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NEWSLETTER

28th INTERNATIONAL OLYMPIAD IN INFORMATICS

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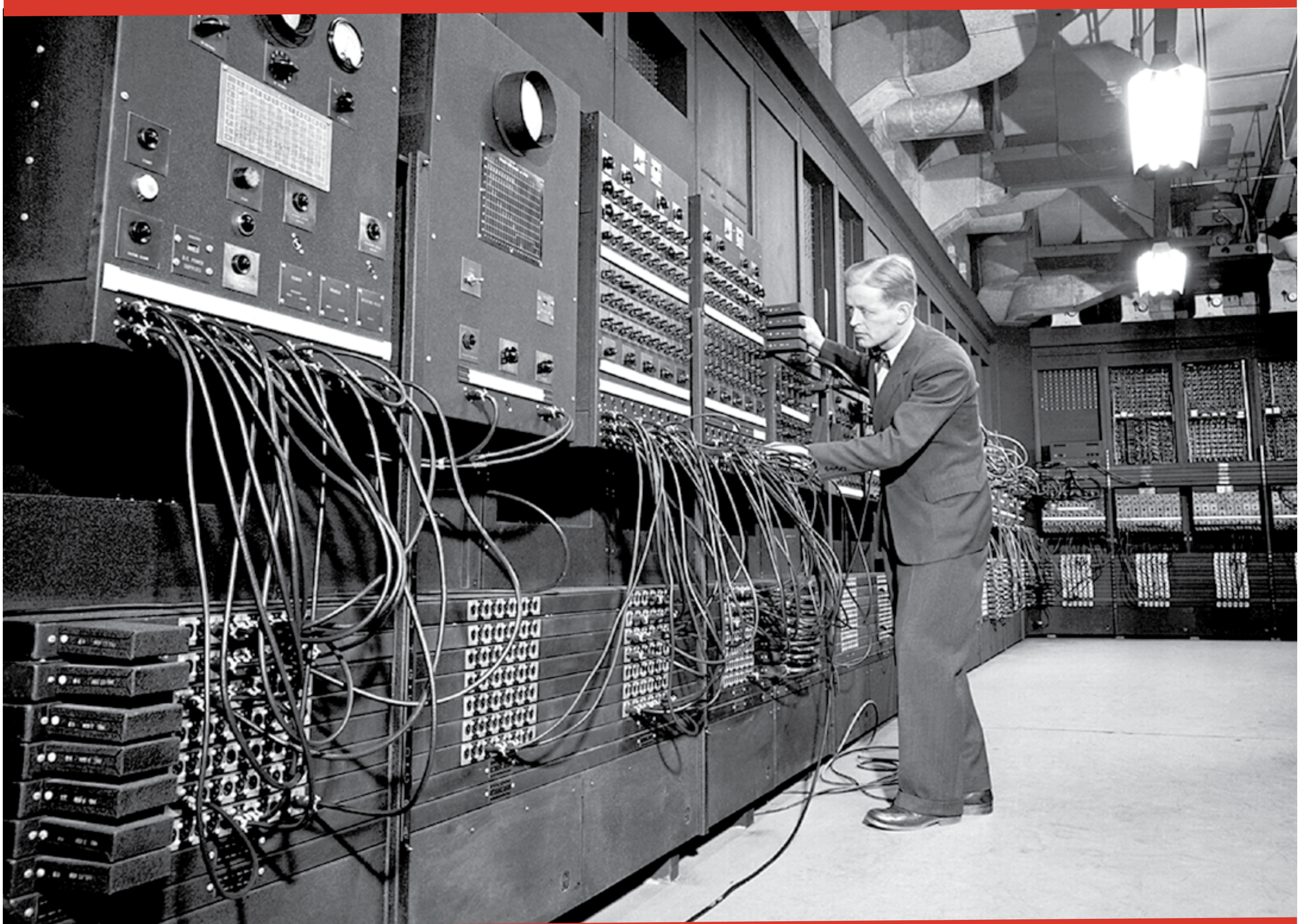


IOI 2016

THE IOI IS COMING TO RUSSIA IN A LANDMARK YEAR, AS 2016 WILL BE THE 70TH ANNIVERSARY OF THE CREATION OF THE FIRST COMPUTER, A MOMENT CONSIDERED TO MARK THE BEGINNING OF DIGITAL CIVILISATION.

The age of the computer first took hold on 14 February 1946, with the launch of the first fully-functional electronic computer ENIAC (USA). Two years later – on 4 December 1948 – the first Soviet computer was presented to the world.

A special medal IOI-2016 has been released commemorating the 70th anniversary of the first computer.

The International Olympiad in Informatics has had a significant impact of the development of IT worldwide. It has enabled computer informatics to find a place on the school syllabus in countries across the world and helped to open IT talent. The IOI offers gifted young people an unprecedented means of career growth.

That the IOI has become a worldwide means of support for children studying informatics is evident in the fact that in the last decade alone, the competition has taken place in every continent on the globe: Europe, Asia, Africa, North and South America and Australia. The IOI encompasses students of IT from every corner of the planet, and that is a real success for the IOI-society.

How it all began

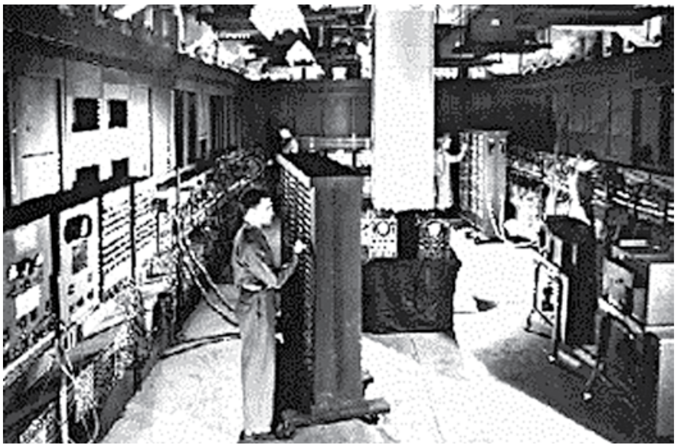
The world's first computer weighed 30 tonnes and comprised 18,000 electronic lamps.

Compared to modern-day PCs, ENIAC moved at a snail's pace: its running speed a mere 5000 operations a second. It was in use for nine years, up until 1955.

But who created the first electronic computer?

The first trial mechanical programming machine, Z1, was created in 1938, and in 1941, using Z1 as a base, the German engineer Conrad Zuse created Z3 – the world's first calculation machine, which displayed all the properties of a modern-day computer.

In 1942 the American physicist John Atanasoff, assisted by his graduate student Clifford Berry, developed and began to assemble the first electronic computer. The project was never completed, but greatly influenced the eventual creation of ENIAC.



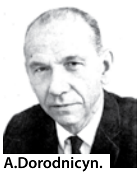
ENIAC's design and construction was financed by the United States Army, Ordnance Corps, Research and Development Command, led by Major General Gladeon M. Barnes. The construction contract was signed on June 5, 1943; work on the computer began in secret at the University of Pennsylvania's Moore School of Electrical Engineering the following month, under the code name "Project PX", with John Grist Brainerd as principal investigator.

ENIAC was designed by John Mauchly and J. Presper Eckert of the University of Pennsylvania, U.S. The team of design engineers assisting the development included Robert F. Shaw (function tables), Jeffrey Chuan Chu (divider/square-rooter), Thomas Kite Sharpless (master programmer), Frank Mural (master programmer), Arthur Burks (multiplier), Harry Huskey (reader/printer) and Jack Davis (accumulators). In 1946, the researchers resigned from the University of Pennsylvania and formed the Eckert-Mauchly Computer Corporation.

So the question of when, where and by whom the first computer was created can thus be answered in various ways. If the term "computer" includes mechanical machines, then Germany's Conrad Zuse can reasonably be considered the creator of the first computer; in a strictly electronic sense, however, the answer would be John Mauchly when he created ENIAC in the USA.

The developers of BESM-6: (From left to right) Front: V.L. Ivanov, S.A. Lebedev, V.I. Semenikhin; Back: V.I. Laut, A.N. Tomilin, V.M. Smirnov, A.A. Sokolov, L.A. Zak, V.A. Melnikov (Moscow, USSR, 1969,Izofond PM).

Key players in Russian informatics in the 20th Century



A.Dorodnicyn.

M.Keldysh.

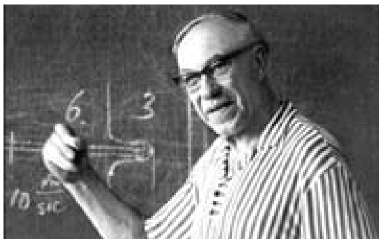
A.Lyapunov.

A.Ershov.

S.Lavrov.

I.Brook.

B.Rameev.



M.Lavrentjev.

N.Moiseev.

S.Sobolev.

The first computer in the USSR.

Ural-1

BESM-6.

The labours of Lebedev

The development and formation of computer technology in Russia owes a great debt to the outstanding scientist and academic that was Sergei Lebedev.

It was Lebedev who built the USSR's first electronic computing machine in the difficult post-war years, and followed his initial success with ever more productive computers. The appearance of an electronic computing machine constituted a technological revolution which fundamentally altered the development of society.

Abroad, the principles of computer construction and electronic calculation were developed by von Neumann, and the classic make-up of a computer has come to be known as the "von Neumann architecture". The sheer scale of Lebedev's scientific efforts is shown in the fact that despite the information blackout of those years, Sergei Alekseyevich reached the same conclusions as von Neumann, but half a year earlier.

Completing the theoretical calculations enabled Lebedev to move on to practical work.

The first significant breakthrough was the Small Electronic Calculation Machine (MESM), which was put into action by the commission in 1951, and by 1952 was already being used to solve important scientific problems in key fields such as thermonuclear procedures, space flights, rocketry, long-range transmission and many others.

BESM-1 consisted of 5000 electronic lamps, and at a processing speed of around 10,000 operations a second on 39-bit binary numbers, was one of the fastest processing machines in the world. BESM was first launched in 1952, with official tests conducted in 1953. That very same year, Lebedev became the director of the Institute of Precision Mechanics and Computer Engineering.

S.Lebedev.

In 1996 the IEEE Computer Society granted Sergei Lebedev the Computer Pioneer Award medal for outstanding innovation in the field of information technology – the society's highest recognition of achievement. The medal was presented to his family and today resides in the Moscow Polytechnic Museum. The front of the medal is adorned with the great English mathematician Charles Babbage; the inscription on the reverse reads: "To Sergei Alekseyevich Lebedev – creator of electronic computing machines".

Meanwhile in the Ukrainian National Academy of Sciences in Kiev, where MESM was developed, are housed the design documentation and files containing materials on the first Soviet electronic computing machine, much of which compiled by Lebedev himself. Written in someone's hand, over 50 years ago, are the words "Keep forever". A fitting tribute to Lebedev's legacy.

Informatics in Russia

It's hard to believe that 70 years ago humanity did not know what a computer was.

But in the 21st century, computers have become a part of every school, office and house. Nowadays informatics and information technology top the list of fastest-developing sciences over the last decades.

Computer informatics in Russia began in the USSR with the work of Isaak Brook. In August 1948, together with the engineer Bashir Rameyev (himself a Tatar), they presented their project and applied for a patent for an "Automatic digital electronic machine".

Certificate of authorship No.10475, granted by the State Committee for Implementation of Frontier Technology in the National Economy on 4 December 1948, was the first officially registered document proving that from that moment, work on an electronic computing machine had begun in the USSR.

This date marks the start of modern informatics as a new science in the USSR and in Russia, combining millennia of human knowledge with contemporary computer informatics: from the first books and libraries to modern electronic devices allowing immediate access to the greatest achievements of science and culture from around the globe. This day is rightly considered the birth of Russian informatics.

Soviet computing machines were fully competitive with their Western counterparts for the best part of two and half decades. In terms of computing algorithms and theoretical informatics, Russia was and is at the cutting edge.

Sadly, for many years contact between Soviet and Western academics and engineers was severely limited, and so Russian scientists received very little in the way of international recognition.

However, thanks to the efforts of the Russian National Sub-committee of the IEEE Computer Society, the pioneering works of Sergei Lebedev and Alexei Lyapunov have received the appreciation they deserved. Both were awarded the IEEE Computer Society's highest award – the Computer Pioneer Award for outstanding work in the development of informatics and computer technology.

Boris Babayan – Creator of the supercomputer

How does the evolution of programming techniques seem to someone who has devoted more than half a century to developing computer technology?

To answer this question is Boris Babayan, associate of the Russian Academy of Sciences, professor, "Micro-processing technologies" department chair at the Moscow Institute of Physics and Technology, Intel Fellow, holder of both the State and Lenin Awards, and most importantly of all – the architect behind the computer systems "Elbrus-1", "Elbrus-2" and "Elbrus-3". During the Soviet period, Boris Babayan was widely known in very select circles; the majority of his work was stamped with the word "classified".

HOW IT WAS

What is computing? It is the realisation of algorithms using hardware and programming languages.

Algorithms are somewhat abstract, timeless. Like a number, for example. There could be any number of different algorithms, all of them eternal. They can be broken down into two components: temporal (sequence of execution of operations) and spatial (objects with which the operations work). Hardware, on the other hand, is not fixed – it changes drastically over time.

At the beginning hardware was very primitive. I enrolled in PhysTech in 1951, before even BESM-1 (Lit. "Large electronic-computing machine") was up and running. At that point, one bit of information was shown by two electronic lamps. That's a cubic decimetre! An unbelievable size. One executing device took up three rooms. And then look at today: an unbelievable number of executors can fit into the space of one crystal.

It's very easy to turn a parallel algorithm into a linear one in space and time. That's how the first machines were made. The programmers worked with whatever the hardware developers gave them. The programs were miniscule as well, so it was easier and more efficient to write in bits than in a language of some kind.

The life of a programmer was not a simple one. Each new machine came with a new system of commands. All programs had to be rewritten. Security and keeping processes from each other did not even come into the equation – the machine would be in a separate room and someone would have the key – that was the security. Everyone carried their data around with them, while the machine worked on a single operation.

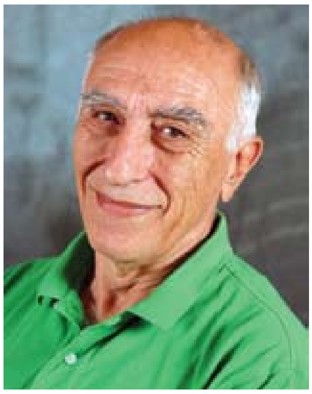
«ELBRUS»

We worked on means of supporting high-level languages. At the time, in 1972, Algol and Fortran were considered to be the languages for high-level programming, but we quickly realised that existing languages were geared towards existing machines where everything is sequential, and that's not the right approach.

Eventually we concluded that a high-level language is a dynamic language with strict index control. This conclusion was also reached independently from us by Niklaus Wirth – he created the type-dynamic language Euler, but it was too inefficient and as a result was not supported by the hardware.

From the very beginning we meant for types to be hardware-tested. We created an actual language – "El-76", on which the "Elbrus" operating system was based. It was created by 26 people in the mid-70s, and was multi-program, multi-processor, multi-terminal.

Our machines were used in systems with extreme levels of responsibility: Moscow's missile defence system, mission control, nuclear projects in Arzamas. And all the while everyone commented that debugging on this machine was 10 times as quick as on older ones.



Boris Artashesovich Babayan is a Soviet and Russian academic, pedagogue, associate of the Academy of Sciences of the USSR, developer of computer technologies, and associate of the Russian Academy of Sciences. He has authored works on architectural principles of computer complex construction and computer software. He is a holder of the State and Lenin Awards and is the first European scientist to be awarded the title of Intel Fellow.

We released "Elbrus-1", our first machine, in '78. This was the first test for the operating system, and as a result Elbrus-1 was widely employed in our country until about 1982-3. At around this time, many universities across the globe had begun to research type safety (means of eliminating type errors). Intel were also interested in this approach, and went on to create the typesafe machine IAPX 432. At the time I wrote that the machine was flawed and would break down in a few months. And so it did.

After that, the world gave up on hardware support of high-level languages. Even today no-one remembers them, even though we had a fully functional manifestation of the idea.

These days high-level languages can be broken down into two groups: Java and C. Java offers strict type control, but is very inefficient. There is no dynamism. In the other group are the C languages, but the general consensus is that they are not high-level languages. It seems that no-one apart from our Elbrus guys knows about the very real advantages of high-level languages.

HOW IT SHOULD BE

The most important thing is to ensure that both the spatial and temporal components in a program are completely equivalent to the algorithm. Then the machine becomes very simple.

If we manage to replace the variety of devices we currently own with a single universal processor, all competition will transfer to the programs themselves. The very algorithms which are now being played out on specialised hardware will be able to be written in programs and executed on a universal machine. Then we would be able to use one device – a universal smartphone – for a multitude of products.

Competition in the IT industry today does not differ massively to how it was in the beginning when everything was linear. The spectre of compatibility looms large: sequential time, sequential space. This is the pattern followed to this day. If we can fix that, we will move closer to the natural limit of algorithms.

And in some ways, that limit has already been reached. A machine is a finite entity; the quantity of different processors is theoretically numbered. So one machine within this finite multitude must be the best. Such is the genius of the developers at Intel that they have practically reached this optimum. They've not reached it theoretically, but in practice. Now they must go one further – introduce an obvious concurrency. Now the algorithm itself is the limit. If a concurrency exists in the algorithm, it cannot be avoided.

A. Nevolin

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