

Development of the Computing Machine

Abacus (1000 - 500 BC) - The first aid to calculation, possibly invented in Babylonia (now Iraq). The improved speed of calculation ensured the success of the abacus, which is still used today in some countries.

Arabic numerals were introduced to Europe (800-1000 AD). The Arabic system included a number for zero, and greatly simplified calculations. It is the decimal system we still use today.

Wilhelm Schickard (1592 - 1635) built a mechanical calculating clock. It could add and subtract. It never made it past the prototype stage.

Blaise Pascal (1623 - 1662) was the son of a tax collector. He spent many hours involved in mathematical operations, which inspired him to build a mechanical calculator in 1642. It had the capacity for eight digits, and could do both addition and subtraction. It was gear driven, and had a tendency to jam.

Gottfried Wilhelm von Leibniz (1646 - 1716) followed Pascal and built a digital calculating machine. It was gear and lever driven, and could do multiplication, division, addition, and subtraction. It was however, somewhat unreliable.

Joseph Jacquard (1752 - 1834) built an automatic Weaving Loom, which used punch cards to control the selection of threads for weaving into complex patterns.

Charles Babbage (1792 - 1872), a mathematics professor of Cambridge, inspired by the Jacquard Loom, designed an automatic calculating machine called a Difference Engine. In 1822 he had a working model, which was to be fully automated, and steam powered. He lost interest in 1833 and began designing another more general machine called an Analytic Engine. It was never completed, partially due to a lack of engineering precision.

Ada Augusta (1816 - 1852), Countess of Lovelace and daughter of Lord Byron is generally considered to be the first computer programmer. She corrected some of Babbage’s errors and added her own ideas about the calculating machine. She is credited as developing the programming loop.

Joseph Henry (1797 - 1878) was a scientist who worked on electrical systems, including the electromagnet, which formed the basis for modern computing technology.

Dr. Herman Hollerith (1860 - 1929) recognised a problem in the US Census Office where he worked. The 1880 US Census took 7 years to tabulate, and the population was steadily increasing. It was estimated that the 1900 Census would not be tabulated before starting on the 1900 census. He developed an Electro-mechanical punch card tabulator, which automatically totalled the cards. The 1890 Census was tabulated in 3 years, and Hollerith formed the Tabulating Machine Company. Thomas Watson joined the company in 1914, and with Watson as president it was renamed International Business Machines (IBM) in 1924.

Personalities and Personal Computers

The personal computer industry is unique in the business world in many ways. It grew incredibly quickly from its beginning in 1975 to a billion dollar industry within 5 years. The industry was created and controlled by kids who had no formal business training. It is an industry where products must be recreated every 18 months, and competition is intense. It is an industry in which anyone can become a millionaire.

Mainframes

Computers continued to play an important part in military and academic institutions, but over the next 20 years, computers began to be used in business. The telephone companies were one of the first industries to embrace computer technology, using computers to route communications signals. As technology developed, the size of computer decreased. The first generation of computers used vacuum tubes (1951 – 1958) which were large and unreliable. The invention of the transistor in 1947 by Bell Telephone Lab resulted in the old glass vacuum tubes (3 - 5cm long) being replaced with a small, cheap and reliable electronic component (approx. 0.5 cm long), and defined the second generation of computers (1959 – 1964). Later, the invention of the Integrated Circuit in 1959 by Texas Instruments/Fairchild Semiconductor started the third generation of computers (1965 – 1971). These silicon chips stored over 1000 transistors on a single piece of silicon. Finally, the fourth generation of computers began around 1971 with the use of large scale integrated circuits (LSI) and very large scale integrated circuits (VLSI).

It was shortly afterwards that the personal computer industry began.

Xerox

In 1969, Xerox opened the Palo Alto Research Center (PARC). During the early 70’s, Xerox decided not to enter the computing market. At this time they were already being investigated for monopolistic business practices. By 1977, half of Xerox’s revenue was spent on defence in court. However, Xerox PARC’s research contributed significantly to many of the advances in computer technology, including Ethernet, WYSIWYG, the development of the GUI (as we know it), the invention of Laser Printers and the development of Smalltalk (the first functional language).
Intel
The first integrated circuit was announced by Fairchild Semiconductors in 1959. Nine years later, in 1968, Robert Noyce and Gordon Moore left Fairchild Semiconductors and formed Intel Corporation. Their microprocessors became more powerful, and in 1974 they created the 8080 chip. This microprocessor had all the components needed for an entire computer. These chips were available to anyone, and the time was right for people to build their own machines.

Altair
Ed Roberts was interested in computers, but could not afford to own one. Like many other enthusiasts, he wanted to build his own computer with the new affordable microprocessors from Intel. He ran a small calculator company called MITS, but nobody was buying his calculators, and MITS was going bankrupt. Ed hoped to save MITS by marketing a kitset computer, and the bank reluctantly agreed to loan him the $65,000 he needed. He was considered an optimist for expecting to sell 800 a year. The first Altair kitset appeared on the cover of Popular Electronics in January 1975. Within a month he was receiving 250 orders a day. The personal computer industry was born. Ed Roberts assembled 40,000 Altairs before he sold the business in 1978 when it became just too competitive.

Microsoft
Paul Allen and Bill Gates had been friends since high school, and had already experience writing software for mainframe computers. The picture on the Popular Mechanics cover excited Allen and Gates who realised that there would be a market for software, and a lot of money could be made. Fearing they were already too late, they wrote a version of BASIC which would work on the 8080 chip. Ed Roberts was shown a demo after which he agreed to package the BASIC language with the Altair. Gates quit Harvard University and together with Allen formed Microsoft.

Homebrew Computer Club
The Altair took about 40 hours to put together, and even then it didn’t always work. If it did work, you ended up with a box with a row of switches and a set of lights. There was no keyboard, no screen, and no storage device for information. It was difficult to use, so people formed clubs where they could discuss problems, and show off new developments. The Homebrew Computer Club was one such club in which everyone shared their solutions and helped each other to learn. It was here that Steve Wozniak and Steve Jobs first met.

Apple
Steve Wozniak was a hardware genius who began building his own computer at the Homebrew Computer Club. His technical ability attracted Steve Jobs who lacked the expertise of Wozniak, but had vision, drive and charisma. Wozniak’s first computer was called the Apple 1, and consisted of a single circuit board without even a case. Steve Jobs managed to sell 30 Apple 1’s which convinced him that there was a market for a personal computer. His dream was to make computing available to everyone, at an affordable price. Some venture capital made the dream a possibility. Steve Wozniak designed the hardware, and Steve Jobs did the rest, demanding the Apple II looked like a piece of consumer electronics. The Apple II was completed in 1977 and launched in 1978 at the West Coast Computer Fair. Two years later when Apple became a public company, both Steve Jobs and Steve Wozniak became millionaires.

VISICALC
Apple computers initially had trouble finding a market. Businesses used mainframes, and nobody had a use for a computer at home, so sales of the Apple II were limited to enthusiasts... that is, until VISICALC. Dan Bricklin and Bob Frankston invented what they called a visible calculator. It was a program which helped in financial planning. A table was created where the value in each cell in the table was related to the value in the other cells accordingly. Today we call such programs Spreadsheets. After a slow start, businessmen everywhere became exited about the spreadsheets, and they all had to have it. VISICALC was only available on the Apple, and it was so useful that it justified buying an Apple computer. Sales soared.

IBM’s Open Architecture
By 1980, the personal computer market was worth over 1 billion dollars. IBM wanted to enter the market, but due to internal structuring of the company, it would take too long to develop a product. Bill Lowe proposed a daring plan. To save time, they would not build a computer from scratch, but would buy existing components from other companies and assemble them. This concept of “open architecture” was alien to IBM, and difficult to sell to the corporate executives, but with the backing of the Chairman, Bill Lowe’s team developed an IBM PC within a year. IBM realised that competitors could copy the same architecture, but knew that the bulk discount would ensure that they could always produce the machines for a lower price than competitors. The only remaining step to secure entry to the PC market was software development. A computer needs an operating system and a language used to write programs before it can be really useful, and IBM had neither.

Microsoft DOS
At the time IBM needed software, Microsoft was already the biggest supplier of languages for the PC market, but they had never written an operating system. IBM was willing to buy languages from Microsoft, but not without an operating system to run them on. Fearing that they would lose the contract, Bill Gates promised to produce an operating system for IBM. The solution was provided by Tim Patterson, a programmer who wrote an operating system based on CP/M. He called it QDOS, and sold it to Seattle Computer Products. Bill Gates bought the license for QDOS from SCP for $50,000. Two years later they handed it over to IBM under the name MS-DOS.

Microsoft was paid a fixed fee (about $80,000) with no royalties for both MS-Dos and BASIC. In itself, this deal wasn’t worth much, but the key to Microsoft’s success was that IBM had no control over the licensing of the software to other people. Microsoft expected other people to build machines compatible with the IBM PC to whom they could licence their software. And that is just what happened.

IBM Clones
The chips used in IBM’s open architecture were made by Intel. These chips were sold to anyone who was interested, and many people were. In 1982, one year after the IBM PC was shipped, a group of engineers got together and formed a company called Compaq in order to create a computer compatible with the IBM PC. They bought the same chips from Intel, and by reverse engineering, produced a computer which behaved the same as an IBM computer, but was a little cheaper. In the first year of business, Compaq sales reached $111 million. Soon, there were many companies repeating the process and producing their own clones, always a little cheaper than IBM.

Driving the sales of both the IBM PC and all the Clones was another spreadsheet. Based on VISICALC, Lotus 1-2-3 provided a spreadsheet for the IBM PC. Within a year, Lotus was worth $150 million, and you no longer needed to buy an Apple II.
Macintosh

In 1968 Doug Engelbart of the Stanford Research Institute publicly demonstrated a word processor which used windows to display the text. Xerox PARC developed this idea further by creating a Graphical User Interface for the computers they were using for research. These computers featured windows, pulldown menus, a mouse and a corresponding pointer for operating the system. In 1979 Steve Jobs was given a tour of PARC, and it was this graphical interface which caught his attention. He had the vision to see that an easy to use interface (like the one in PARC) would open up computing to the masses, and allow everyone to share the computing experience. Steve Jobs set about creating a computer that anyone could use. It began as the Lisa, and was later redesigned and renamed the Macintosh. It was released in January 1984. Over time, driven by Lotus 1-2-3 and backed by its good name, IBM began to overtake sales of the Apple II. The Macintosh had to be good, and it needed software. It needed something that IBM PC’s couldn’t do.

Adobe

John Warnock had developed a new technology, which allowed laser printers to print exactly what was displayed on the screen. He left Xerox PARC and founded Adobe systems to develop the concept of WYSIWYG (What you see is what you get). Steve Jobs recognised the value of his work, and Apple invested in 20 percent of Adobe. The quality of laser printed images, combined with Macintosh’s ease of use created a brand new industry; desk-top publishing. The Macintosh had found its place in the market, a position which it still holds today. Apple was still in trouble however, but Steve Jobs would not admit it. He disagreed with the management of Apple, and in 1985 sold all his shares in Apple and left in disgust.

Compaq’s 386

Once IBM had entered the personal computer industry, it threatened to dominate the entire market. The early success of Apple computers was beginning to fade in the mid 80’s and IBM held 50% of the market. People were concerned that IBM would swallow the personal computer market and maintain a complete monopoly over computer technology. The turning point for IBM came in September 1986 when Compaq released a new IBM compatible computer based on the new Intel 80386 chip. This computer was released before IBM had released its own version based on the same chip. Compaq showed the world that IBM could be beaten, and others could compete against Big Blue. The prices of the clones keep falling, and IBM could not keep pace. By the early 90’s, IBM was losing enormous amounts of money (5-6 million dollars a day), and it retreated from the PC industry, defeated by its own open architecture design.

Microsoft Windows

Impressed by the GUI concept of the Macintosh, Microsoft began to build its own version. The first couple of versions weren’t very good, but then in 1990, Windows 3.0 was launched, and it was good enough to compete with the Macintosh. People could now do the same things on a Macintosh that they did on a IBM compatible, but for lower cost, since the IBM clones were much cheaper than the Macintosh. Apple computers became a fading influence in the PC industry. In August 1995 Microsoft released Windows 95 with a GUI that was extremely similar to the Macintosh, and Apple was consigned to a niche in the market.

Conclusion

The computer industry is driven by technology that gets more powerful, yet cheaper every day. In order for a computer to survive this terrible competition, it must have both hardware and software. The software available for a machine has an overriding influence upon the consumer. The IBM compatible computer has become so popular because of a self-reinforcing cycle in the marketplace. People write software for the most popular machine because they can sell more programs. The more software that is available, the more popular the machine will become. Good products are ignored or overshadowed by marketing, and market forces. Steve Jobs had a vision of every home owning a computer. Bill Gates had a vision that they would all run Microsoft software. Both visions are coming true.

References:

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