***The Comparative Analysis Of The History Of The Computer Science And The Computer Engineering In The USA And Ukraine.***

**HOWARD H. AIKEN AND THE COMPUTER**

Howard Aiken's contributions to the development of the computer -notably the Harvard Mark I (IBM ASSC) machine, and its successor the Mark II - are often excluded from the mainstream history of computers on two technicalities. The first is that Mark I and Mark II were electro-mechanical rather than electronic; the second one is that Aiken was never convinced that computer programs should be treated as data in what has come to be known as the von Neumann concept, or the stored program.  
It is not proposed to discuss here the origins and significance of the stored program. Nor I wish to deal with the related problem of whether the machines before the stored program were or were not “computers”. This subject is complicated by the confusion in actual names given to machines. For example, the ENIAC, which did not incorporate a stored program, was officially named a computer: Electronic Numeral Integrator And Computer. But the first stored-program machine to be put into regular operation was Maurice Wiles' EDSAC: Electronic Delay Storage Automatic Calculator. It seems to be rather senseless to deny many truly significant innovations (by H.H.Aiken and by Eckert and Mauchly), which played an important role in the history of computers, on the arbitrary ground that they did not incorporate the stored-program concept. Additionally, in the case of Aiken, it is significant that there is a current computer technology that does not incorporate the stored programs and that is designated as (at least by TEXAS INSTRUMENTS) as “Harvard architecture”, though, it should more properly be called “Aiken architecture”. In this technology the program is fix and not subject to any alteration save by intent - as in some computers used for telephone switching and in ROM.  
  
 **OPERATION OF THE ENIAC.**  
  
Aiken was a visionary, a man ahead of his times. Grace Hopper and others remember his prediction in the late 1940s, even before the vacuum tube had been wholly replaced by the transistor, that the time would come when a machine even more powerful than the giant machines of those days could be fitted into a space as small as a shoe box.  
Some weeks before his death Aiken had made another prediction. He pointed out that hardware considerations alone did not give a true picture of computer costs. As hardware has become cheaper, software has been apt to get more expensive. And then he gave us his final prediction: “The time will come”, he said, “when manufacturers will gave away hardware in order to sell software”. Time alone will tell whether or not this was his final look ahead into the future.

DEVELOPMENT OF COMPUTERS IN THE USA

In the early 1960s, when computers were hulking mainframes that took up entire rooms, engineers were already toying with the then - extravagant notion of building a computer intended for the sole use of one person. by the early 1970s, researches at Xerox's Polo Alto Research Center (Xerox PARC) had realized that the pace of improvement in the technology of semiconductors - the chips of silicon that are the building blocks of present-day electronics - meant that sooner or later the PC would be extravagant no longer. They foresaw that computing power would someday be so cheap that engineers would be able to afford to devote a great deal of it simply to making non-technical people more comfortable with these new information - handling tools. in their labs, they developed or refined much of what constitutes PCs today, from “mouse” pointing devices to software “windows”.  
Although the work at Xerox PARC was crucial, it was not the spark that took PCs out of the hands of experts and into the popular imagination. That happened inauspiciously in January 1975, when the magazine *Popular Electronics* put a new kit for hobbyists, called the Altair, on its cover. for the first time, anybody with $400 and a soldering iron could buy and assemble his own computer. The Altair inspired Steve Wosniak and Steve Jobs to build the first Apple computer, and a young college dropout named Bill Gates to write software for it. Meanwhile. the person who deserves the credit for inventing the Altair, an engineer named Ed Roberts, left the industry he had spawned to go to medical school. Now he is a doctor in small town in central Georgia.  
To this day, researchers at Xerox and elsewhere pooh-pooh the Altair as too primitive to have made use of the technology they felt was needed to bring PCs to the masses. In a sense, they are right. The Altair incorporated one of the first single-chip microprocessor - a semiconductor chip, that contained all the basic circuits needed to do calculations - called the Intel 8080. Although the 8080 was advanced for its time, it was far too slow to support the mouse, windows, and elaborate software Xerox had developed. Indeed, it wasn't until 1984, when Apple Computer's Macintosh burst onto the scene, that PCs were powerful enough to fulfill the original vision of researchers. “The kind of computing that people are trying to do today is just what we made at PARC in the early 1970s,” says Alan Kay, a former Xerox researcher who jumped to Apple in the early 1980s.

MACINTOSH PERFORMA 6200/6300  
Researchers today are proceeding in the same spirit that motivated Kay and his Xerox PARC colleagues in the 1970s: to make information more accessible to ordinary people. But a look into today's research labs reveals very little that resembles what we think of now as a PC. For one thing, researchers seem eager to abandon the keyboard and monitor that are the PC's trademarks. Instead they are trying to devise PCs with interpretive powers that are more humanlike - PCs that can hear you and see you, can tell when you're in a bad mood and know to ask questions when they don't understand something.  
It is impossible to predict the invention that, like the Altair, crystallize new approaches in a way that captures people's imagination.

Top 20 computer systems

From soldering irons to SparcStations, from MITS to Macintosh, personal computers have evolved from do-it-yourself kits for electronic hobbyists into machines that practically leap out of the box and set themselves up. What enabled them to get from there to here? Innovation and determination. Here are top 20 systems that made that rapid evolution possible.  
 **MITS Altair 8800**There once was a time when you could buy a top-of-the-line computer for $395. The only catch was that you had to build it yourself. Although the Altair 8800 wasn't actually the first personal computer (Scelbi Computer Consulting`s 8008-based Scelbi-8H kit probably took that honor in 1973), it grabbed attention. MITS sold 2000 of them in 1975 - more than any single computer before it.   
Based on Intel`s 8-bit 8080 processor, the Altair 8800 kit included 256 bytes of memory (upgradable, of course) and a toggle-switch-and-LED front panel. For amenities such as keyboard, video terminals, and storage devices, you had to go to one of the companies that sprang up to support the Altair with expansion cards. In 1975, MITS offered 4- and 8-KB Altair versions of BASIC, the first product developed by Bill Gates` and Paul Allen`s new company, Microsoft.  
If the personal computer hobbyists movement was simmering, 1975 saw it come to a boil with the introduction of the Altair 8800.  
 **Apple II**Those of you who think of the IBM PC as the quintessential business computers may be in for a surprise: The Apple II (together with VisiCalc) was what really made people to look at personal computers as business tools, not just toys.  
The Apple II debuted at the first West Coast Computer Fair in San Francisco in 1977. With built-in keyboard, graphics display, eight readily accessible expansion slots, and BASIC built-into ROM, the Apple II was actually easy to use. Some of its innovations, like built-in high-resolution color graphics and a high-level language with graphics commands, are still extraordinary features in desk top machines.  
With a 6502 CPU, 16 KB of RAM, a 16-KB ROM, a cassette interface that never really worked well (most Apple It ended up with the floppy drive the was announced in 1978), and color graphics, the Apple II sold for $1298.  
 **Commondore PET**Also introduced at the first West Coast Computer Fair, Commondore`s PET (Personal Electronic Transactor) started a long line of expensive personal computers that brought computers to the masses. (The VIC-20 that followed was the first computer to sell 1 million units, and the Commondore 64 after that was the first to offer a whopping 64 KB of memory.)  
The keyboard and small monochrome display both fit in the same one-piece unit. Like the Apple II, the PET ran on MOS Technology's 6502. Its $795 price, key to the Pet's popularity supplied only 4 KB of RAM but included a built-in cassette tape drive for data storage and 8-KB version of Microsoft BASIC in its 14-KB ROM.  
 **Radio Shack TRS-80**Remember the Trash 80? Sold at local Radio Shack stores in your choice of color (Mercedes Silver), the TRS-80 was the first ready-to-go computer to use Zilog`s Z80 processor.  
The base unit was essentially a thick keyboard with 4 KB of RAM and 4 KB of ROM (which included BASIC). An optional expansion box that connected by ribbon cable allowed for memory expansion. A Pink Pearl eraser was standard equipment to keep those ribbon cable connections clean.  
Much of the first software for this system was distributed on audiocassettes played in from Radio Shack cassette recorders.  
 **Osborne 1 Portable**By the end of the 1970s, garage start-ups were pass. Fortunately there were other entrepreneurial possibilities. Take Adam Osborne, for example. He sold Osborne Books to McGraw-Hill and started Osborne Computer. Its first product, the 24-pound Osborne 1 Portable, boasted a low price of $1795.  
More important, Osborne established the practice of bundling software - in spades. The Osborne 1 came with nearly $1500 worth of programs: WordStar, SuperCalc, BASIC, and a slew of CP/M utilities.  
Business was looking good until Osborne preannounced its next version while sitting on a warehouse full of Osborne 1S. Oops. Reorganization under Chapter 11 followed soon thereafter.  
 **Xerox Star**This is the system that launched a thousand innovations in 1981. The work of some of the best people at Xerox PARC (Palo Alto Research Center) went into it. Several of these - the mouse and a desktop GUI with icons - showed up two years later in Apple`s Lisa and Macintosh computers. The Star wasn't what you would call a commercial success, however. The main problem seemed to be how much it cost. It would be nice to believe that someone shifted a decimal point somewhere: The pricing started at $50,000.  
 **IBM PC**Irony of ironies that someone at mainframe-centric IBM recognized the business potential in personal computers. The result was in 1981 landmark announcement of the IBM PC. Thanks to an open architecture, IBM's clout, and Lotus 1-2-3 (announced one year later), the PC and its progeny made business micros legitimate and transformed the personal computer world.  
The PC used Intel`s 16-bit 8088, and for $3000, it came with 64 KB of RAM and a 51/4-inch floppy drive. The printer adapter and monochrome monitor were extras, as was the color graphics adapter.  
 **Compaq Portable**Compaq's Portable almost single-handedly created the PC clone market. Although that was about all you could do with it single-handedly - it weighed a ton. Columbia Data Products just preceded Compaq that year with the first true IBM PC clone but didn't survive. It was Compaq's quickly gained reputation for engineering and quality, and its essentially 100 percent IBM compatibility (reverse-engineering, of course), that legitimized the clone market. But was it really designed on a napkin?  
 **Radio Shack TRS-80 Model 100**Years before PC-compatible subnotebook computers, Radio Shack came out with a book-size portable with a combination of features, battery life, weight, and price that is still unbeatable. (Of course, the Z80-based Model 100 didn't have to run Windows.)  
The $800 Model 100 had only an 8-row by 40-column reflective LCD (large at the time) but supplied ROM-based applications (including text editor, communications program, and BASIC interpreter), a built-in modem, I/O ports, nonvolatile RAM, and a great keyboard. Wieghing under 4 pounds, and with a battery life measured in weeks (on four AA batteries), the Model 100 quickly became the first popular laptop, especially among journalists.  
With its battery-backed RAM, the Model 100 was always in standby mode, ready to take notes, write a report, or go on-line. NEC`s PC 8201 was essentially the same Kyocera-manufectured system.  
 **Apple Macintosh**Whether you saw it as a seductive invitation to personal computing or a cop-out to wimps who were afraid of a command line, Apple`s Macintosh and its GUI generated even more excitement than the IBM PC. Apple`s R&D people were inspired by critical ideas from Xerox PARK (and practiced on Apple`s Lisa) but added many of their own ideas to create a polished product that changed the way people use computers.  
The original Macintosh used Motorola's 16-bit 68000 microprocessor. At $2495, the system offered a built-in-high-resolution monochrome display, the Mac OS, and a single-button mouse. With only 128 KB of RAM, the Mac was underpowered at first. But Apple included some key applications that made the Macintosh immediately useful. (It was MacPaint that finally showed people what a mouse is good for.) **IBM AT**George Orwell didn't foresee the AT in 1984. Maybe it was because Big Blue, not Big Brother, was playing its cards close to its chest. The IBM AT set new standards for performance and storage capacity. Intel`s blazingly fast 286 CPU running at 6 MHz and 16-bit bus structure gave the AT several times the performance of previous IBM systems. Hard drive capacity doubled from 10 MB to 20 MB (41 MB if you installed two drives - just donut ask how they did the math), and the cost per megabyte dropped dramatically.  
New 16-bit expansion slots meant new (and faster) expansion cards but maintained downward compatibility with old 8-bit cards. These hardware changes and new high-density 1.2-MB floppy drives meant a new version of PC-DOS (the dreaded 3.0).  
The price for an AT with 512 KB of RAM, a serial/parallel adapter, a high-density floppy drive, and a 20-MB hard drive was well over $5000 - but much less than what the pundits expected.  
 **Commondore Amiga 1000**The Amiga introduced the world to multimedia. Although it cost only $1200, the 68000-based Amiga 1000 did graphics, sound, and video well enough that many broadcast professionals adopted it for special effects. Its sophisticated multimedia hardware design was complex for a personal computer, as was its multitasking, windowing OS.  
 **Compaq Deskrpo 386**While IBM was busy developing (would “wasting time on” be a better phrase?) proprietary Micro Channel PS/2 system, clone vendors ALR and Compaq wrestled away control of the x86 architecture and introduced the first 386-based systems, the Access 386 and Deskpro 386. Both systems maintained backward compatibility with the 286-based AT.  
Compaq's Deskpro 386 had a further performance innovation in its Flex bus architecture. Compaq split the x86 external bus into two separate buses: a high-speed local bus to support memory chips fast enough for the 16-MHz 386, and a slower I/O bus that supported existing expansion cards.  
 **Apple Macintosh II**When you first looked at the Macintosh II, you may have said, “But it looks just like a PC. ”You would have been right. Apple decided it was wiser to give users a case they could open so they could upgrade it themselves. The monitor in its 68020-powered machine was a separate unit that typically sat on top of the CPU case.  
 **Next Nextstation**UNIX had never been easy to use , and only now, 10 years later, are we getting back to that level. Unfortunately, Steve Job's cube never developed the software base it needed for long-term survival. Nonetheless, it survived as an inspiration for future workstations.  
Priced at less than $10,000, the elegant Nextstation came with a 25-MHz 68030 CPU, a 68882 FPU, 8 MB of RAM, and the first commercial magneto-optical drive (256-MB capacity). It also had a built-in DSP (digital signal processor). The programming language was object-oriented C, and the OS was a version of UNIX, sugarcoated with a consistent GUI that rivaled Apple`s.  
 **NEC UltraLite**Necks UltraLite is the portable that put *subnotebook* into the lexicon. Like Radio Shack's TRS-80 Model 100, the UltraLite was a 4-pounder ahead of its time. Unlike the Model 100, it was expensive (starting price, $2999), but it could run MS-DOS. (The burden of running Windows wasn't yet thrust upon its shoulders.)  
Fans liked the 4.4-pound UltraLite for its trim size and portability, but it really needed one of today's tiny hard drives. It used battery-backed DRAM (1 MB, expandable to 2 MB) for storage, with ROM-based Traveling Software's LapLink to move stored data to a desk top PC.  
Foreshadowing PCMCIA, the UltraLite had a socket that accepted credit-card-size ROM cards holding popular applications like WordPerfect or Lotus 1-2-3, or a battery-backed 256-KB RAM card.  
 **Sun SparcStation 1**  
It wasn't the first RISK workstation, nor even the first Sun system to use Sun's new SPARC chip. But the SparcStation 1 set a new standard for price/performance, churning out 12.5 MIPS at a starting price of only $8995 - about what you might spend for a fully configured Macintosh. Sun sold lots of systems and made the words *SparcStation* and *workstation* synonymous in many peoples minds.  
The SparcStation 1 also introduced S-Bus, Sun's proprietary 32-bit synchronous bus, which ran at the same 20-MHz speed as the CPU.  
 **IBM RS/6000**  
Sometimes, when IBM decides to do something, it does it right.(Other times... Well, remember the PC jr.?)The RS/6000 allowed IBM to enter the workstation market. The RS/6000`s RISK processor chip set (RIOS) racked up speed records and introduced many to term *suprscalar*. But its price was more than competitive. IBM pushed third-party software support, and as a result, many desktop publishing, CAD, and scientific applications ported to the RS/6000, running under AIX, IBM's UNIX.  
A shrunken version of the multichip RS/6000 architecture serves as the basis for the single-chip PowerPC, the non-x86-compatible processor with the best chance of competing with Intel.  
 **Apple Power Macintosh**  
Not many companies have made the transition from CISC to RISK this well. The Power Macintosh represents Apple`s well-planned and successful leap to bridge two disparate hardware platforms. Older Macs run Motorola's 680x0 CISK line, which is running out of steam; the Power Macs run existing 680x0-based applications yet provide Power PC performance, a combination that sold over a million systems in a year.  
 **IBM ThinkPad 701C**  
It is not often anymore that a new computer inspires gee-whiz sentiment, but IBM's Butterfly subnotebook does, with its marvelous expanding keyboard. The 701C`s two-part keyboard solves the last major piece in the puzzle of building of usable subnotebook: how to provide comfortable touch-typing.(OK, so the floppy drive is sill external.)  
With a full-size keyboard and a 10.4-inch screen, the 4.5-pound 701C compares favorably with full-size notebooks. Battery life is good, too.  
**The development of computers in ukraine and the former USSR**

The government and the authorities had paid serious attention to the development of the computer industry right after the Second World War. The leading bodies considered this task to be one of the principal for the national economy.  
Up to the beginning of the 1950s there were only small productive capacities which specialized in the producing accounting and account-perforating (punching) machines. The electronic numerical computer engineering was only arising and the productive capacities for it were close to the naught.  
The first serious steps in the development of production base were made initially in the late 1950s when the work on creating the first industry samples of the electronic counting machines was finished and there were created M-20, “Ural-1”, “Minsk-1”, which together with their semi-conductor successors (M-220, “Ural-11-14”, “Minsk-22” and “Minsk-32”) created in the 1960s were the main ones in the USSR until the computers of the third generation were put into the serial production, that is until the early 1970s.  
In the 1960s the science-research and assembling base was enlarged. As the result of this measures, all researches connected with creating and putting into the serial production of semi-conductor electronic computing machines were almost finished. That allowed to stop the production of the first generation machines beginning from the 1964.  
Next decades the whole branch of the computer engineering had been created. The important steps were undertaken to widen the productive capacities for the 3d generation machines.

**Kiev  
the homecity of mesm**

MESM was conceived by S.A.Lebedev to be a model of a Big Electronic Computing Machine (BESM). At first it was called the *Model* of the Big Electronic Computing Machine, but ,later, in the process of its creation there appeared the evident expediency of transforming it in a small computer. For that reason there were added: the impute-output devices, magnetic drum storage, the register capacity was enhanced; and the word “*Model*” was changed for “*Malaya*” (Small).  
S.A.Lebedev was proposed to head the Institute of Energetics in Kiev. After a year; when the Institute of was divided into two departments: the electronical one and the department of heat-and-power engineering, Lebedev became the director of the first one. He also added his laboratory of analogue computation to the already existing ones of the electronical type. At once he began to work on computer science instead of the usual, routine researches in the field of engineering means of stabilization and structures of automated devices. Lebedev was awarded the State Prize of the USSR. Since autumn 1948 Lebedev directed his laboratory towards creating the MESM. The most difficult part of the work was the practical creation of MESM. It might be only the many-sided experience of the researches that allowed the scientist to fulfill the task perfectly; whereas one inaccuracy was made: the hall at the ground-floor of a two-storied building was assigned for MESM and when, at last, the MESM was assembled and switched on, 6,000 of red-hot electronic lamps created the “tropics” in the hall, so they had to remove a part of the ceiling to decrease the temperature.  
In autumn 1951 the machine executed a complex program rather stabile.  
  
ÒÍÅ MESM WITH SOME OF THE PERSONAL (KIEV, 1951)  
Finally all the tests were over and on December, 15 the MESM was put into operation.  
If to remember those short terms the MESM was projected, assembled, and debugged - in two years - and taking into consideration that only 12 people (including Lebedev) took part in the creating who were helped by 15 engineers we shall see that S.A.Lebedev and his team accomplished a feat (200 engineers and many workers besides 13 main leaders took part in the creation of the first American computer ENIAC).  
As life have showed the foundations of the computer-building laid by Lebedev are used in modern computers without any fundamental changes. Nowadays they are well known:

1. such devices an arithmetic and memory input-output and control ones should be a part of a computer architecture;
2. the program of computing is encoded and stored in the memory as numbers;
3. the binary system should be used for encoding the numbers and commands;
4. the computations should be made automatically basing on the program stored in the memory and operations on commands;
5. besides arithmetic, logical operations are used: comparisons, conjunction, disjunction, and negation;
6. the hierarchy memory method is used;
7. the numerical methods are used for solving the tasks.

The main fault of The 70s  
or  
the years of “might-have-been hopes”

The great accumulated experience in creating computers, the profound comparison of our domestic achievements with the new examples of foreign computer technique prompted the scientists that it is possible to create the computing means of new generation meeting the world standards. Of that opinion were many outstanding Ukrainian scientists of that time - Lebedev, Dorodnitsin, Glushkov and others. They proceeded from quite a favorable situation in the country.  
The computerization of national economy was considered as one of the most essential tasks. The decision to create the United system of computers - the machines of new generation on integrals.  
The USA were the first to create the *families* of computers. In 1963-64 the IBM Company worked out the IBM-360 system. It comprised the models with different capacities for which a wide range of software was created.  
A decision concerning the third generation of computers (their structure and architecture) was to be made in the USSR in the late 60s.  
But instead of making the decision based on the scientific grounds concerning the future of the United system of computers the Ministry of Electronic Industry issued the administrative order to copy the IBM-360 system. The leaders of the Ministry did not take into consideration the opinion of the leading scientists of the country.  
Despite the fact that there were enough grounds for thinking the 70s would bring new big progresses, those years were the step back due to the fault way dictated by the highest authorities from above.

**The comparison of the computer development  
in the usa and ukraine**

At the time when the computer science was just uprising this two countries were one of the most noticeably influential. There were a lot of talented scientists and inventors in both of them. But the situation in Ukraine (which at that time was one of 15 Republics of the former USSR) was complicated, on one hand, with the consequences of the Second World War and, on the other hand, at a certain period Cybernetics and Computer Science were not acknowledged. Of cause, later it went to the past, but nevertheless it played a negative role on the Ukrainian computer development.  
It also should be noticed that in America they paid more attention to the development of computers for civil and later personal use. But in Ukraine the attention was mainly focused on the military and industrial needs.  
Another interesting aspect of the Ukrainian computer development was the process of the 70s when “sovietizing” of the IBM-360 system became the first step on the way of weakening of positions achieved by the Soviet machinery construction the first two decades of its development. The next step that led to the further lag was the mindless copying by the SU Ministry of Electronic Industry and putting into production the next American elaborations in the field of microprocessor equipment.  
The natural final stage was buying in enormous quantities of foreign computers last years and pressing to the deep background our domestic researches, and developments, and the computer-building industry on the whole.  
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# CONCLUSION

Having analyzed the development of computer science in two countries I have found some similar and some distinctive features in the arising of computers.  
First of all, I would like to say that at the first stages the two countries rubbed shoulders with each other. But then, at a certain stage the USSR was sadly mistaken having copied the IBM-360 out of date technology. Estimating the discussion of possible ways of the computer technique development in the former USSR in late 1960s - early 1970s from the today point of view it can be noticed that we have chosen a worse if not the worst one. The only progressive way was to base on our domestic researches and to collaborate with the west-European companies in working out the new generation of machines. Thus we would reach the world level of production, and we would have a real base for the further development together with leading European companies.  
Unfortunately the last twenty years may be called the years of “unrealized possibilities”. Today it is still possible to change the situation; but tomorrow it will be too late.  
Will the new times come? Will there be a new renaissance of science, engineering and national economy as it was in the post-war period? Only one thing remains for us - that is to wait, to hope and to do our best to reach the final goal.

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