Some Key Aspects in the History of Computing in Romania

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Abstract

Computers in Eastern Europe were built in the 1950-1960s not very long after the first computers launched in USA and Western Europe. The paper presents a chronology of Eastern European first generation of computers compared with the chronology of Western first generation computers.
The first Romanian computers are described: CIFA-1 (1957) in Bucharest, MECIPT-1 (1961) in Timisoara, DACICC-1 (1962) in Cluj-Napoca. The role of Academician Grigore C. Moisil, a great mentor of all teams, is presented.
Cases of international cooperation among Western and Eastern countries and among Eastern countries are presented, e. g. Prof. Sir Maurice Wilkes, FRS, from Cambridge University, the father of microprogramming, Romanian scientist Grigore C. Moisil who brought to Romania several famous Russian professors, Timisoara team and a the Hungarian Academy Institute. Victor Toma supported the creation of Vitosha, the first Bulgarian computer (1963). His role was recognized by his election as Honorary Member of the Bulgarian Academy in 2008.
The first generation of computers were followed by a series of second generation transistorized computers CET -500 (Victor Toma-1963), MECIPT-2 (Lowenfeld, Kaufman, Baltac – 1963), DACICC-200 (Muntean, Farkas, Bocu -1964).
In the 1965-1966 the Romanian government recognized the need of a computer industry. All research teams were assembled in a powerful R&D Institute for Computers. A license from CII-France was acquired to produce IRIS-50, a computer renamed in Romania as FELIX C-256. The license was given by decision of General De Gaulle in infringement of embargo of USA for such a technology. Factories were built and a computer industry was born in the 1970s. The institute first enlarged the FELIX family with two additional members and further developed a minicomputer family named INDEPENDENT -100 to celebrate 1977, the year of the first centenary of Romanian Independence. A joint venture with Control Date Corporation – USA, then a powerful IT corporation was set up in Bucharest, manufacturing modern peripherals. A software industry emerged as well.
Other countries in Eastern Europe decided to build a unified series of computers Ryad (EC EVM) and further Mini EVM (SM EVM). The reasons of Romania not participation at Ryad, but actively joining SM EVM are recalled.
The paper reviews the link between political decisions and computer industry development and traces roots of the present IT development in the past. A case of professional restoration (MECIPT-1) is presented[3].

First World Computers

The glory of being the first computer is disputed by ZUSE 3, built by Conrad Zuse in 1941 [1], a relay based computing equipment, and ABC built by John Atanasoff and Clifford Berry at Iowa University in 1942 [1], a non-programmable device. During the war years in complete secrecy COLLOSSUS was built in UK for the need of war decryption work. Only recently information was declassified on COLOSSUS and it shows that COLOSSUS Mark 1 was a programmable machine, but not yet a Turing complete machine [3]. Most authors consider ENIAC announced in 1946, built by John Mauchly and J. Presper Eckert of the University of Pennsylvania for the US Army, as the first truly general purpose computer [4].

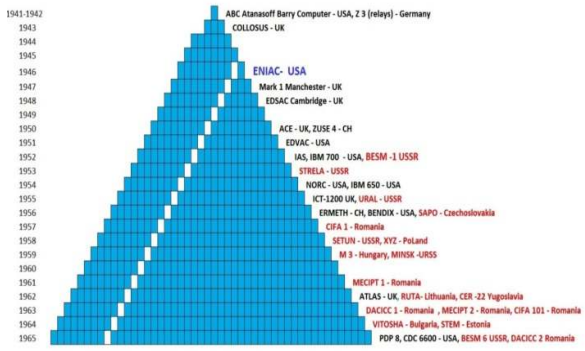

Figure 1 First World Computers

First computers in Eastern Europe

The years 50s and 60s

Not very long after the first computers were launched in USA and Western Europe, research started in USSR and Eastern Europe to build computers. The first one seems to be BESM-1, completed in 1952 at the Academy of Sciences of USSR in Moscow. Some sources mention an earlier smaller variant MESM-1 [5] built 1948-1951 in the same place. BESM-1 was a fully programmable computer [6], used for scientific calculations, automatic translation, etc. It consisted of 5000 electronic tubes, paper tape input, magnetic drum and band memories, photographic printer, etc. Next machines were also built in USSR: STRELA and URAL in 1953 and 1955. First computers outside USSR were SAPO built in Czechoslovakia in 1956 and CIFA-1 built in Romania in 1957. They were followed by SETUN in USSR and XYZ in Poland in 1958 and M-3 in Hungary

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2 Horia Gligor is Senior Researcher, Head of the Institute for Computer Technology - Timisoara Branch. He serves as vice president of ATIC – Association for the Information Technology and Communications of Romania. He managed the project of MECIPT-1 restoration and set up of the Computer Branch of Banat Museum.

[3] Presentation by Mitzu Maria, Expert in metal – ceramics restoration of the Museum of Banat Timisoara - as appendix to this paper

and MINSK in USSR in 1959. MECIPT-1 was put into operation in Romania in 1961, followed by RUTA Lithuania and CER -22 in Yugoslavia. First generation computers were still launched in 1963 in Romania (DACICC 1 and CIFA 101) and in 1964 in Bulgaria (VITOSHA) and Estonia (STEM). But the years 1963-1965 marked the advent of the second generation transistorized machines MECIPT 2 in 1963 in Romania, BESM -6 in USSR and DACICC 2 in Romania in 1965.

Table 1 Chronology of Eastern Europe (including USSR) Early Computers

Year	Computer name	Country	Place	Computer Generation	Bibliography
1952	BESM 1	USSR	Academy of Sciences, Moscow	Electronic tubes	[5]
1953	STRELA	USSR	Special Design Bureau 245, Moscow	Electronic tubes	[7]
1955	URAL	USSR	Scientific Research Institute of the Ministry of Machine and Measuring Instruments Industries	Electronic tubes	[8]
1956	SAPO	Czechoslovakia	Academy of Sciences, Prague	Electronic tubes + relays	[9]
1957	CIFA 1	Romania	Institute of Atomic Physics, Bucharest	Electronic tubes	[10]
1958	XYZ	Poland	Academy of Sciences, Warsaw	Electronic tubes	[11]
1958	SETUN	USSR	Moscow University	Electronic tubes	[8]
1959	M 3	Hungary	Academy of Sciences, Budapest	Electronic tubes	[12]
1961	MECIPT 1	Romania	Polytechnic University of Timisoara	Electronic tubes	[10]
1962	RUTA	Lithuania (USSR)	Special Design Bureau Vilnius	Electronic tubes & semiconductors	[15]
1962	CER 10	Yugoslavia	Mihailo Pupin Institute Belgrade	Electronic tubes & semiconductors	[16]
1962	CIFA 101	Romania	Institute of Atomic Physics, Bucharest	Electronic tubes	[10]
1963	DACICC 1	Romania	Institute of computing, Cluj-Napoca	Electronic tubes	[10]
1963	MECIPT 2	Romania	Polytechnic University of Timisoara	Semiconductors	[10]
1964	VITOSHA	Bulgaria	Academy of Sciences, Sofia	Electronic tubes	[14]
1964	CET 500	Romania	Institute of Atomic Physics, Bucharest	Semiconductors	
1965	STEM	Estonia	Institute of Cybernetics, Tallinn	Electronic tubes & semiconductors	[15]
1965	BESM 6	USSR	Institute of Precision Mechanics and Computer Engineering, Moscow	Semiconductors	[5]

The technology divide

The chronology drawn in Table 1 according to various sources shows a serious lag behind USA and Western Europe. This was due not only to inherent problems of the centralized planned economies characteristic to the period in USSR and Eastern Europe, but to ideology problems. The computers were considered a part of cybernetics, and cybernetics was considered in the fifties a "capitalist pseudoscience" [13]. In the 1950s, Romania was heavily influenced by the Soviet political dominance. The Philosophical Dictionary published in 1953 in Moscow described cybernetics as a "reactionary bourgeois science directed against the working class." [10]. The situation changed in 1955 when a classified report stated that "As a result of irresponsible allegations by incompetent journalists, the word "cybernetics" became odious and cybernetic literature was banned, even for specialists, and this has undoubtedly damaged the development of information theory, electronic calculating machines, and systems of automatic control"[13].

However, Soviet and Eastern European Romanian scientists promoted computers and cybernetics, in academic, university, industrial and high school circles and research on computers flourished despite technological difficulties.

It is to be said that during the first generation of computers the research was able to keep the technology divide limited to several years. The electronic tubes and the passive circuitry was produces in USSR and Eastern Europe, complexity of computer architecture was not big, programming was simple. With the development in integrated circuitry and LSI, on one hand and complex operating systems on the other, the divide started to grow during 60s to 80s.

Figure 2 Victor Toma and CIFA-1

Romanian computers

First and second generation

CIFA

The first Romanian computer was built at the Institute of Atomic Physics (IFA) in Bucharest starting 1954 and put into operation in April 1957. CIFA-1 had 1500 electronic tubes, a magnetic drum memory of 512 31 bit words, paper tape input, typewriter output and was able to process data at 50 operations per second. Its creator was

Victor Toma (1922-2008) (figure 2), researcher at IFA, continued building new versions of the first generation CIFA (CIFA 2 to CIFA 4) and the second generation CET-500 released in 1964. During 1962-1964 within an agreement of Romanian and Bulgarian academies of sciences, Victor Toma contributed to the creation of VITOSHA, the first Bulgarian computer [17].
His contribution to computer development was recognized by both academies. Romanian Academy elected him Honorary Member in 1993 and Bulgarian Academy elected him also honorary Member in 2008.
In the same institute another team led by Armand Segal (1929-2010) built CIFA-101 launched in 1962, a first generation computer with serial processing of data leading to a much simplified hardware.

MECIPT

At the Polytechnic Institute (now Politehnica University) of Timisoara a team led by Wilhelm Lowenfeld (1922-2004) and Iosif Kaufmann(1921-) started in 1957 the project MECIPT-1. In 1960-1961 Vasile Baltac (1940-) joined the team being in charge with the design of the diode decoder matrix and memory optimization [10]. The computer was put in operation in 1961 (figure 3) and had over 2000 electronic tubes, tens of thousands of passive components, 30 bit words, magnetic drum memory of 1024 words, paper tape input, electric typewriter output, machine code programming. The speed was 50 operations per second increased to 70 operations per second through interleaving algorithm by Vasile Baltac. MECIPT 1 introduced the concept of microprogramming, based on paper sent by Prof. Sir M. V. Wilkes, FRS of Cambridge University, father of microprogramming.[10].

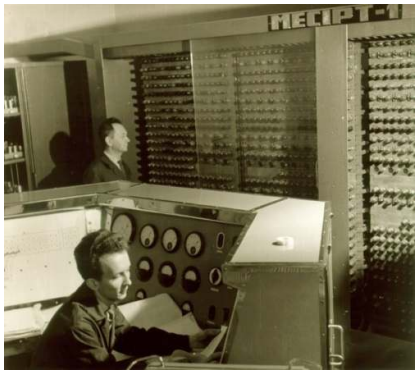


Figure 3 Wilhelm Lowenfeld and Vasile Baltac (at the console) and MECIPT-1 in 1962

As MECIPT was built in a university, the first courses on computer engineering were started at Timisoara Polytechnic Institute in 1963 and the first graduates in computer engineering finished their studies in 1966.
Next computer was MECIPT 2, fully transistorized and with a ferrite core memory. Both computers were fully utilized for scientific and technical computing. A first automatic translation from English into Romanian was performed with MECIPT in 1963.


Pupitrul de comanda al calculatorul DACICC 1, in timpul primelor exercitii efectuate de cercetatorii clujeni

MECIPT was the place were intense technical cooperation took place, both domestic and internationally. Based on plans delivered by MECIPT team, a Romanian Army team built CENA, the first military computer in Romania.
The magnetic drums for MECIPT 1 and 2 were acquired from the Hungarian colleagues from the Academy of Sciences of Budapest who built them within M-3 project [18].

DACICC

At the Institute for Computing of the Academy from Cluj-Napoca a computer called DACICC 1 was finished in 1963, by a team led by Emil Muntean and Gheorghe Farkas. The computer was based on electronic tubes, but used several transistors. Next computer was the second generation fully transistorized DACICC 200 delivered in 1968 with a nucleus of operating system [19]

Romanian Computer Pioneers

The development of early computers would not have been possible without help from prominent scientists of the period engaged in promoting computer science and despite official repudiation of cybernetics. One such personality was academician Grigore C. Moisil (1906-1973), mathematician, founder of a school of polyvalent logic. He gave a great support to all teams building computers in Bucharest, Timisoara and Cluj-Napoca, sent students to summer sessions, brought scientists from USSR and Eastern countries to IFA and MECIPT. Recognizing his role, IEEE Computer Society awarded him post-mortem in 1996 the Computer Pioneer Award.
In Cluj-Napoca a great mentor of those who created DACICC was Academician Tiberiu Popoviciu (1906-1975), founder of a school of applied automatic calculus.

Figure 4 Romanian Computer Pioneers awarded National Orders - 25 February 2003

The gallery of Romanian computer pioneers, people who were engaged in developing first and second generation computers includes Victor Toma, Armand Segal (CIFA - Bucharest), Wilhelm Lowenfeld, Iosif Kaufmann, Vasile Baltac (MECIPT- Timisoara), Emil Muntean, Gheorghe Farkas, Mircea Bocu (DACICC –Cluj-Napoca). In 2003 the Presidency of Romania recognized their contribution and awarded them national orders. A rare photo shows all of them who were alive in 2003 and could participate at the ceremony (Figure 4).

National and International Cooperation

The cooperation among teams of CIFA, MECIPT and DACICC took place by participation to scientific conferences and exchange of published papers. Academician Moisil did a great job promoting exchanges of visits among teams. Due to this normal environment the early Romanian computers had different approaches and they did not have common parts.

There was a quite active international cooperation. Victor Toma and Wilhelm Lowenfeld paid visits to sites in USSR. At MECIPT an active cooperation was established with the Cybernetics Research Group of the Hungarian Academy of Sciences who built the M-3 computer based on documentation of Soviet M-3 computer [20]. The cooperation included the delivery of magnetic drum memories used by MECIPT-1 and 2. On that occasion Vasile Baltac, Kovacs Gyozo and Balint Domolki met for the first time in Budapest in 1962.

At MECIPT, Iosif Kaufmann wrote a letter to Prof. M. V. Wilkes, FRS father of microprogramming and creator of EDSAC, first British computer. As a result prints of his published papers were sent to Timisoara, inspiring the design. Later on, Prof. Wilkes agreed to accept in his Mathematical Laboratory at the University of Cambridge, England, the young researcher Vasile Baltac, who was able to step up at a different level of computing. After many years Prof. Sir Wilkes remembered those years in an e-mail to Vasile Baltac (figure 5).

Vasile, It gave me very great pleasure to receive your letter. {..}.

Meeting you when you spent a year in Cambridge in 1966-67 was a great experience for me. I had never met anyone before from such a different background who absorbed, as readily and as rapidly as you did, information that we were able to offer you.
By the time you left, you were a fully experienced user of the Cambridge Multiple Access System with a knowledge of its internal working. ... I am glad that I was able to help you in the early part of your career.

I am now 94 years old and not as active as I was. However, I still read my email and respond to it. I shall always be glad to hear from you.

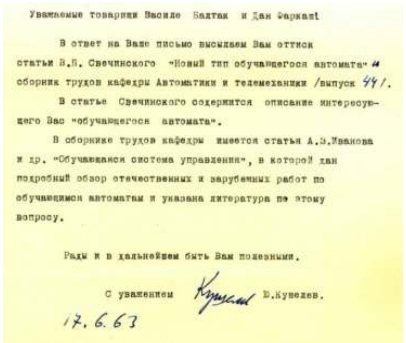
With very kind regards and best wishes... Maurice Wilkes

12 July 2007

Figure 5 Letter of Prof. Sir M. V. Wilkes, FRS to Vasile Baltac (2007)

Other international cooperation at MECIPT included exchanges with laboratories from USSR. Wilhelm Lowenfeld paid a visit to Leningrad (now Sankt Petersburg) and Soviet professors accompanied by Grigore C. Moisil visited Timisoara.

In fact, the teams that built first Romanian computers of the first and second generation were engaged in more than building computers: research in computer applications, language translation, mathematical algorithms, computer aided design, etc. flourished. New areas were explored such as self-learning automata. Vasile Baltac and Dan Farcas exchanged papers on this subject in 1963 with Professor Kusheliov from Moscow Energy University who sent them a paper on the subject (see Figure 6).



Уважаемые товарищи Василе Балтак и Дан Фаркаш

В ответ на Ваше письмо высылаем Вам оттиск статьи Э.Л. Свечинского "Новый тип обучающегося автомата" и сборник трудов кафедры Автоматики и телемеханики /выпуск 44/.

В статье Свечинского содержится описание интересующего Вас "обучающегося автомата".

В сборнике трудов кафедры имеется статья А.Э.Иванова и др. "Обучающаяся система управления", в которой дан подробный обзор отечественных и зарубежных работ по обучающимся автоматам и указана литература по этому вопросу.

Рады и в дальнейшем быть Вам полезными.

С уважением Э.Кушелев.

17.6.63

Figure 6 Letter of Prof. Kusheliov to Vasile Baltac and Dan Farcas (1963)

Computer education

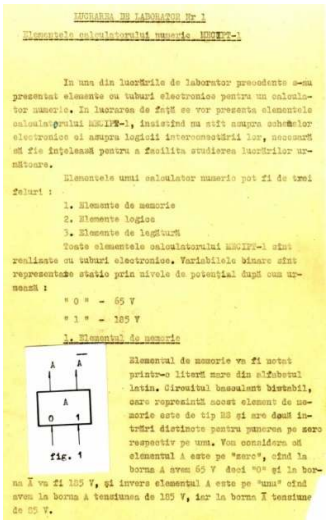
Romania had a tradition in university training in electronic and electrical engineering, mathematics, economics. The first Romanian computers brought the new science into the curricula of several universities. The first generation of computer engineers graduated in 1966 from the Politehnica University of Timisoara. Professor Alexandru Rogojan (1914-1984) was the initiator of this new university diploma courses in close cooperation with MECIPT team. Computer courseware based on MECIPT (1964) is illustrated in

Figures 7 and 8. Early graduates in computer science or engineering appeared in 1967–1968 from universities in Bucharest (the Polytechnic University, Bucharest University's Faculty of Mathematics, the Academy of Economic Sciences) and in Cluj-Napoca (the University of Cluj-Napoca).

Computer Industry in Romania 1968-1990

Despite the great research efforts, the gap between the own computers and Western computers already mass manufactured started to be alarmingly big, both as time lag and technological capability to industrial manufacturing [8] [10].

In 1967, the government of Romania decided to promote the industrial development of computers. A Governmental Committee for Computers and Data Processing was formed in 1967 led by a vice prime-minister and having as the first permanent secretary Prof. Mihai Draganescu (1929-2010). A national plan to introduce computers in the economy was announced. A modern infrastructure of a computer industry was formed. All research teams of the country were merged in 1968 in a computer R&D institute in Bucharest - ITC, with branches in Timisoara and Cluj-Napoca. Victor Toma was appointed as the first scientific director. Manufacturing plants were set up: Computer Plant FCE, Peripheral Plant FEPER together with a service company IIRUC. An Institute of Informatics was also set up in 1970 with the aim at promoting the introduction of computers in the Romanian economy [10]. Missions were sent to USA, UK, France, Italy, Netherland and Japan to assess the best solution for data processing equipment for Romania. The approach was to build a national computer industry able to mass produce data processing equipment for the domestic needs and also for export.


LUCRAREA DE LABORATOR Nr.1

Elementele calculatorului numeric MECIPT-1

In una din lucrările de laborator precedente s-au prezentat elemente cu tuburi electronice pentru un calculator numeric. In lucrarea de față se vor prezenta elementele calculatorului MECIPT-1, insistînd nu atît asupra schemelor electronice cî asupra logicii interconectării lor, necesară ca fie înțeleasă pentru a facilita studierea lucrărilor ur-mătoare.

Elementele unui calculator numeric pot fi de trei feluri :

1. Elemente de memorie
2. Elemente logice
3. Elemente de legătură

Toate elementele calculatorului MECIPT-1 sînt realizate cu tuburi electronice. Variabilele binare sînt reprezentate statîo prin nivele de potențial după cum urmează :

" 0 " - 65 V

" 1 " - 185 V

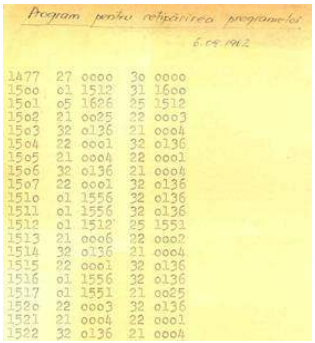
1. Elementul de memorie

fig. 1

Elementul de memorie va fi notat printr-o literă mare din alfabetul latin. Circuitul basculant bistabil, care reprezintă acest element de memorie este de tip RS și are două intrări distincte pentru punerea pe zero respectiv pe unu. Vom considera că elementul A este pe "zero", cînd la borna A avem 65 V deci "0" și la borna $\bar{A}$ va fi 185 V, și invers elementul A este pe "unu" cînd avem la borna A tensiunea de 185 V, iar la borna $\bar{A}$ tensiune de 65 V.

Figure 7 Courseware based on MECIPT (1964)

The final decision was to buy a license for a third generation computer from France, a license for accounting machines from Frieden–Netherlands, a license for calculating machines and to continue search for peripheral equipment licenses (disk drives, magnetic tape memories, printers, etc. While the Romanian computers were performant, they were developed in research laboratories and there was no experience for industrial production.


Program pentru refăcirea programului

6.05.1962

1A77 27 0000 30 0000
1500 01 1512 31 1600
1501 05 1626 25 1512
1502 21 0025 22 0003
1503 32 0136 21 0004
1504 22 0001 32 0136
1505 21 0004 22 0001
1506 32 0136 21 0004
1507 22 0001 32 0136
1510 01 1556 32 0136
1511 01 1556 32 0136
1512 01 1512 25 1551
1513 21 0006 22 0002
1514 32 0136 21 0004
1515 22 0001 32 0136
1516 01 1556 32 0136
1517 01 1551 21 0025
1520 22 0003 32 0136
1521 21 0004 22 0001
1522 32 0136 21 0004

Figure 8 Program for MECIPT-1 written in machine code (1962)

IRIS-50 License

The transfer of technology to Eastern countries was then regulated in the Western world, - an organization known as COCOM approved any transaction that may affect the West. All major companies in the US, UK, Japan and other countries mentioned that they would export to Romania complete computers, but no subassemblies, parts and technology to manufacture them.

The only country that agreed to offer a manufacturing license was France, led at those times by General De Gaulle. France was out of military structure of NATO and upset by the decision of US Administration to block the delivery of a supercomputer CDC 6600 to France, had launched its own program to build computers, the famous *Plan Calcul*. A new company was formed: CII – *Compagnie Internationale pour L'Informatique*, the production of a new third generation computer *IRIS-50* has started, other companies were engaged in manufacturing integrated circuits (*Thompson CSF*) and peripherals (*Sperac*).

In May 1968 *General De Gaulle*, then President of France, paid a state visit to Romania. As a result it was agreed not only to deliver to Romania the plans of IRIS-50, a third generation computer, but to deliver subassemblies, components, technology and what was decisive to deliver also an integrated circuit components plant and a printed circuit board plant [21]. This was a very serious leap forward for the Romanian electronic industry.

A first big national debate started at time. A group, mostly industrialists, supported the license from France and the creation of an industry. Another group, mostly economists, was in favor of importing IBM computers. In the end the crisis was settled by Ceausescu, in power since 1965, which was in favor of an industry.

While in principle agreeing with the creation of a computer industry, Victor Toma was against IRIS-50 license, his wish being the industrial reproduction of his CIFA computers, obviously not a solution for the country. He resigned in 1969 and in his place was appointed the then young Vasile Baltac.

FELIX computer family

IRIS-50 was renamed in Romania as FELIX C-256. The ancient name of the present Romania when it was a Roman province was *Dacia Felix*. So in the 1960s the name *Dacia* was given to Romanian cars produced under

a license from Renault[4] and *Felix* to Romanian computers. C-256 was related to capacity of internal memory that was at IRIS 50 of 256 Kilobytes. The operating system was SIRIS 2. The production of Felix C-256 started in 1970. FELIX computers were not IBM compatible, as IRIS-50 was a computer based on the structure of a computer called *Sigma 7,* manufactured by a US company SDS.
ITC promoted the concept: buy a license and further develop it by your own R&D. This meant that independently from CII, the institute started immediately to develop the license as a computer family. First new member was a smaller member called C-32. For this model a new operating system was developed including file manager and assembler. Next was a bigger member C-512/1024, also with a new operating system fully developed in the country HELIOS. The upward compatibility for application programs was assured.
The production of C-32 started in 1972 and of FELIX C-512 in 1975. Altogether, 650 FELIX mainframes compatible IRIS were produced 1970-1990. Mostly of these computers were installed in Romania, but 11 were exported to P. R. China. The number of FELIX C-256 computers identical with IRIS-50 produced was most probably 160 [22]. An additional number of 15 pieces of a mainframe called FELIX 5000 developed in the country with an advanced hardware technology and the new operating system HELIOS was produced 1988-1990.
Initially, IRIS computers were delivered with French *Sperac* disk drives, *Ampex* core memories, *Ampex* tape memories, *Control Data* printers. Sperac drives proved to be unreliable and were replaced by Control Data drives.
The search for manufacturing licenses for peripherals was launched 1970-1973. The main result was cooperation with *Control Data Corporation – CDC*, but also with *Ampex* and other US companies.
Due to COCOM regulations the technology for core memory existent in IRIS-50 was not received, complete blocks been imported. The technology was developed by domestic R&D at *ITC Timisoara Branch* and produced later at the newly set *Timisoara Electronic Memory Factory*- FMECTC.

RCD peripherals
Control Data Corporation - CDC agreed to cooperate on peripheral equipment manufacturing. During the negotiations it was concluded that the necessary technology transfer approval will be easier if CDC keeps a participation in the project. Then, a joint venture company Rom Control Data – RCD was set up in 1973, the Romanian partner keeping 55% of the shares. RCD initially produced disk drives, tape transports, drum printers, matrix printers, plotters, etc.
RCD was an elite member of the Romanian computer industry with high quality products. Romanian computer exports were favored configuring computers with RCD peripherals, more reliable than the peripherals made in other Eastern countries.
CDC expected also a direct export of peripherals to the big P. R. China market, never achieved mainly by currency transfer problems.

Minicomputers
Following the world trend, two minicomputer families were developed in Romania: INDEPENDENT and CORAL. The first minicomputer INDEPENDENT I-100 created by ITC was launched in 1977 on the occasion of centenary of Romania's independence as a state (1877-1977). The name is related with this event.
This time after a second national debate the compatibility with a world recognized minicomputer was chosen and INDEPENDENT -100 was made compatible with DEC PDP-11/34. The INDEPENDENT I-100 model was followed in 1979 by the more powerful I-102F.
The CORAL family was launched a few years later in 1979 by FCE with a different technology with more Western components, fully compatible with INDEPENDENT family and using the same operation systems.
Both INDEPENDENT and CORAL families were configured with Rom Control Data peripherals and they were quite competitive, being exported in many countries: Czechoslovakia, East Germany, P. R. China, Middle East countries, etc. An estimated 4500 minicomputers of INDEPENDENT and CORAL families were produced.

Microcomputers, PCs
Beginning 1974-1975 microcomputers and latter PCs stated to be produced in Bucharest and Timisoara. They followed the world pattern being built around INTEL microprocessors. Statistics do not exist, but only FCE produced 52.000 pieces of M-8 to M-216.

Operating systems and application software
The first generation computers CIFA-1, MECIPT-1, DACICC-1 and CIFA 101 were programmed in machine code (figure 7) and were not compatible among them. The second generation had rudiments of operating systems and assemblers.
FELIX family was initialy using licensed operating system SIRIS -2, upgraded to SIRIS -3.

[4] Now a successful Renault trade mark

Beginning 1970 in ITC a software engineering concept was introduced with separate teams for development, testing, validation. The operating systems were developed in Bucharest, compilers in Cluj-Napoca and assemblers in Timisoara.
DOS-C32 and DOS C-64 opwerating systems were developed for junior members of FELIX family C-32 and C-64.
A new original operationg systems for FELIX larger mainframes HELIOS was developed, probably the first major operation system fully developed in Eastern Europe.
Two operating systems for minicomputers AMS and MINOS were developed in ITC based on their DEC PDP and VAX models RSX and VMS.

ES EVM
Not only Romania, but all Eastern countries started programs to build computers on an industrial base. In 1968 Soviet Union had the initiative to create a unified series of mainframes called ES EVM (Edinaya Sistema Electronnykh Vytchislitel'nykh Mashin – Unified series of Electronic Computing Machines). The decision taken was to make computers compatible with IBM 360 series, of course without the approval of IBM. But so did Western companies such as Amdahl, Siemens and Hitachi [23]. The main reason was not to replicate the high cost of software development. The models were called Ryad (Series).
Romania's participation was insignificant as FELIX computers were not compatible with IBM 360. Romanian experts were present mainly in application software task groups. Participants to the meetings in 1968-1969 were not able to understand Romanian delegations obvious reservation on any technical decisions, as details about IRIS-50 deal were not yet released. Romania already had the decision not to manufacture Ryad computers.

SM EVM
A similar organization was created to produce minicomputers. The name was SM EVM (Systema Malyh Electronnykh Vytchislitel'nykh Mashin - System of Mini Computers). The multi-national decision was to make them compatible with DEC PDP-11 and VAX.
This time, Romania was quite active in this organization the PDP compatible minicomputers INDEPENDENT I-100 and I-102F, being internationally commissioned and as a result exported in many Eastern countries, except USSR.

The Intergovernmental Commission on Cooperation in the field of the Computer technology (MPK po VT)
An international organization was created in the 1970s to promote cooperation in the field of computer technology. Its name was MPK po VT (Mejpravytelnaya Comisya po Vytschyslitelynoi Technike - *The Intergovernmental Commission on Cooperation in the field of the Computer technology)*. All COMECON countries and Cuba were members.
Its structure included:

- Council of Chief Designers for ES EVM
- Council of Chief Designers for SM EVM
- Council for Applications
- Economic Council
- Council for service and Maintenance

Technical decisions were taken in the councils. As said, Romania was not very interested in ES EVM (Ryad) computers, its range FELIX being not compatible with IBM. However, the participation in SM EVM was important with INDEPENDENT range very popular in Eastern Europe.
The economic decisions were taken mostly by Soviet Union and were politically based. Bulgaria was the great winner, being designated the main manufacturer of disk drives exported in large quantities to USSR at prices much higher than world prices (For example, a 7 MB disk drive was sold for 25.000 rubles, while in USA was 5.000 USD). Using higher prices than world prices was a more general practice in COMECON, but computer related products were at the highest prices possible. As USSR exported to Comecon countries raw materials at prices closer to world prices, buying computers and computer equipment at huge prices became a political tool. Due to Romania's independent political position in COMECON and Warsaw Pact, exports of Romania to USSR were under strict embargo.

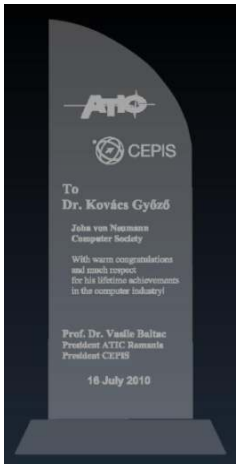


Figure 9 ATIC/CEPIS recognition of Kovacs Gyozo

Coordination Center

The day to day coordinate activities a Coordination Center was set up in Moscow with representatives from all country members.
The commission ceased its activity in 1990, but not officially all members left. It seems that the coordination center still exists under old name [24], but it is not clear

what represents.

Computer Industry post 1989

The transition to market economy has completely changed the industry. The transition was quick as it had deep roots in the past. The existence of first and second generation of computers developed in Romania accelerated the creation in 1968-1970 of a computer industry, as Romania had a base of several hundreds of high level specialists.
The 1980 decade marked an autarchy that damaged the computer industry, all western imports being forbidden by Ceausescu's decision. However, the presence in SM EVM preserved the links and the industry had still grown at a pace superior to other industries.
Most important, in 1989 as a result of the existence of a computer industry and networks of computing centers, Romania had more than 100,000 trained IT people.
Now Romania is a major player in IT and, despite specific brain drain, the country had in 2013 more than 1,4 Billion Euros exports of software and IT services [29], all major IT multinational being present in the country.

Figure 10 Participants to MECPT 50 years celebration in Timisoara 2011

Computer History

ATIC Events
ATIC – IT&C Association of Romania is one of active promoters of computer history in various forms. By cooperation with IEEE the international award Computer Pioneer was given to Grigore C. Moisil. Several conferences were organized in cooperation with Romanian Academy [26, 27]. ATIC awards were given on several occasions to computer pioneers. One such award was given in cooperation with CEPIS to computer pioneer Kovacs Gyozo from Hungary (figure 8).

MECIPT 50 Years

A special celebration was organized in 2011 marking 50 years of MECIPT-1. That included a dedicated conference, marking with a commemorative plaque the building where MECIPT was built and a meeting of veterans (figure 10) and a book [27].
On this occasion the Banat Museum finished the restoration of some parts of MECIPT 1 and 2 and opened a Computer History branch in Timisoara.

Figure 11 MECIPT-1 Control desk and drum memory restored on 50 years anniversary

Restoration of MECIPT by Banat Museum
A special work has been done at the Museum of Banat by a team lead by Maria Mitzu, expert in metal – ceramics restoration, in cooperation with ATIC represented by Horia Gligor [28]. The time deteriorated the computer components. The command board, two logical circuits with electronic tubes and the memory of magnetic roll have been restored and preserved.
The restoration continues.

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APPENDIX

MECIPT 1 RESTORATION AND CONSERVATION

Author: Expert in metal – ceramics restoration: Mîţu Maria Museum of Banat Timisoara

In 1961 MECIPT 1 started to be used, the first computer realized by The Politehnic Institute of Timişoara. The time passing and the rough conditions deteriorated the computer components (photo 1). The command board, two logical circuits with electronic tubes and the memory of magnetic roll have been restored and preserved.
It was necessary to execute some physical and chemical operations in order to recondition all these objects. The command board was the first piece that needed to be restored.
The commission formed of Dr. Ciubotaru Dan Leopold, the manager of Museum of Banat, Timişoara, Dr. Eng. Horia Gligor, from The Politehnic University of Timişoara, prof. Dudaş Vasile, the History Section chief, drd. Dan Octavian Paul, The Zonal Laboratory chief and Mîţu Maria, expert in metal - ceramics restoration, decided to restore the computer components. According to this, there has been made a material report needed for the command board restoration.

The Command Desk

The first step is the photography before the restoration (photo 2) , followed by dust removal and disassembling of the deteriorated plates. The degreasing was made with organic solvents (acetones) . The removal of the oxide deposit from the metal frames was made physically and chemically. We used a round wire brush installed on a little electric engine (dental mill), an easy bath on H3 PO4 (phosphoric acid) 20% solution with inhibitor, followed by successive brushings under water flush and neutralization with distilled water to neutral ph. Then followed a free draining , at room's temperature. On the deteriorated melamine panels we completed the losses with the same material. For mobility, there were mounted 4 wheels, followed by the chromatic integration of the metal body and panels (photo 3) and the installing of all components.
On March 25 of 2011 we celebrated 50 years since the MECIPT – 1 was put into service and this Command Desk was exposed on the entrance lobby of the Polytechnic University Rectorship. Today, MECIPT – 1 can be found in the exhibition rooms of the Museum of Banat, Timişoara.
The restoration process did not finished with the Command Desk restoration, it continued and worked up the interest of several persons, especially Dr. Eng. Horia Gligor. We continued with the restoration of the two logical circuits with electronic tubes and the computer's memory, process that was finished on October.

Computer Memory restoration and conservation

Taking photos of the computer memory was the first step before the restoration. This step was followed by dust removal and degreasing where necessary. I must mention that this component was less deteriorated than the others. The removal of the oxide deposit from the metal frames was physically made, by using the round wire brush. The next step was chromatic integration – using acrylic dyestuff, followed by spraying with silicone oil for conservation.

The two Logical Circuits with electronic tubes - restoration and conservation

These pieces were more deteriorated because of the bad storage conditions.
First of all, the electronic tubes were disassembled; this was followed by the same phases as above, the circuits having significant oxide deposit which was completely removed by using a more resistant round wire brush, with a higher yield. The next step was chromatic integration, followed by conservation – using silicone oil – and taking pictures in the final phase of the process. (photo 4)

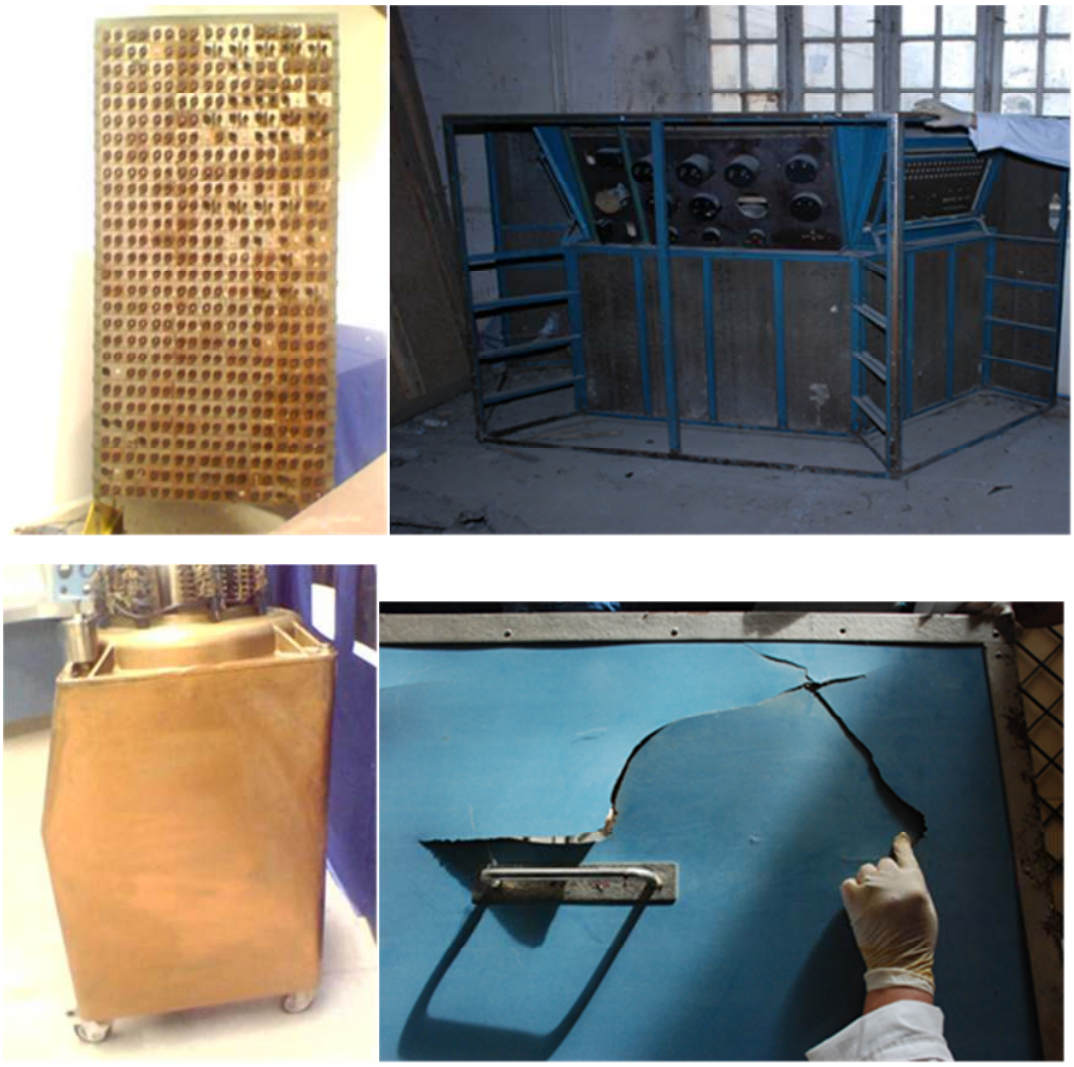

Photo 1

Photo 2

Photo 3

Photo 4