By <u>Jeremy Reimer</u> (mailto:jeremy_reimer@hotmail.com)

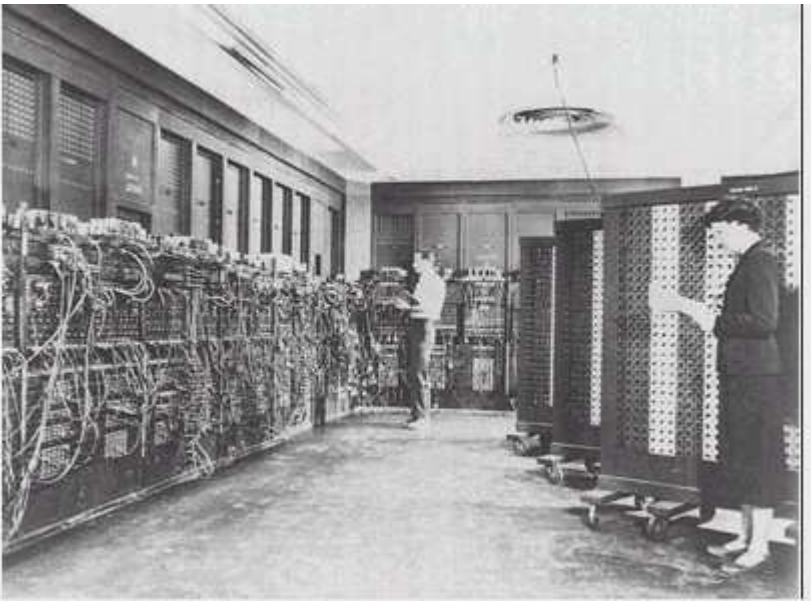**17 Grudzień 2005 23:06**

Introduction

Electronic digital computers moved out of science fiction and into reality during World War II. Less powerful than a modern pocket calculator, the first real job for these massive machines was to speed up the calculation of artillery firing tables.

Thirty years later, computers had firmly cemented themselves in the public imagination. They were huge boxes, covered with blinking lights and whirring reels of tape. Banks and big corporations all had computer rooms, closely guarded by a priesthood of programmers and administrators. Science fiction novels and movies imagined impossibly brilliant supercomputers that guided spaceships and controlled societies, yet they were still room-sized behemoths. The idea of a personal computer, something small and light enough for someone to pick up and carry around, wasn't even on the radar.

Colossus

Even the major computer companies at the time didn't see the point of small machines. The mainframe industry was dominated by IBM, who was the Snow White to the Seven Dwarves of Burroughs, CDC, GE, Honeywell, NCR, RCA and Univac. Mainframes took up entire floors and cost millions of dollars. There was also a market for slightly smaller and less expensive minicomputers, machines the size of a few refrigerators that sold for under a hundred thousand dollars. This industry was dominated by Digital Equipment Corporation (DEC), with strong competitors such as Data General, Hewlett-Packard and Honeywell-Bull. None of these companies considered the personal computer to be an idea worth pursuing.

ENIAC, the second electronic digital computer, circa 1943

It wasn't that the technology wasn't ready. Intel, at the time primarily a manufacturer of memory chips, had invented the first microprocessor (the 4-bit 4004) in 1971. This was followed up with the 8-bit 8008 in 1972 and the more-capable 8080 chip in 1974. However, Intel didn't see the potential of its own product, considering it to be useful mainly for calculators, traffic lights, and other embedded applications. Intel had built a reference design with a microprocessor and some memory that could be programmed using a terminal, but it was used for testing purposes only. An Intel engineer approached chairman Gordon Moore with the idea for turning it into a consumer product, but Moore, with a rare lack of insight, couldn't see any practical purpose for such a device and decided not to go ahead with the project.

The task of inventing the personal computer, and with it the personal computer industry, was left instead to the manager of a small, little-known calculator company in Albuquerque, New Mexico. His name was Ed Roberts.

The Altair (1975-77)

Ed Roberts always dreamed of becoming a doctor, but instead he wound up starting his own private electronics company. Micro Instrumentation and Telemetry Systems (MITS) started out selling model rocket telemetry kits and

subsequently recently branched out into selling pocket calculators. By 1973, the company had a couple of dozen employees, and was doing fairly well. Then electronics giants that manufactured their own CPUs and other chips, like Texas Instruments, began a calculator price war that nearly drove MITS into bankruptcy.

With his company over US$300,000 in debt, Roberts took a fateful trip to the bank, to discuss whether or not he would have to shut down the company. He told the bank manager about his plans to sell a kit computer to electronics hobbyists. The manager wanted to know how many Roberts expected to sell each month, and he guessed that they might sell as many as a hundred. This was enough to stave off the company's execution.

In the mean time, Les Solomon, the technical editor of Popular Electronics magazine, was looking for a cover story to compete with Radio Electronics' article on how to assemble a machine called the "Mark 8" from a collection of bare parts including an Intel 8008 CPU. The Mark 8 was merely a list of parts, but Solomon wanted a story about a fully-fledged personal computer that you could go out and buy, if not in fully assembled form, at least in an easy-to-build kit. He contacted Ed Roberts who told him about his plans, and a mockup of Robert's design made it on the cover of Popular Electronics' January 1975 issue.

The machine needed a name. Les Solomon asked his young daughter what the computer on Star Trek was called, and she replied "Computer." Telling her that was less than helpful, she retorted that they should call it the "Altair," as that was where the Enterprise was headed that week. The name stuck.

The Altair looked in some respects like a modern desktop computer (at least in the days when desktops actually sat on your desk). It was encased in a metal and plastic rectangular box that opened up to allow the user to connect add-on boards. However, there was no keyboard or display offered with the system initially. The machine was programmed by flicking a series of toggle switches on the front panel, and the results of the program could be viewed on a long string of LEDs. Roberts admitted that the design for the front panel was significantly inspired by the panel of Data General's popular Nova minicomputer.

The original Altair computer, with its top off

Ed Roberts had worked out a deal with Intel to purchase 8080 CPUs. Normally, these CPUs sold for US$300 in small quantities, but Roberts was able to purchase a batch with cosmetic defects for only US$75 each. This enabled him to set the price of the Altair kit at US$399. He calculated that he would need to sell 200 units over the product's lifetime to reach the break-even point. After a week of being available on the market, MITS had orders for over 2,000 machines.

Basically, the hobby electronics community went nuts. The pent-up demand for a personal computer was so great that MITS had far more orders than it could possibly ship. People were willing to wait for months for the company to work its way through the backlog, just so they could get a machine of their own. Some people even set up camp outside MITS headquarters.

The success of the new machine spawned a collection add-on hardware products and imitators. Other companies cloned the Altair's 100-pin 8-bit bus, and called it the "S-100" bus, infuriating Roberts. Boards that interfaced with teletypes and CRT terminals made the Altair resemble a modern computer. A young HP employee named Steve Wozniak saw the Altair at a Homebrew Computer Club meeting and decided that he could make something like it himself, which ended up becoming the Apple I. And an unknown college dropout named Bill Gates, together with his partner Paul Allen, wrote a version of the programming language BASIC for the Altair, forming a company called

Micro-Soft in the process. He would later drop the hyphen and the capital S, and make billions of dollars.

MITS struggled to keep up with demand, not only for the Altair, but for the 4k memory cards that were required to run BASIC. Competition from other add-on companies and new computer companies hurt MITS, and Roberts eventually sold the company to the hard disk manufacturer Pertec in May 1977. Pertec management failed to move the company forward and it went bankrupt a few years later.

The Altair ultimately failed in the marketplace, but it sold thousands of units and jump-started the entire personal computer industry. The concept and form factor of desktop computers, with add-on boards that plugged into a standardized bus, the concept of third-party software, and the idea of retail computer dealers and dealer expositions were all pioneered by MITS. Ed Roberts took the millions from the sale of his company and reinvested them in himself. He completed his medical training and achieved his life-long dream of becoming a doctor. He still keeps an Altair in his office.

Ed Roberts, with his creation

The first trinity: the Commodore PET, the Radio-Shack TRS-80, and

the Apple][(1977-1980)

 Despite the success of the Altair, the big computer companies still considered these small machines to be the domain of a few slightly screwy enthusiasts, and not a product for the mass market. This didn't stop many of these same enthusiasts from starting their own computer companies, almost all of which no longer exist today.

There was Processor Technology's Sol, designed by Lee Felsenstein who went on to design the first "portable" computer, the Osborne 1. There was Cromemco, which was started by two Stanford students, and made add-on boards for the Altair before designing their own computer products. Vector Graphic also started making S-100 memory boards before introducing their own computer system. A company called IMSAI built an Altair clone and had the distinction of having the first personal computer ever to be featured in a movie, Wargames, before imploding due to overexpansion and forced est training for management that distorted fiscal realities. SouthWest Technical Products (SWTP) built a machine using Motorola's new 6800 CPU. In the UK, the NASCOM-1 kit attempted to mirror the success of the Altair on the other side of the Atlantic.

By the end of 1976, over 40,000 personal computers had been sold, with MITS selling approximately 25%, IMSAI 17%, Processor Technology 8%, and SWTP 8%. There were dozens of other companies selling computers. Many of them sold too few products to even show up on the radar. In ten months, Steve Jobs and Steve Wozniak had managed to sell only 175 units of the hand-assembled Apple I motherboard, which lacked a keyboard, monitor, or even a case.

From left to right: a Vector Graphic, SOL-20, SWTP 6800.
Bottom row: NASCOM-1, Apple I, Cromenco Z-2, IMSAI 8080

The stage was set for the a second, more professional, group of electronics
companies to introduce their own products.

The holy trinity: Commodore PET, TRS-80 Model I, and the Apple][

The first of these was a calculator firm called Commodore, which was started as a typewriter repair company in 1954 by Auschwitz survivor Jack Tramiel. When Texas Instruments started their price war that nearly drove MITS out of business, Tramiel realized that it was vital for his company to own semiconductor technology that could produce chips in-house, just like TI did. He found ex-Motorola engineer Chuck Peddle, who had invented a vastly cheaper 6800 clone called the 6502. Commodore bought Peddle's company, MOS Technologies, and let him continue working on his own projects. One of these projects became the PET computer, ostensibly standing for Personal Electronic Transactor, but Commodore engineers sometimes called it Peddle's Ego Trip after it wound up becoming a smash success.

The PET had its own built-in monitor, keyboard, and tape drive, giving early computer users everything they needed to start working. It even had a version of BASIC purchased from Bill Gates' tiny Micro-Soft company. The keyboard was a cheap "Chiclet" job that was replaced in later models. Commodore sold 4,000 PETs in 1978 and sales kept rising. A base model PET sold for US$795.
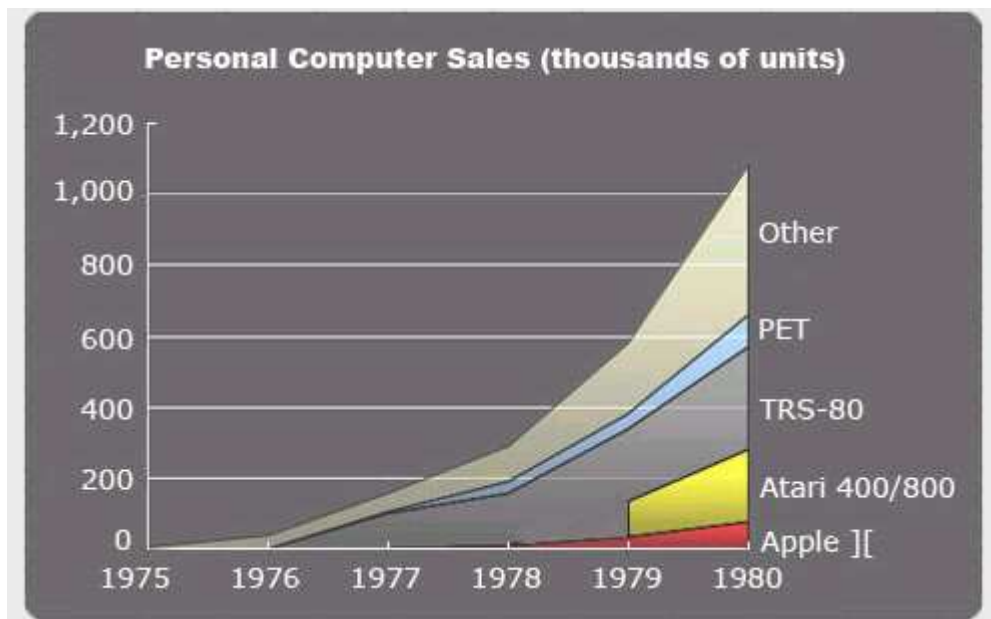
Elsewhere, the electronics chain Radio Shack decided that they should get into the personal computer business. Their Tandy-Radio Shack 80, or TRS-80 (known to some computer hobbyists as a "Trash-80," in the first of many platform flamewars to come) was available in modular form, with the keyboard and computer selling for US$399, the black and white display for US$199, and a cassette storage system for US$49. The main advantage that Radio Shack had over the others was their built-in distribution system. Each of their 3,000 stores was given a single TRS-80 to sell, but within a month the company had over 10,000 orders. The lowly TRS-80 quickly became the top-selling personal computer of the trinity, as new models enhanced its capabilities.

The final computer of the trinity was made by the only company to survive into the modern age as a computer company. The Apple][was a refined version of the Apple I motherboard, with added color, memory capacity, eight expansion slots, and an attractive beige case with a built-in brown keyboard. It retailed for US$1,298 with 4k of RAM, or US$1,698 with 16k. Initial sales were sluggish as Apple sold only 600 machines in 1977, mostly due to the high price compared to the PET and TRS-80. However, with the addition of the fast and relatively inexpensive Disk][floppy drive accessory, made possible by an ingenious disk controller using only eight chips that Wozniak designed, the Apple][sold 7,600 units in the following year and 35,000 in 1979. It was still a

distant third compared to the other two machines in the trinity, however.

Apple's response to being in third place involved the genius of Regis McKenna, the former Intel PR executive who had spearheaded "Operation Crush," the predecessor of the "Intel Inside" campaign. McKenna decided that what the company needed was great marketing, so all advertising for the Apple][was glossy and rich, and some ads even claimed that the Apple][was the "best-selling personal computer." It had nowhere near such status at the time.

What really turned the company around, however, was the release of the first ever "killer app." This was VisiCalc, the original spreadsheet application, which was released in 1979. The author, Dan Bricklin, wrote it for the Apple][simply because that machine, borrowed from his publisher Dan Fylstra, was the only one he had available. A combination of great marketing and even better luck propelled the Apple][from an also-ran to a serious contender. In 1981 the company sold 210,000 units, leaving the PET in the dust and nearly equaling the TRS-80's numbers.

Personal computer market share during the "trinity" years

The 8-bit era (1980-1984)

Time Magazine: January 1983

The star of the personal computer was rising. For 1982, Time Magazine featured a generic version as "Machine of the Year," the one and only occasion a nonhuman has won that award. By this time, many new firms had joined the fight, releasing the third generation of machines. Most of these used the 6502 CPU, because of its excellent bang-for-the-buck ratio.

Commodore, realizing that the PET was running out of gas, started a number of new 8-bit computer projects based around their 6502 and custom chips developed in-house by MOS Technologies. One of them, the VIC-20, named after the Video Interface Chip that ran its graphics, was enormously successful. Despite limitations in the VIC chip that could only display 22 columns of text, the colorful and inexpensive computer sold 600,000 units in 1982.

But the big winner for Commodore was yet to come. Rushed into production by shoehorning components into the VIC-20 case, the Commodore 64 made its debut in late 1982 for US$595 with a full 64KB of RAM, the maximum directly addressable by 8-bit CPUs. At the time, computers with that much RAM cost at least three times as much. By integrating the full 64KB of RAM as part of the standard model, the C-64 enabled software developers to write and port stunning high-resolution games to the platform. An improved VIC chip allowed not only 40 column text but supported sprites, making it easier to

create fast-moving, flicker-free game graphics. In addition, a multifrequency synthesized sound chip (the legendary SID) gave the small machine a sweeter voice than any other machine of its time. Sales of this new computer took off, reaching a staggering 2 million units in 1983.

Commodore VIC-20, top. Commodore 64, bottom

This incredible volume, unheard of in the personal computer industry before (and it would still be a respectable figure for a new computer model today!) allowed Commodore to get its final revenge on Texas Instruments. A price war which left the C-64 selling for as little as US$199 caused TI to panic and remove its own computer, the TI-99/4A, from the market.

The Atari 400 and 800

Atari 65XE/130XE Series
8-bit Home Computers

Atari XE Series Computer

In 1985, the new Atari Corp. delivered on its promise to advance the 8-bit Atari system by replacing the 800XL/600XL with the new 130XE and 65XE in 1985. The 65XE is nearly identical to the 800XL in features, minus the PBI. The 130XE, however, offers 128K RAM, plus

the FREDDY chip, supporting the unique (but rarely used) ability for the 6502C and the ANTIC to independently access RAM banks. In addition, the 130XE replaces the PBI port with the Enhanced Cartridge Interface (ECI), continuing the powerful feature of direct memory access.

Atari 65XE : 1994 rok

Atari, flushed with the success of PONG and its 2600 games console, released the 400 and 800 series of computers in 1979. The 400 was essentially a cheaper version of the 800 with less memory and an awkward "membrane" keyboard. Designer Jay Miner had fitted these machines with impressive technology, including a custom blitter chip that could blast large sections of graphics on the screen without involving the CPU. The 400/800 could play games, like Frogger, that were indistinguishable from the arcade versions. However, Atari kept most of the details about its hardware secret in order to try and give an advantage to its in-house software developers. This limited the long-term success of the platform, which peaked at 600,000 units in 1982 and went steadily downhill.

The Atari 800 could have been much more, were it not for an accident of fate. Mighty IBM, the 800-pound gorilla of the computer industry, was starting to worry about being left behind in this new market, which had emerged at dizzying speeds.

"The worry was that we were losing the hearts and minds," IBM executive Jack Sams reminisced. "So the order came down from on high: 'Give me a machine to win back the hearts and minds.'"

At first, IBM thought about rebranding an existing computer, and had selected the Atari 800. However, after a visit to Atari headquarters, where IBM businessmen were literally put in a box and run through the assembly line by unorthodox and sometimes stoned Atari employees, the computing giant decided they would rather build their own computer.

To gain an advantage over existing personal computer models, IBM decided to use the new Intel 8088 CPU, which had a 16-bit memory model making it capable of directly addressing 1MB of memory (although unlike the fully 16-bit 8086, the 8088 chip saved money by being 8-bit externally). Bill Gates, in negotiations at the time for delivering BASIC for this new machine, was tremendously excited about the potential for a 16-bit CPU, and to this day

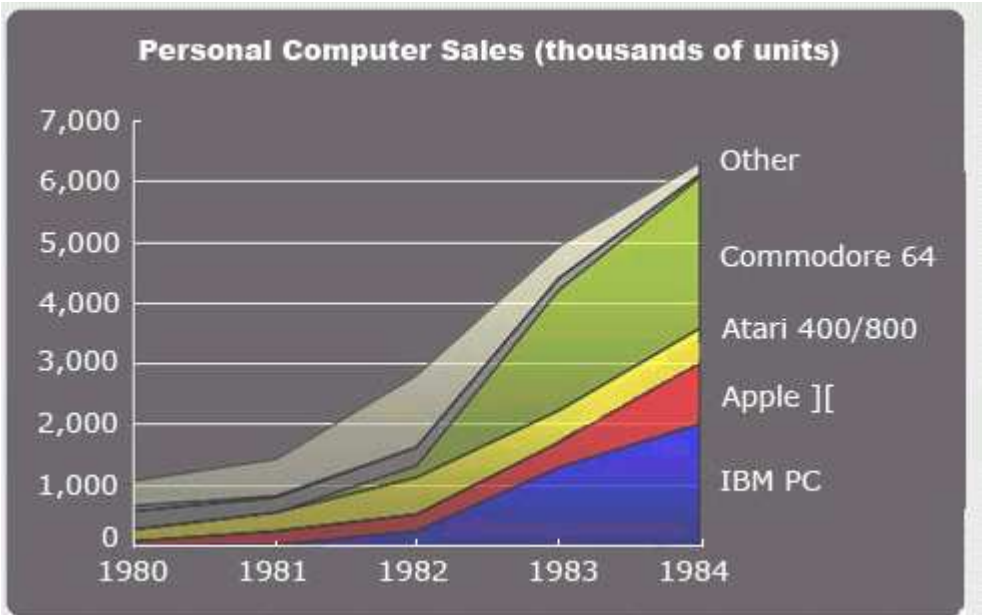claims that his input "tipped the balance" in favor of this chip.

Because the personal computer market was growing so rapidly, a rogue IBM design group in Boca Raton, Florida was given the go-ahead to design and build the new computer in less than a year. This necessitated a few shortcuts in the design, which unlike most IBM computers used primarily off-the-shelf chips. Even the operating system was contracted out to another company. Originally it was meant to be Digital Research, maker of the popular CP/M operating system for 8-bit computers. However, when DR took its time signing IBM's non-disclosure agreements, Microsoft seized its chance and won a deal to provide the operating system instead. A combination of off-the-shelf hardware and an operating system available from a third party made the rise of 100% compatible IBM PC clones possible, once the ROM BIOS of the PC had been successfully reverse-engineered. Compaq was the first company to do so, in 1982, but many others followed.

The original IBM PC, Model 5150. 5150 is also a police code for a severely disturbed person.

The IBM PC was released in late 1981 and retailed for US$2880, with 64k of

RAM and a monitor. Despite the popularity of the IBM brand name, sales were initially sluggish, but picked up dramatically in the following year. The PC's own version of the killer app, the multi-function spreadsheet Lotus 1-2-3, drove many sales. By 1984 the PC and its innumerable clones were selling 2 million units a year, nearly as many as the Commodore 64 and eclipsing older machines like the Apple][. Many personal computer companies saw the PC as a threat. Their answer was to try and beat the giant with superior technology. It almost worked.

Personal Computer Sales (thousands of units)

Other
Commodore 64
Atari 400/800
Apple][
IBM PC

1980 1981 1982 1983 1984

Personal computer marketshare during the 8-bit era

The 16-bit era (1984-1987)

The original, 128k Macintosh, with optional extra 400k floppy drive

In January 1984, Apple announced the Macintosh, a distinctive computer with a built-in 9-inch monochrome screen. Attached to the keyboard was a curious device called a mouse, invented in 1966 by pioneer Doug Engelbart. While Apple had introduced a mouse-driven computer with a graphical user interface the year before with the Lisa, its US$10,000 price tag drove away all but the most enthusiastic early adopters. The Macintosh sold for US$2,495, still quite expensive for 1984 but much more within the reach of ordinary mortals.

The history of the graphical user interface is a long and fascinating tale. By the mid-1980s, almost everyone agreed that windows, icons, a mouse, and a pointer (affectionately referred to as WIMP) was the way of the future. Bill Gates announced the development of Windows in 1983, and many other projects were already underway to combine the power of new 16-bit microprocessors (including the amazing new Motorola 68000) with the flash of WIMP.

The Amiga 1000 came with 256k of RAM, expandable to 512k

Commodore released its powerful Amiga 1000 computer, designed by ex-Atari guru Jay Miner, in 1985. Selling for US$1,495, its 4,096-color graphics, 4-voice stereo sampled sound and preemptive multitasking operating system made it seem like it came from ten years in the future. You could pull down any screen, including the Workbench, to reveal running screens behind, even if they were in different resolutions. Unfortunately, Commodore was in financial difficulties at the time and was unable to properly market the machine. They also took it off the market prematurely and cancelled all advertising, thinking that the advanced 2000 and cheaper 500 models were imminent. Sadly, these were delayed until 1987.

The Atari 520 ST. Later models would double the RAM to 1MB

In addition, Commodore was fighting one of their own. Jack Tramiel had left the company in a dispute with his financial backer, and had purchased Atari's computer division. He spearheaded the rapid development of the Atari ST, sometimes called the "Jackintosh." It also used a 68000 but lacked the Amiga's advanced custom chips and multitasking operating system. Nevertheless, it was still capable of playing great games, and its cheaper price (it originally retailed for US$799 with a monochrome monitor) hurt Amiga sales.
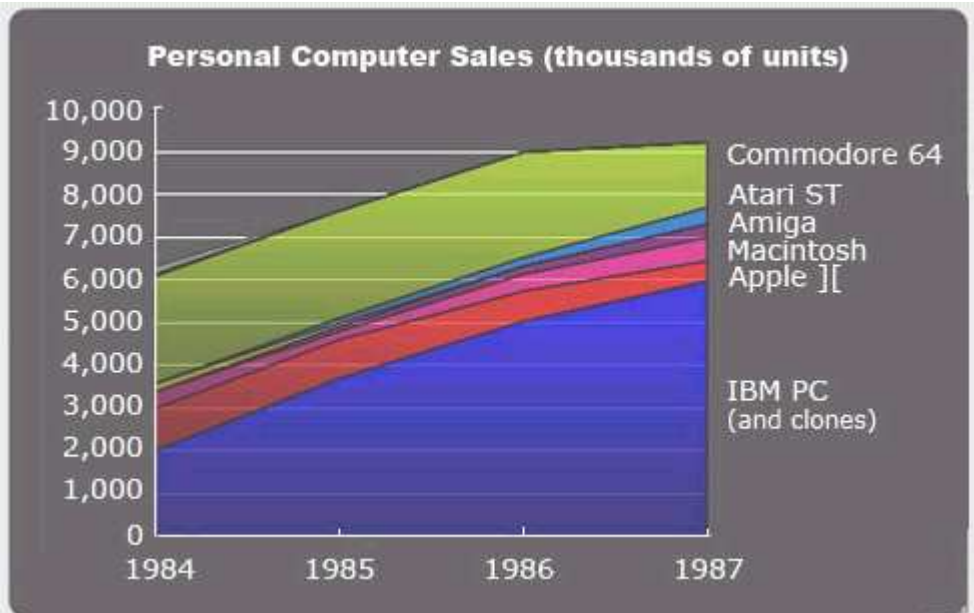
Apple's Macintosh sold reasonably well in 1984 but sales actually went down in the following year, mostly due to limitations with the original 128KB hardware and competition from Commodore and Atari. It too needed a killer app to survive, and it found one in Aldus' PageMaker, released in July 1985. PageMaker jump started the desktop publishing industry. Even though a PC version came out in 1986 and DTP packages Calamus and Pagestream were later released for the Atari and Amiga respectively, the Macintosh had already won the DTP market. This was enough to lift Macintosh sales above both the Amiga and Atari by the end of 1987.

The redoubtable Commodore 64 enjoyed its greatest sales during this era. The combination of low price and a wide variety of software titles made the little machine irresistible, with over 2 million units being sold each year. Software products like Geos brought a graphical user interface to the platform, and Commodore continued to release newer, cheaper models. However, by 1987, 8-bit computers were widely regarded as being behind the times

technologically, and sales began to fall.

In the meantime, sales of IBM PCs and clones continued to relentlessly march ahead. Despite the fact that competing platforms were more powerful and, in the case of the Amiga and Atari ST, less expensive, the PC became acknowledged as the industry standard. By the end of 1986, the PC platform had, for the first time, passed the 50 percent market share mark. It would never look back.

Personal computer market share during the 16-bit era

The rise of the PC (1987-1990)

 In 1985, Bill Gates wrote an amazing memo to Apple management. In the memo, he praised the Macintosh for its innovative design, but noted that it had failed to become a standard, like the IBM PC was becoming. He correctly deduced that it was the advent of inexpensive, 100%-compatible clone computers that was propelling the PC ahead, and that any defects in the design of the computer would eventually be remedied by the combined force of the many companies selling PCs and PC add-on products, such as new graphics cards. He proposed a plan, which Microsoft would help bring to fruition, whereby Apple would license their operating system and hardware design to a number of other computer companies. Microsoft had been an early supporter and promoter of the Macintosh, but Gates feared that without compatible machines, it would fail to become a "second standard."

Apple management ignored the memo, and decided to concentrate instead on making better computers themselves. The Macintosh II, introduced in 1987 for US$5,500, eschewed the original's all-in-one design in favor of a standard desktop chassis that supported add-in cards, and could be connected to a color monitor. Professional users loved it, although the price kept it out of the hands

of most buyers.

The Macintosh II. Users could add their own video cards using the NuBus slots

Commodore finally introduced the more-powerful and -expandable Amiga 2000 (US$1495) and the cheaper Amiga 500 (US$595) with integrated keyboard, in 1987. The latter was expected to take over the Commodore 64's place as a cheap yet powerful home computer for the masses, and sales rose, peaking at over 1 million units in 1991.

Top: Amiga 2000. Bottom: Amiga 500

http://www.zimmers.net/cbmpics/ca2000.html

*The Amiga 2000 is clearly the first mature Amiga computer. Commodore released numerous upgrade cards for this machine, including PC emulators, hard drive cards, and other I/O goodies. The "Zorro" slot was the secret to this new ability. Commodore also released variations on this model, including the 2000HD (2000 with hard drive card and hard drive), as well as the 2500 with a processor upgrade. **Statistics, features, and A2000/A2000HD resources:***

***CPU:** Motorola 68000 7.14mhz **RAM:** 1024 kilobytes Expandable to 9 megabytes **ROM:** 256 kilobytes **Video:** CSG "Daphne/Denise" chip Text: 60 X 32 and 80 X 32 Hires: 320 X 200 through 640 X 512 4096 color palette **Sound:** CSG "Portia/Paula" chip Four voice stereo Sound **Ports:** CSG "Portia/Paula" chip 25 pin Centronics*
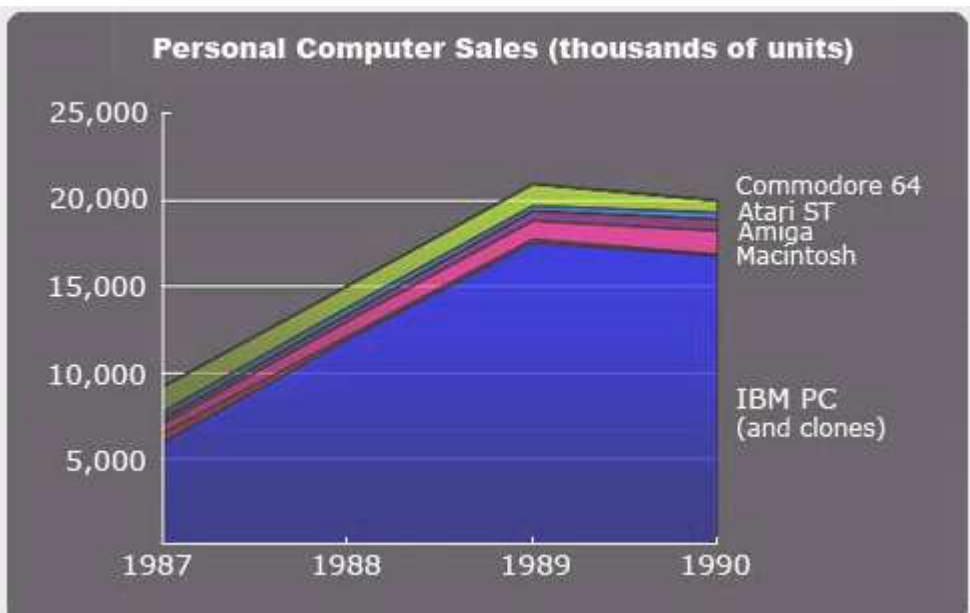
*Parallel port 25 pin RS232 Serial port Stereo RF Sound plugs 9-pin Mouse/Joystick ports (X2) 25-pin Amiga Floppy port 23-pin Amiga Video port Composite RF Video port Internal Zorro and ISA slots **Keyboard:** Full-sized 95 key QWERTY 18 key numeric*
*keypad 4 direction cursor-pad **Extra hardware:** Internal 880K 3.5" Floppy Disk Drive "HD" model has an internal*
200mb hard drive

Amiga 2000HD ECS: 1998rok

Meanwhile, the Atari ST's momentum tailed off, with sales slowly declining as better games started coming out designed specifically for the Amiga 500. Atari did not release any new models of the ST except for a version with extra RAM preinstalled. Thanks to the inclusion of a MIDI port with every model, however, the ST became the computer of choice for digital musicians.

But the real winner of this era was the IBM PC platform. Sales kept increasing, and by 1990 PCs and clone sales had more than tripled to over 16 million a year, leaving all of its competitors behind. The platform went from a 55 market share in 1986 to an 84% share in 1990. The Macintosh stabilized at about 6% market share and the Amiga and Atari ST at around 3% each.

Bill Gates' predictions were coming true, as new, inexpensive graphics cards that cloned the new IBM VGA standard were starting to make the PC a credible game platform. In 1990, Origin released the first Wing Commander game. Its 256-color, scaled, and rotated bitmaps gave the illusion of 3D and made existing 2D space shooters on other computers, game consoles and arcades seem instantly outdated and quaint by comparison. 3D came to role playing games with Ultima Underworld in 1992 and fast-action first-person shooters with Wolfenstein 3D the same year. Now it was the PC that was setting the standard for new games, instead of the Amiga.

Personal computer market share during the late 80s

The end of eras (1990-1994)

 The golden age of PC gaming had arrived, with classics like Wing Commander, DOOM, Ultima 7 and System Shock pushing the boundaries of computer entertainment. At the same time, the PC became easier to use with the release of Windows 3 in 1990 and 3.1 in 1992. The latter operating system proved incredibly popular, pushing PC sales back from their minislump in 1991. By 1994 PCs and clones were selling at the incredible rate of 37 million units per year.

The Macintosh was also doing well, rising from 1.3 million units in 1990 to its all-time high of 4.5 million units in 1995. Macintosh market share peaked at 12% in 1993. It was a boom time for Apple, with the future looking bright.

Other companies were not so lucky. Sales of the Atari ST tailed off and only 30,000 units were sold in 1993. Atari itself fell into a severe cashflow crisis as Nintendo had taken all of its console market share, and the company was sold to hard drive manufacturer JTS in 1996.

The venerable Commodore 64 also fell off sharply, dropping from 1.25 million units in 1989 to only 175,000 units in 1993. This sudden loss of revenue hurt the company greatly. Sales of Amigas had also fallen drastically as new management cancelled best-selling units like the 500 and replaced them with the more expensive yet feature-poor 600, while delaying the next generation of AGA machines that would have competed with the PC's VGA chipset. Stuck with tons of old machines that couldn't sell and unable to build enough new machines for the Christmas '93 season, the company fell into a downward financial spiral which led inevitably to its bankruptcy in April 1994.
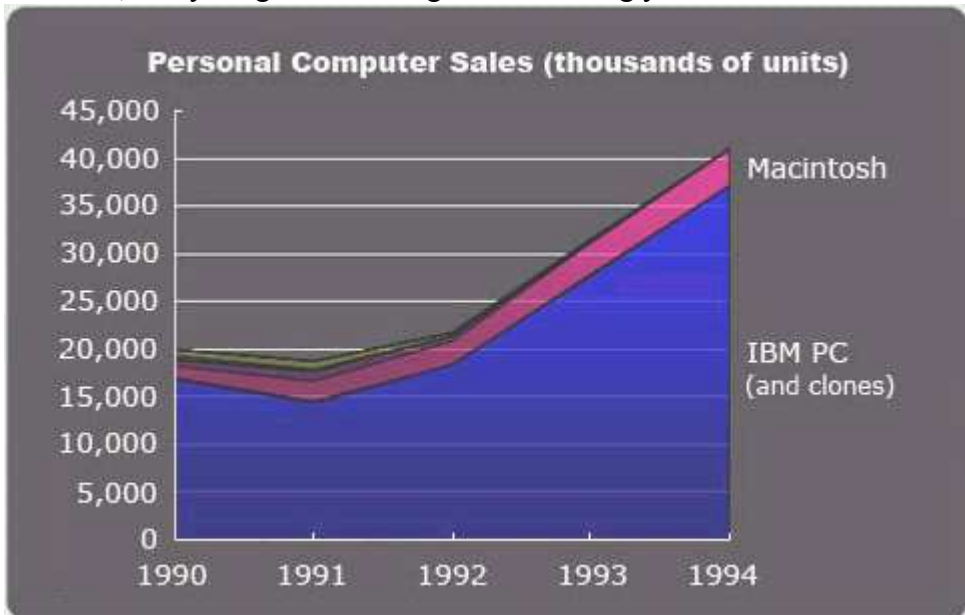

The NeXT cube, displaying all four of its brilliant shades of grey

Steve Jobs, exiled from Apple in 1985 because of poor sales of the original Macintosh, had built a new company called NeXT out of his personal fortune. The first NeXT cubes shipped in 1988, but their US$10,000 price tag doomed them to the same fate as the Lisa. NeXT never shipped more than 16,000 computers in a single year, and in 1993 the company laid off many of their employees and dropped all of their hardware to focus entirely on an Intel version of their operating system called NEXTSTEP/486. The company still failed to make money, however, and wound up being sold to Apple in 1996.

The PC kept soldiering on relentlessly, rising from 84% marketshare in 1990 to over 90% in 1994. However, there was still a chance for alternative operating systems to rise to dominance on that platform. The release of OS/2 2.0 by IBM in 1992 was briefly seen as a legitimate challenger to Windows, selling over two million copies. A new open-source, enthusiast operating system called Linux, first released in 1991, was starting to take shape and slowly gained

popularity in academic circles. There was even GeoWorks Ensemble, a version of the GEOS GUI for the Commodore 64 that was much faster on low-end hardware than Windows due to it being written largely in assembly language. However, everything would change the following year.

Personal computer market share during the end of eras

The Mac stands alone (1994-2001)

 The release of Windows 95 in August 1995 was a huge media event, unprecedented in personal computer history. People lined up around the block at midnight to be one of the first to receive the new software, and Tonight Show host Jay Leno emceed the launch party, with "Start Me Up" by the Rolling Stones playing as the official theme song of the event.

Many Macintosh, Amiga and OS/2 users wondered what all the fuss was about. Windows 95 contained many "new" features, like long filenames and preemptive multitasking, which had been a part of these operating systems since their inception (with the exception of Mac OS, which did not have preemptive multitasking). However, Windows 95 brought all these features to the mainstream, and third-party software developers flocked to it. Strong developer support by Microsoft and an eagerness by OEMs to bundle it with

their machines ensured its success. Meanwhile, sales of OS/2 fell off the ends of the earth and IBM eventually stopped updating it in 2001.

PC sales shot up, and Macintosh sales slumped. By 1998, PCs were closing in on sales rates of 100 million units per year, while Macintosh sales fell from 4.5 million in 1995 to just 2.7 million in 1998. Many industry analysts started to predict that the Macintosh was doomed, and that Apple was set to follow Commodore into oblivion. However, Apple was able to float a junk bond in 1997 that kept them financially above water, despite losing over US$700 million in 2Q 1996 and again in 2Q 1997.
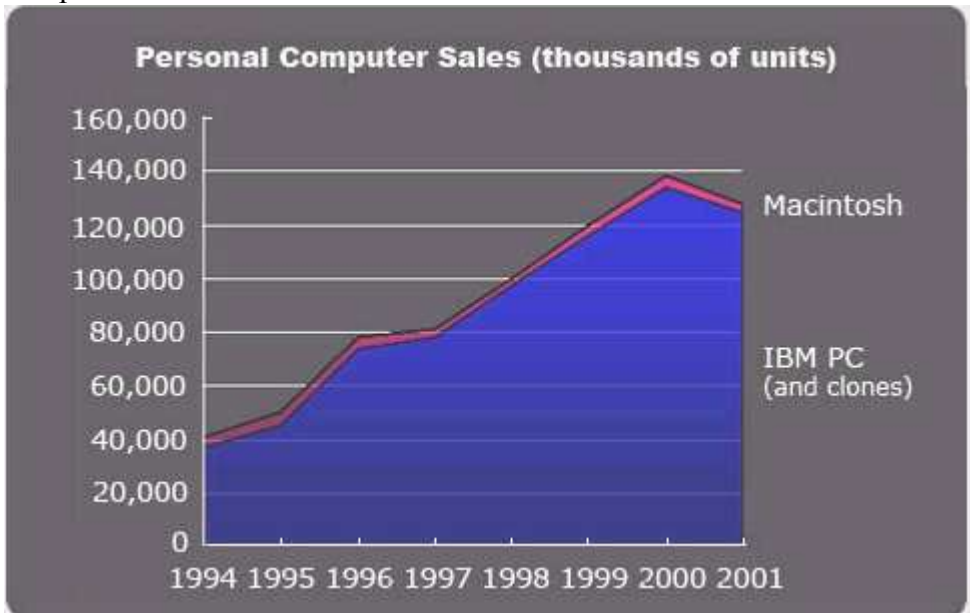

Bill Gates and Jay Leno share jokes about things that are Micro and Soft

Apple was at loose ends trying to complete a major update to their operating system, called Copland. Eventually Copland was cancelled, and Apple had to go shopping for a new operating system, one that could support preemptive multitasking and memory protection. Originally Apple had decided to purchase BeOS, which had been started on its own custom hardware then ported to PPC and x86 computers by ex-Apple employee Jean-Louis Gassee. But the flamboyant CEO of Be, Inc. held out for too much money and ultimately overplayed his hand. Steve Jobs jumped at his chance, and sold NeXT, Inc. outright to Apple for US$400 million in December 1996.

The new strategy for Apple was to have two operating systems, one based on NeXTSTEP and aimed at high-end users, and the other based on the now-creaky Classic Mac OS with bits of Copland's corpse bolted on. The latter OS shipped as Mac OS 8, and proved popular with Macintosh users. The

former, now called Rhapsody, shipped only in Developer Preview releases, which confused developers completely. What should they develop for, Mac OS or Rhapsody? The two OSes had completely different APIs and programs from one could not work on another. This confusion, combined with more staggering financial losses in 1997, allowed Steve Jobs to stage a coup d'etat, seizing control of the company from the flailing Gil Amelio in July of 1997. Jobs placed most of his former NeXT engineers in charge of the operating system division, with their job no longer to enhance the Classic Mac OS, but to replace it completely.

This was to become Mac OS X, which added a subset of the Classic Mac OS API, called "Carbon," to the existing NeXTSTEP/Rhapsody API, which was now called "Cocoa." With the gradual phasing out of Classic Mac OS and its replacement by Mac OS X, Steve Jobs achieved two of his greatest goals: saving the Macintosh and replacing it with the NeXT Big Thing, all at the same time. The release of the colorful "gumdrop" iMac computer in 1998 revived Apple's fortunes, and with Mac OS X on the horizon, the Macintosh enjoyed a bump in sales to 3.8 million units in both 1999 and 2000.

Personal computer market share during the late 90s

The new era (2001-)

2001 saw many changes in the computer industry. Windows XP was released, finally combining the core and stability of the corporate version of Windows (Windows NT) with the consumer-friendly face of Windows 95, 98 and ME. The first shipping version of Mac OS X, 10.0, was also released, and although the initial version was slow and feature-incomplete, the 10.1 update later that year addressed many of those issues. Now the two remaining platforms, the PC and the Macintosh, were on roughly equal technical footing. Both operating systems supported not only preemptive multitasking but full protected memory for all applications.

Macintosh market share slowly declined from 3.2% in 1999 to 1.98% in 2004 as sales of Macintoshes remained flat, despite the new operating system and several flashy new models, including the Cube and the new, lamp-like, flat-panel iMac. However, with the release and overwhelming sales success of the iPod in 2001, positive buzz began surrounding Apple again and Macintosh sales started to creep up again in late 2004.
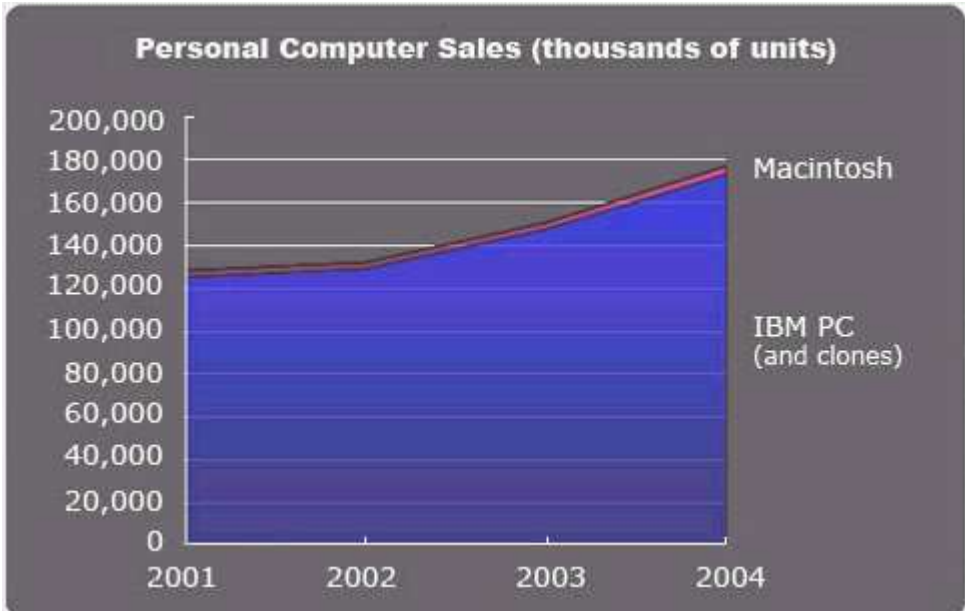
The loser in the replacement Mac OS sweepstakes, Be, Inc. ran out of money and closed operations in 2001. Its assets were sold to Palm, Inc., but a new German company called YellowTab bundled together the unfinished bits of BeOS, which would eventually be released as Zeta 1.0 in 2005.

While IBM officially dropped all support of OS/2 in 2005, a company called Serenity Systems continues to sell and update it, rebranded as eComStation. A new version is planned for 2006.

Even GeoWorks Ensemble got into the rebranding game, rereleased as New Deal Office from New Deal Inc. in 1996. Updates continued to be released as late as 2000.

And in an event that has to rank as the most surprising comeback in the entire history of personal computing, a new official Amiga computer, based on a PowerPC CPU, and a new version of AmigaOS for PPC, called AmigaOS4, were released in 2004. While the Amiga market had virtually disappeared after over ten years in the wilderness, enthusiasm for the new platform ran high among those who had not forgotten their fondness for the old computer. While sales figures are in the low thousands and not enough to even show up on a market share graph, this release showed that almost nothing can really kill an operating system. Despite the PC and Windows gaining a completely dominant

97% market share, alternatives like Linux, the Macintosh and even OS/2, Zeta, and the Amiga continue to exist.

Personal computer market share during the recent era

Conclusions

The story of the personal computer is a fascinating tale, and I can't help but get excited every time I read a new book or article that uncovers some new secret about this wild and wooly history. The lack of reliable information about the sales figures and market share for early computers compelled me to stay up all night a few years back, scouring the Internet and flipping through all my computer history books in the hope of compiling a complete set of figures.

It was not an easy job. Many sources are incomplete, and some are contradictory. Before IDC came along to count up all personal computers being sold every quarter, it was difficult to figure out the exact numbers for total machines sold. In the end, I had to combine and cross-reference many sources, canceling out those that contradicted each other and filling in the gaps with interpolation. There are undoubtedly some errors in the figures, but overall I believe they represent the most complete picture available for the industry as a whole over the last thirty years.
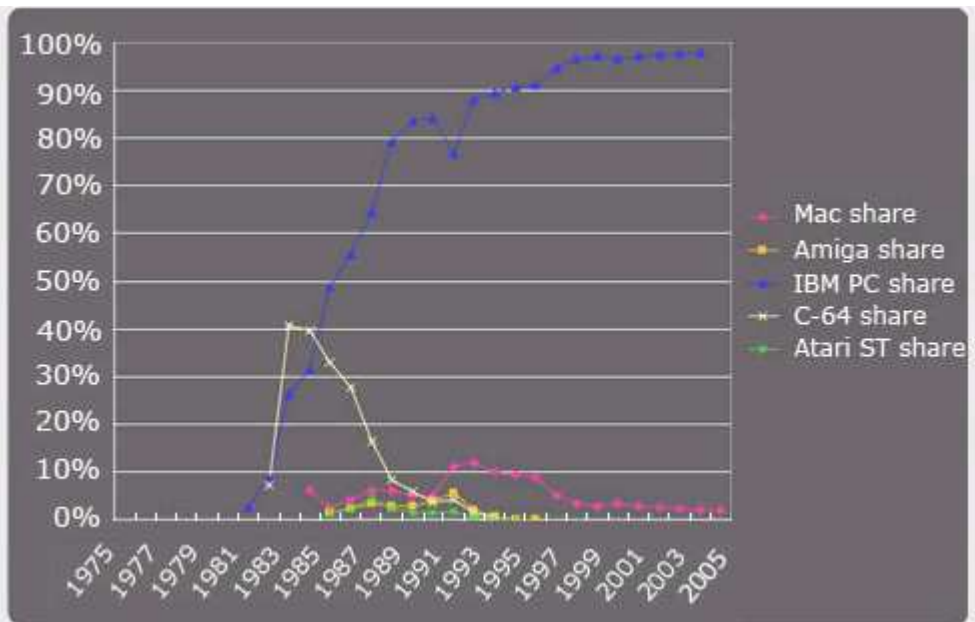
When you step back and look at the big picture, the overall dominance of the PC becomes clear. However, this was not always the case, and in fact it wasn't until 1986 that the PC platform first surpassed 50% market share. This was more than a decade after the first personal computer was sold.

What caused the rise of the PC platform? Undoubtedly, it was the clones. No other platform was ever cloned to the extent that the PC was. (The Apple][was cloned by Franklin computers and others before Apple sued them out of existence, and Apple did briefly flirt with licensed Macintosh clones from 1995 until 1997). If IBM hadn't come late to the personal computer party, and hadn't rushed its first PC from off-the-shelf parts and a third-party operating system, this story might have read very differently today.

The only person who predicted the Attack of the Clones was Bill Gates, who recalled that many mainframe computers had spawned work-alike clones in the past. It was this foresight that enabled him to get IBM to agree to a contract whereby Microsoft could license MS-DOS to third parties. IBM, thinking in mainframe timelines and assuming that clones would be perpetually years behind the originals, thought nothing of this stipulation. They were only concerned with getting the lowest possible flat rate for MS-DOS (which they mistakenly called PC-DOS) in the first place.

A combination of extreme foresight and even better luck enabled Microsoft's rise to dominance along with the PC platform. While some may look at this story as having a sad ending, I prefer to see things differently. While alternative platforms may be marginalized today, they still exist, and each platform contributed something of importance to the overall rise of the personal computer, which was the real triumph in this tale.

Before 1975, people could only dream of owning a personal computer. A handful of geeks and enthusiasts turned that dream into reality, and today personal computers are everywhere. Over 173 million computers were sold in 2004, and the figures are expected to continue to rise, as falling prices enable people all over the world to enjoy the benefits of personal computing.

Personal computer market share as percentages: 1975-2005

Redelert, Warszawa, Polska