iBook model with G4 processor and a promoted version of the new operating system MacOSX. It was also promoted with a 64-bit Power Macintosh G5 that brings Apple in the new era of computers. While the new architecture provides new possibilities which is also shown with the project for preparation of supercomputers that are composed of 1100 connected G5 Power Macintosh. The concept of this supercomputer is based on cluster architecture (a network of individual units that join their computer capacities). The good side of these supercomputers is that if one unit is switched of or if it fails, the system continues running. This computer was installed at the Technical Faculty in Virginia.

Figura 1.51: Power Macintosh G4 G5

2005

IBM Blue Gene/ L supercomputer is becoming the fastest computer with a speed of 360 TeraFLOPS.
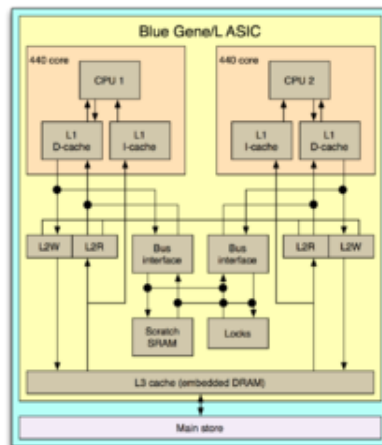
This year the iPod Nano portable media player was promoted with two models of 4 GB and 8 GB, as well as the iPod shuffle, digital audio player with models of 1,2 and 4

GB.

Figura 1.52: Apple's 7th Generation iPod Nano

Developer	Apple Inc.
Manufacturer	Foxconn
Type	Portable media player
Retail availability	September 7, 2005–present
Operating system	1.0.2
Power	Lithium-ion battery
Storage capacity	16 GB flash memory
Display	TFT LCD 240×432 at 202 PPI
Input	Multi-touch touchscreen,accelerometer
Connectivity	Lightning connector, 3.5 mm headphone jack (TRS connector), Bluetooth 4.
Predecessor	iPod Mini
Related articles	iPod Classic, iPod Shuffle , iPod Touch
Website	http://www.apple.com/ipod-nano/

2006

In the beginning of this year the first Apple computer was presented, based on the Intel processors. Few months later an installation of the windows operating system was enabled.

2007

New version of Windows-Windows Vista as 64-bit operating system. It has a new GUI interface (aero), threedimensional appearance and a visual feeling. It was launched in five versions: Home Basic, Home Premium, Business, Enterprise and Ultimate. Windows Vista brought many innovations: new graphical surrounding, new safety technology, voice command, touchscreen support, superfetch and readyboost technology.

Figura 1.53: Desktop Vista

The iPod touch was promoted, a portable media player with models of 8,16 and 32 GB. Steve Jobs presented the iPhone – combination of 2,5 GHz GSM and EDGE cellular phone with Mac OSX, Safari web and navigation. It has 3,5" display, it is sensitive to touch (touch screen), with 4 or 8 GB memory, Bluetooth, Wifi.

2008

The iPhone 3G emerges with GPS navigation.

Figura 1.54: iPhone 3G

Developer	Apple Inc.
Manufacturer	Foxconn
Slogan	The iPhone you have been waiting for. The first phone to beat the iPhone.
Generation	2nd (2G)
Model	A1324 (China) A1241[3]
First released	July 11, 2008[4]
Units sold	1 million over first weekend[5]
Predecessor	iPhone
Successor	iPhone 3GS
Related	iPad, iPod Touch (comparison)
Type	Smartphone
Form factor	Slate
Dimensions	115.5 mm (4.55 in) H. 62.1 mm (2.44 in) W. 12.3 mm (0.48 in) D
Weight	133 g (4.7 oz)
Operating system	iOS 4.2.1 (build 8C148) Released November 22, 2010;
CPU	Samsung 32-bit RISC ARM1176JZ(F)-S v1.0[7] 620 MHz Underclocked to 412 MHz[8]
Memory	128 MB eDRAM[9]
Storage	8 or 16 GB flash memory
Battery	1150 mAh, 3.7 V Internal, user inaccessible Rechargeable Li-ion[10]
Data inputs	Multi-touch touchscreen display 3-axis accelerometer Proximity sensor
Display	3.5-inch screen (diagonally) 320-by-480-pixel resolution at 163 ppi 2:3 aspect ratio 18-bit (262,144-color) LCD
Rear camera	2.0 MP with geotagging
Sound	3.5 mm TRRS One speaker 20 Hz to 20 kHz frequency response (internal, headset) Microphone
Connectivity	Quad-band GSM/GPRS/EDGE (850 900 1,800 1,900 MHz) Tri-band UMTS/HSDPA 3.6 (850 1,900 2,100 MHz)
Website	apple.com/iphone

2009

Windows 7 was presented, which unlike its predecessor Windows Vista, it is fully compatible with the previous versions of Windows and their managing programs. It has been proven as a more stable, faster and more functional version. It is intended for use for personal computers, home and business desktops, laptops, netbook and tablet computers.

Windows 7 has many new functions such as support for virtual hard discs, better performances of multi-core processors, improvement of the boot performances.

Windows 7 is available in 4 versions including Home, Premium, Professional and Ultimate available to the users, and Home Basic only with the new computers.

The professional Windows 7 is increasingly used in companies due to its characteristics:

- speed and security

- compatibility

- easier exchange of documents

- quick recovery of deleted documents or files

- better protection of confidential information

- bigger on-line security
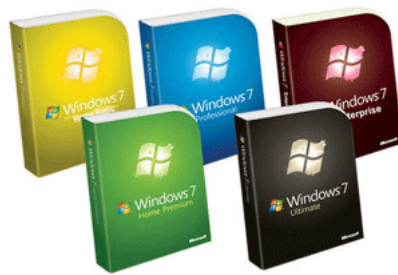
2010

The application Viber was designed (free messages and calls) for Andriod and iPhone.

2011

Apple dominates with the promotion of Tablet PC computers.

2012

The latest operating system of the company Microsoft - Windows 8 was presented. Windows 8 is intended for use of desktop computers, laptops, tablets and home cinemas.

It appears in October 2012 and unlike the other operating systems, Windows 8 focuses on the experiences of the user. The touch friendly user interface is based on the Microsoft Metro design. The innovations include the new "Start" screen with few rows of dynamically updated tiles that represent applications, use of the technological advantages such as USB 3,0, 4Kn Advanced format, NFC (Near Filed Communications), cloud computing and many others..

Il windows ha 4 versioni:

- Windows 8 - versione generale

- Windows 8 Pro

- Windows 8 Enterprise

- Windows - RT

With the emergence of the operating system Windows 8, also Windows Phone 8 (W8P) emerged, a software package that provides mobile phones to have the prefix smart.

The first telephones that were presented include Windows Phone 8X by HTC and Windows Phone 8S by HTC.

The company Samsung presents the latest models of Samsung Notebook 9 (with a simple flat design with a thickness of 12,9mm and a weight of 1,16kg) and the tablet computer Galaxy Tab.

Figura 1.55: Samsung Notebook 9

Figura 1.56: Galxy tab

The company Sony presented the Vaio portable computer with powerful performances and fashionable design.

Apple promoted the latest generation of Mac mini computers made of aluminum and with very small dimensions.

Figura 1.57: 2011 Unibody Mac Mini

Manufacturer	Apple Inc.
Type	Desktop Server
Release date	October 23, 2012 (current release) January 22, 2005 (original release)
Introductory price	US $599- $799
Media	CD/DVD drive (pre-July 2011 models), Digital distribution(post-July 2011 models)
Operating system	OS X
Power	84 W PSU (7 A@12 V)
Display	None included
Connectivity	Wi-Fi, Ethernet, Bluetooth,FireWire, USB 3 (current release), HDMI, SDXC,Thunderbol
Dimensions	1.4 inches (36 mm) H, 7.7 inches (196 mm) W, 7.7 inches (196 mm) D
Weight	2.7 pounds (1.2 kg)
Related articles	iMac, Mac Pro
Website	Apple – Mac mini , Apple – Mac mini Server

2013

Viber 3,0 is available for desktop computers, PC and Mac computers. At this moment Viber is used by more than 200 million people in the world.

1.3 Characteristics and classification of modern computers

The basic characteristics of the development of computers from the past to today include the following:

- increase of the working rate (GHz) – increase of speed

- increase of the capacity of the primary and secondary memory (GB)

- parallel processing

- bigger width of the buses (8 b,....64 b)

- smaller dimensions, lower price and lower costs

Today the modern computer is multifunctional and adjustable device with almost unlimited application:

- it executes many mathematical operations

- it launches intercontinental rockets

- it manages machines, atomic power plants etc.

The modern man today is working with different types of computers, which although they are based on the same technology, they still have some great differences. New technologies and services are developed:

- Internet browsers (search engines)

- Internet telephony

- On-line banking

- E-commerce

- E-business

- Portals

- Real time transfer of images and videos.

Computers can be classified in different categories according to many criteria. The most common classification is according to computer power and this includes:

1. Supercomputers

2. Mainframe Computers

3. Mini Computers – Servers:

4. Workstations

5. Personal Computers (PC)

6. Embedded and special purpose computers

1.3.1 Supercomputers

Many companies need computers with high computer power. Such computers are the supercomputers that use expensive, most modern technology (RISC,NxCPU...) for stimulation and modeling of complex phenomena: chemical and physical processes, nuclear explosions, weather forecast, space research, war purposes etc.

The speed of supercomputers is measured in FLOPS (Floating Point Operations per Second).

2008 – the first supercomputer with a performance measured in petaflops and a price of 500.000 dollars to few hundered million.

2009 – IBM's computer Roadrunner with 129.600 processor cores.

- Jaguar with processors of 4 cores, in total 150.152 cores (37.538 processors). Today

it is difficult to determine the difference between supercomputers and mainframe computers. Supercomputers are most commonly adjusted for a particular user, focused on processor's power and execution of one task.

The mainframe computers are intended for the execution of many operations, great processor power is enabled and they are focused on data flow.

1.3.2 Mainframe computers

Today these expensive computers use the large companies for critical applications and processing of massive data, as well as data for voting, different statistical data, financial transactions etc. The name originates from their initial appearance and

these computers are compatible with the architecture of IBM System/360 which was represented in 1965.

Modern mainframe computers have smaller dimensions, their price is about 1 million dollars and they operate in a special surrounding. Their speed is million operations in a second and the easily manage and process vast quantity of data (more than 1.000 transactions). The input of data and the output of information are performed through

desktop terminals which do not have built-in processors, or through portable terminals for entry of data – PDET (Portable Data Entry Terminals). Examples for PDET include: barcode reader, gasmeter, optical tag reader, scanner, graphics board and magnetic card reader. With these features, the mainframe computers are used in large companies:
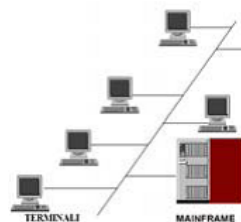
banks, state institutions, airlines etc.

1.3.3   Mini computers – Servers

These computers are smaller and cheaper than the mainframe computers, however they are more powerful than the PCs and they are designed in order to provide software support and other resources to other network computers.

Hence the large computer dedicated only to the database is called database server, the file servers manage files, the webservers process webpages and web applications etc.

1.3.4 Workstations (R/St)

For scientific analyses of voluminous data, mini computers have been replaced with workstations – desktop computers with high performances. Most commonly they are connected to a large computer system and they are intended for design, processing of images, 3D graphics and movie visual effects.

Workstations have processors and a graphical display with high performances, local storage with a great capacity, network capacity and multitasking operating system.

Practically workstations are used by only one person in a particular period, and they are used by scientists, engineers, analysts, designers etc.

1.3.5 Personal computers – PC

This category of modern computers is called personal computers and they are intended for individual application. Usual applications of PCs include: text processing, computation, games, social networks, listening to music, watching movies etc.

The capacities of a PC are increased with the implementation of microprocessors and the development of CPU in a single chip. The number of installed PCs in the world to 2008 reached one billion and it is assumed that to 2014 this number would be increased for another billion. Most commonly used operating systems in a PC are Microsoft Windows, Mac OS and Linux, while usually the CPU microprocessors are compatible to the x86 processor.

Modern PCs often have a modem with a speed of 56 Kbps for connection to the Internet and the users have at their disposition a lot of commercial and free applications and service programs that are easy to install.

Types of PC:

1.3.5.1 Desktop PC

1.3.5.2 Portable (laptop, notebook, tablet)

1.3.5.3 Handheld (PDA, palmtop, i Pod, i Phone...))

1.3.5.4 Desktop PC

The term desktop refers to the horizontal case with a display placed on the case for the purpose of protection of space. Many modern desktop computers have separate screens and keyboards, and their cases are produced in different shapes, from vertical to small, which can be hidden behind the LCD display.

1.3.5.5 Portable computers

These computers are not connected to desks and they had the fastest development in the category of PCs. The first portable computers had a weight of 9kg, with a separate keyboard and a small display similar to the TV screen. The modern portable computers of the type laptop have a weight of 2-3kg, they are intended for mobile work and they are often called notebook computers. Examples of these computers include: laptop, notebook, tablet... The tablet PC has a touchscreen or it uses graphic/screen hybrid

technology that enables the user to work with a stylus, with a digital pen or with the press of a finger. For the operation of these computers, the interface hardware devices,

the parallel and serial ports, the graphics cards, the sound cards etc. are all usually integrated in a single unit. Many of the computers have a battery for autonomous mobile work, and their disadvantage is that they can be only slightly upgraded.

1.3.5.6 Handheld computers

Intended for mobile work. Examples of such computers include: PDA (Personal Digital Assistant), Palmtop, i Pod and i Phone devices.

All these computers are constructed with a similar microprocessor same as the desktop computers, however they are much more expensive. Their basic drawback is the inability to upgrade and to increase performances. The handheld PDA computer by Microsoft can be used with other devices such as receivers, barcode readers and video cameras.

With the emergence of Windows Mobile 6 in 2007, Microsoft revoked the name pocket computer and replaced it with Windows Mobile Classic. The computers with integrated mobile telephony and touchscreen are called Windows Mobile Professional. By
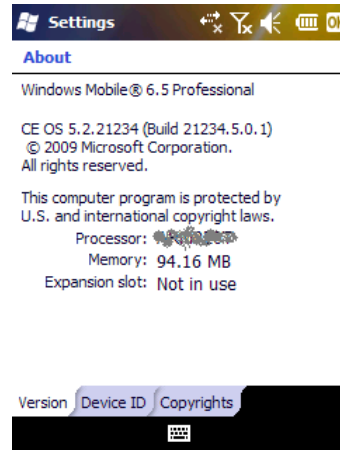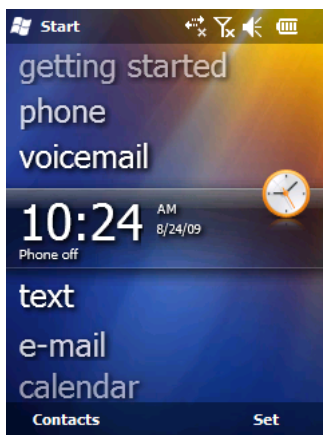
convergence of the devices that combine functions of personal computers and digital recorders, the so called home movie was developed (Home Theater PC-HTPC).

1.3.6 Embedded and special purpose computers

Some computers have been constructed only for a special purpose and they execute specific tasks such as temperature control, managing of large industrial machines or control of the heart function. Unlike the desktop PC, these computers also have a program which cannot be changed (loaded in the microprocessor so called firmware), intended for management with specific machines or one function of those machines.

The entire consumer electronics, from an electrical tooth brush to cars and industrial machines, is composed of modern microcomputers.

Examples of embedded computers in network devices – routers, cars, watches, monitoring devices. . .

Slower and cheaper CPUs than the CPUs in PCs are used for the embedded computer systems and they are supposed to complete only one function.

1.3.7 CONCLUSION

Computers have evolved since Charles Babbage's plan for an analytical machine in modern supercomputers. In a period shorter than a person's life span, computers have evolved from massive, expensive and insecure, to modern, powerful computers with different sizes and characteristics, incomparably cheaper, faster and more secure.

As it was difficult for the pioneers of computer engineering to foresee the technological development of computers, it is as much difficult today to foresee the impact of computers on the development of the human community in future.

Today computers are not a luxury, rather they are a need and they are included in all aspects of everyday life. Different applications of computers have been enabled with the development of technology and their continuous evolutionary development. Computer literacy every day improves our life and our professional development and the applications provide us the following:

- text processing

- tabular calculations

- database

- computer graphics and digital photography

- telecommunication networks

- social networks (Facebook, Twitter...)

- entertainment (music, movies)

- artificial intelligence – it is applied every day in medical diagnostics, text translation, development of video games, management of robots...

Computers have very large influence on the evolution of human intelligence, however from ethical point of view they bring their own risks:

- personal privacy is threatened

- there is a risk of computer crime

- danger of automatization (dehumanization) of work

- abuse of data in economy and politics

- danger of addiction to technology

- online identity theft

- blurring of reality (virtual reality)...

We are witnessing an expansive development of the information technology which is constantly stepping forward with large steps. Particular scientists are looking for new methods to increase the speed of computers, whose speed could be measured with the speed of light. Every day completely new technologies and innovations emerge, and computers are becoming smarter and more intelligent. Computers and information

technology thoroughly and irreversibly changed the world. Today people do not use computers only for work or games. They simple live with computers.

2 The Virtual Museum: 3D Max, Unity

Contents

2.1 Introduction

New technologies are constantly encountered in the life of humans. Something that was impossible in the past, now became part of our everyday life. The human desire to accomplish as much as possible resulted from the rapid development of technology, and this is mostly visible in the communication between the human and the computer.

The communication human-computer (Human-Computer Interface, HCI) is enabled with any software or hardware that enables the user to communicate with the computer. The world that is stimulated by computers has a tendency to be similar to the real world with rules that apply in the real world, such as topography, gravitation, movement, actions and mutual communications.

The museum is an institution that takes care of collections of artifacts and other objects that have scientific, artistic, cultural or historic importance and makes them available to the public. Today with the development of technology, Internet museums are created, which offer virtual samples of their contents. Museums should represent bridges between the past and the future, and this implies preservation of the values from the past and their upgrading with the initiatives and creative opportunities of the young people and the new technologies. The project aims to present the heritage from the past and to introduce it to young people in a close and interesting manner.

2.2 Creating a Virtual museum

4 programs were used for the creation of the Virtual museum:

- Photoshop

- ArchiCad

- 3DS max Studio

- Unity

The virtual museum comprises of 4 rooms where the historical development of computers is presented. The first room represents the manual, the mechanical and the electromechanical age to 1946. The second room represents the computers from the I, the II and the III generation of the computer age. The third room represents the computers from the IV and the V generation of the computer age. The last, fourth room represents the computers from the VI generation of the computer age, that is, from 1990 to this day. So each room contains its own history and the middle part displays the famous machine in 3D that was very influential in that period. On the walls of every room there are pictures that are typical for the given period. Under every picture there is a plate that shows the basic characteristics and the meaning of the picture.

In the entrance part of the museum there is an information desk and another part represented as a shop where one can find virtual souvenirs and books, which can be virtually purchased.

During the creation of a virtual museum, we should primarily have a schematic representation of the initial conception and our idea for the final appearance. Once a decision is made about the type of museum we would like, we are creating the structural design and we are placing walls and windows. ArchiCad is the most commonly used program for creating graphical representation. ArchiCad provides simple manipulation of objects and elements and it is extended with the options to displace, align and distribute objects regardless of whether we are in the 2D or the 3D model.

One should begin with 2D design with determination of the elevation of the placed structure.
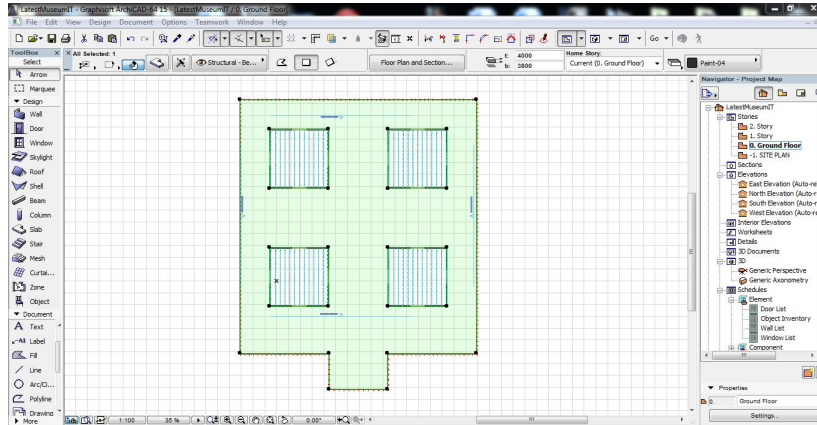

Figura 2.1: Schematic representation of the museum scene 1

Then the size of the structure is determined. The museum is built on a space of 1200m2. Each room has a size of 100 m2. The corridors cover larger surface and inside the corridors, next to the information desk and the part for souvenirs, there are posters and 3D designs of historical machines that gave great contribution for the development of information technology.

Once we have determined the size of the structure, the next step is the construction of walls, windows and interior design.
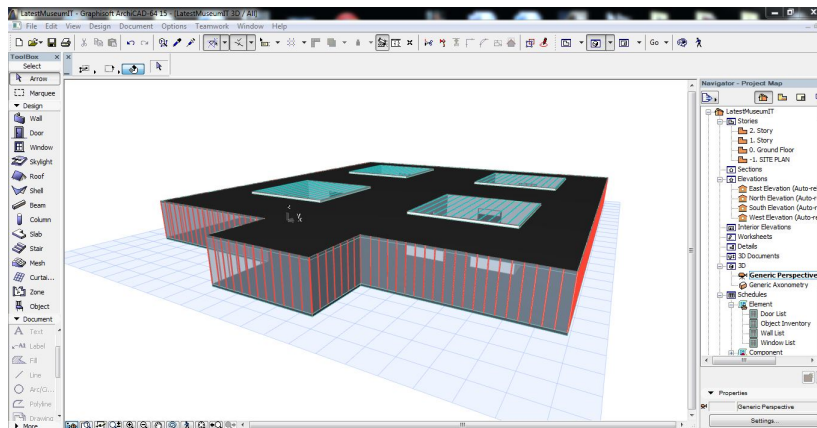

Figura 2.2: Exterior appearance of the museum

From the figure one can notice that all parts of the structure have different color and this denotes that they are separate parts for which later on we determine of what mate-

rial they will be constructed. ArchiCad provides us precise operations with graphical elements, copying, displacement, rotation, scanning. It also enables visual representation of the structure in 3D.
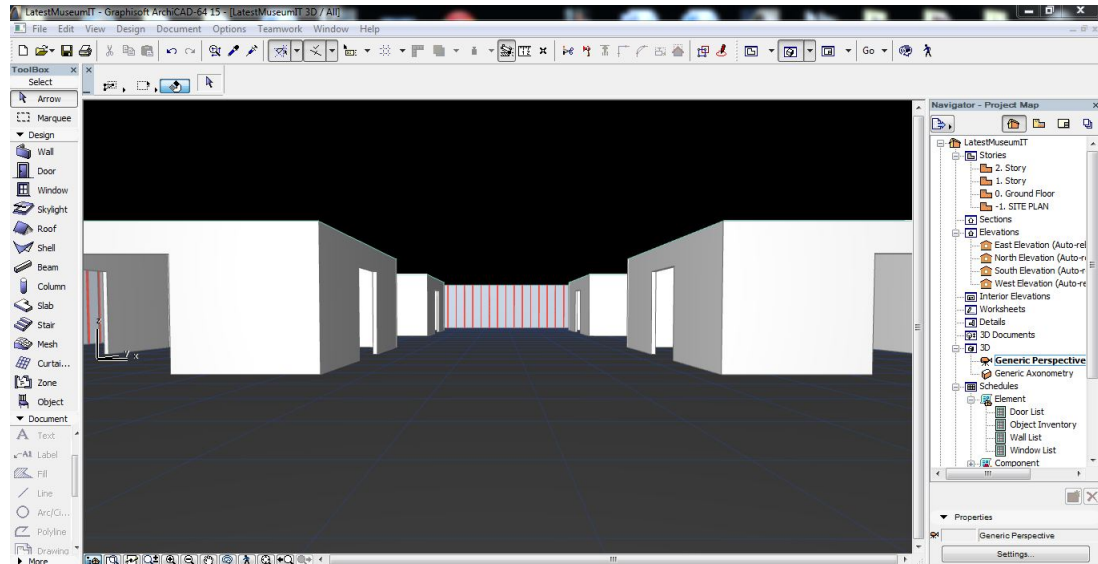

Figura 2.3: This picture represents the interior appearance of the positioned rooms and the base of the museum

This is where the structural appearance terminates.

This format is saved in 'save as' in 3D as a 3DS document. Then it is imported in 3D max studio.

2.2.1 The beginning of 3D max studio

The original 3D Studio was created for the DOS platform by Yost Group and announced by Autodesk. After the fourth version of 3D Studio DOS, the product was developed for the Windows NT platform with a new name „3D Studio MAX". This version was created by the same developers, Yost Group, however it was announced by Kinetix – which in that period was part of Autodesk which deals with multimedia and entertainment. Autodesk buys the product and is working internally on the next two versions. Then the name is changed into „3ds max" (all lower case). After the eighth version, the product gets a capital "M" i.e. "3ds Max" (lower and capital letters). In 2009 the product gets the logo of Autodesk, and the name is "Autodesk 3ds Max" in which the project is formed.

Autodesk 3ds Max is the most famous 3d computer for creation of 3d animations, models and images. It has tools for modeling flexible data and it can be used with the

Microsoft Windows operating system. It is often used for visualization of architectural solutions.

After importing the prepared material from the program ArchiCad, 3D visualization of the project is obtained.
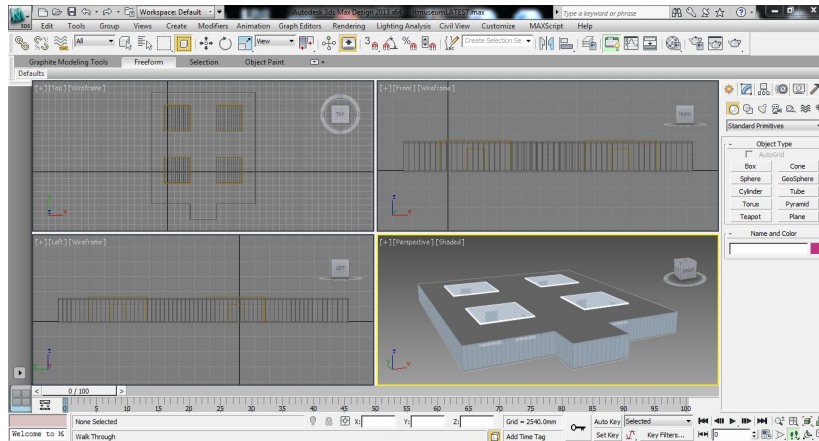

Figura 2.4: 3D max studio, exterior appearance of the museum

As one can see in the figure, all four sides of the project are simultaneously edited. The front side of the museum is shown in the lower right corner is and the aerial perspective of the museum is shown in the upper left corner.

The desired materials are set in the program Autodesk 3ds Max and they are placed in particular spots.

One of the most important tools in the program 3D max is the determination of the spatial light and the sunlight.

Certain materials are used to form white walls, mesh ceiling and appropriate flooring by using the tool UVWmap.

As it was previously mentioned, in every room there is a specific machine from the corresponding age made in 3D. For the preparation of this machine the basic figures have been used such as cylinder, cube etc. which are later on given color, position and style.
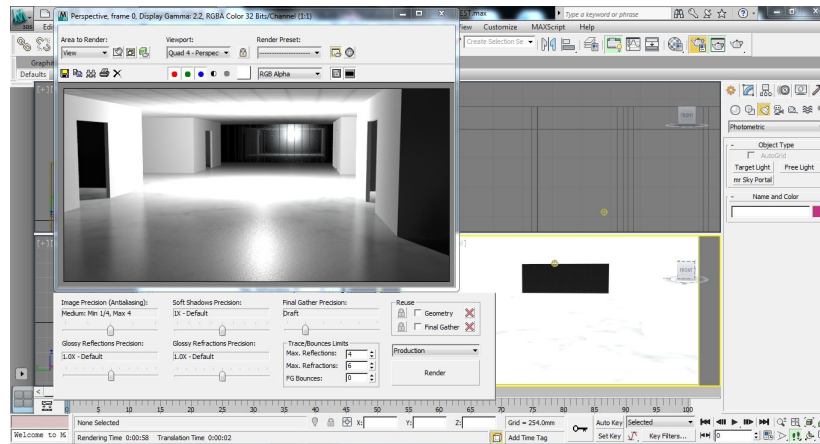
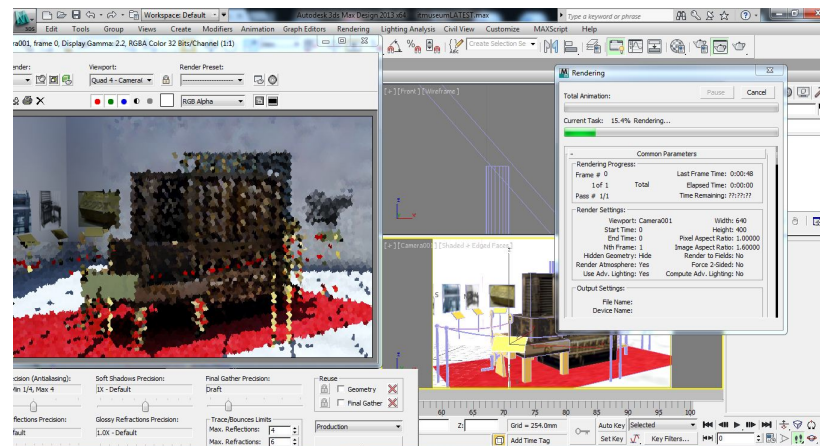Figura 2.5: Insertion of spatial light and determination of materials

Figura 2.6: Making a render of a particular structure

For successful shaping of the machine, the basic characteristics and the quality of the particular machine that we want to represent are determined, and then a RENDER is used. In this manner we are getting visual processing of what we have made.

Three axes X, Y and Z are used for precise placement of the objects in the museum.

In the rooms of the museum, on the walls, pictures have been places which are typical for the period they represent. The plates under the pictures with a title and years are made by using the famous program photoshop. They are saved as pictures and then they are put in 3ds max and they are placed in the desired position.
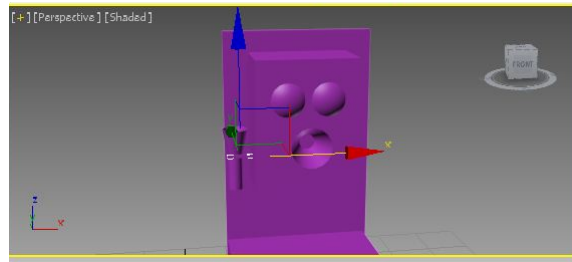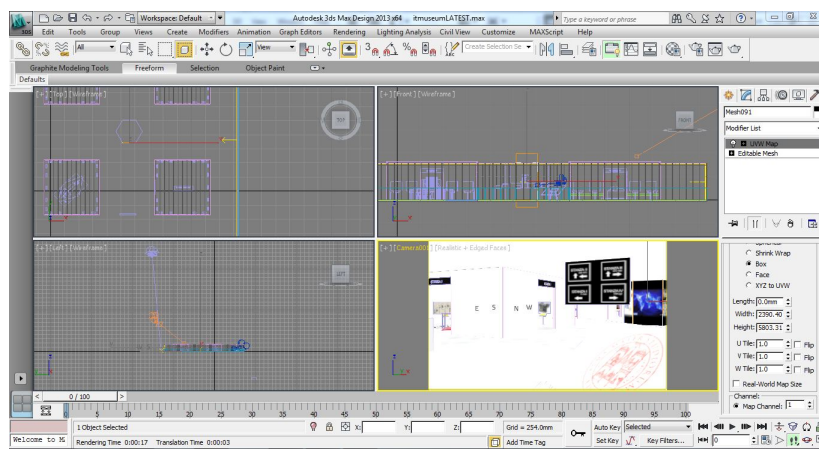
Figura 2.7: Representation of X, Y , Z axis

Figura 2.8: Placing elements made in photoshop

In a specific space in the museum a stand has been placed for souvenirs that are made in mini-shape from the previously made famous machines in 3D. There are also books that are made in 2D format on which images are placed later on, from their external side.

Upon termination of the insertion of objects, details and materials, the program Unity is started. Unity is a program for creation of games with multi-platforms created for unity Technologies. It is one of the most modern programs for creation of video games for web plugins, desktop platforms, consoles and mobile devices. Unity supports formats from 3ds, Max, Maya, Softimage, Blender, modo, ZBrush, Cinema 4D. The program is a game engine, powerful machine with a complete set for intuitive tools and fast workflows for creation of interactive 3D contents. There are thousands of tools for getting a fantastic quality of the 3d content.

In the program unity all our figures, images, texts and materials from the museum should be once again imported in unity and they should be inserted in the desired part. Also the color of each of the objects should be set.

Figura 2.9: Placement of all fragments in the program Unity

After the entire procedure is finished, we are selecting the size of our project. My virtual museum is made for 32bit, 64bit and for web. Let's play!

2.3 Conclusion

One of the most important events in the history of mankind is happening in the past years, known as information revolution, Internet revolution or web revolution. The Internet and the web technologies along with the remaining information technologies change the manner we work, live and learn. These changes are more dynamical than any other changes that have happened so far, mainly boosted by the rapid and the everyday development of information and communication technologies.

One of the most important events in the history of mankind is happening in the past years, known as information revolution, Internet revolution or web revolution. The Internet and the web technologies along with the remaining information technologies change the manner we work, live and learn. These changes are more dynamical than any other changes that have happened so far, mainly boosted by the rapid and the everyday development of information and communication technologies.

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