**CS4182 Project**

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# Historical Developments in Computer Science

Within this project, we will be going into detail surrounding the historical developments in Computer Science. Our timeline of events will range from 1801 to 2017, beginning with a loom that used punched wooden cards that inspired similar punch cards in early computers, and ending with a program that uses molecules as computers. With this project we hope to inform and educate you on everything that has happened in the past to make computer science what it is today.

To begin, we go to 1801, where a Frenchman by the name of Joseph Marie Jacquard invented a loom that used punched wooden cards to make a pattern to design fabric. This invention inspired similar punch cards that ere used in early computers. Next we jump forward to 1822 where Charles Babbage, an English mathematician thought up a steam driven calculating machine that could compute tables of numbers. This project, funded by the English government in hopes to eliminate numerical errors in a set of navigation tables, soon became the most expensive government funded project in that point of English history and was a complete failure. (Kopplin, 2002)

We move on to 1890, to a man regarded as “the father of modern automatic computation”, Herman Hollerith. He built the first punched-card tabulating and sorting machines and founded the company that is now known as IBM. Hollerith worked on the 1880 US census, which was “a laborious and error-prone operation”. In 1888, a competition was held, by the Census Bureau, for someone to find a more efficient way to process and tabulate data. Hollerith entered the competition and captured and processed the given data in 72.5 hours, then tabulated the data in 5.5 hours, winning him the competition and earning him the contract to process and tabulate the 1880 census data. The Hollerith Machine was also used in Russia, Austria, Canada, France, Norway, Puerto Rico, Cuba, and the Philippines. Modified versions of his technology were continued to be used at the Census Bureau until replaced by computers in the 1950s. (Cruz, 2001)

In 1936, we look to Alan Turing, a British scientist and a pioneer in computer science. Turing presented a machine capable of computing anything that is computable. This was named the Turing Machine. He “considered whether a method or process could be devised that could decide whether a given mathematical assertion was provable”. Turing developed proof that not all mathematical problems can be solved by automatic computation by analyzing the methodical process, logical instructions, the action of the mind, and a machine that could be embodied as a physical form. This concept was the Turing machine. The central concept of the modern computer and the theory of computation and computability were based off his ideas. (Hom, 2013)

The next stop is 1941 where we look at John Vincent Atanasoff, who, with the help of one of his students Clifford E. Berry, created the ABC (Atanasoff-Berry Computer) in Iowa State College. This was “the first electronic digital computing device. The purpose of this computer was to solve simultaneous systems up to 29 linear equations. It accepted two linear equations at a time with up to 29 variables and a constant, this data was used to eliminate one of the variables. The machine then could continue to eliminate one variable each time until the entire system was solved.

The ABC had a fixed function and “was not a general-purpose computer” but it did use “3 of the most important ideas used in computers now-days.” Those were, binary digits to represent all the numbers in a data set, performing all the calculations electronically, and “using the principle from the Von Neumann architecture where the memory and the computations were separate.” It also used a “regenerative capacitor memory” that is still used these days in Dynamic Random Access Memory. (Dorovski, Unknown)

Next on our timeline is 1943-1944, where two University of Pennsylvania professors, John Mauchly and J. Presper Eckert, build the Electronical Numerical Integrator and Calculator (ENIAC). This was “the first programmable general-purpose electronic digital computer” and was funded by the United States government. It was designed specifically to compute values for artillery range tables. There were advantages and disadvantages to this machine. It used plugboards to communicate instructions to the machine so that it ran at electronic speed. But it would take “days to rewire the machine for each new problem. ENIAC was enormous, occupying the 50 by 30-foot basement of the Moore School. (Swaine & Freiberger, 2018)

In 1946, Mauchly and Presper left the University of Pennsylvania and struggled to find capital to “build their latest design”, the Universal Automatic Computer (UNIVAC). They received funding from the Census Bureau and delivered the first UNIVAC in 1951. The UNIVAC was built as a stored program computer and used an operator keyboard and console typewriter for “simple, or limited, input” and then magnetic tape for any other input and output. “Printed output was recorded on tape and then printed by a separate tape printer.” The UNIVAC was a commercial computer designed so that it could replace the punch card accounting machines at the time. It was considered the “fastest business machine yet built”, as it could read 7,200 decimal digits per second. (Freiberger & Swaine, 2011)

Next up is 1947, with the three men, William Shockley, John Bardeen and Walter Brattain, of Bell Laboratories who invented the transistor. This has been called “the most important invention of the 20th Century”. The transistor was the first device able to amplify an electrical signal and turn it off and on, allowing the electrical current to flow or to be blocked. This small and very dependable device paved the way forward for nearly every electronic device, “from radios to computers to space shuttles. The transistor came to be discovered because at the time AT&T wanted to expand their telephone coverage, so they turned to their research and development company, Bell Laboratories. The current telephone technology at the time was vacuum tubes but they were “incapable of picking up rapid vibrations.”, the transcontinental telephone communication needed “ultrahigh frequency waves”. After many tests and modifications, the trio presented their “little plastic triangle” to the Bell Laboratories VIPs on December 23rd. (Levine, 2008)

Next, we go to 1953 with Grace Hopper who had a PhD in mathematics and physics and was also enlisted in the Navy from 1943-1986. Hopper played a major part in computer science from having a part in creating the UNIVAC, creating the first computer compiler (“which translates source code from one language to another”), and she also created a programming language called FLOW-MATIC that was “a widely used framework for coding languages at the time” said the Navy, but was also “a basis of the widely used Common Business Operating Language (COBOL).” Hopper helped contribute so much to the computer programming field, and frankly without her the Apollo would never have been possible. More specifically, her co-creation, UNIVAC was “instrumental to the Apollo missions. NASA created a Deep Space Tracking System (DSTN) for the Apollo missions. There were three DSTN stations each with “85-foot wide movable radio dishes” and computer rooms that contained UNIVAC systems which processed continuous data streams from the Apollo. The DSTN is still in use today. (Howell, 2016)

We now move to 1957, when the FORTRAN programming language was developed. FORTRAN is an acronym for Formula Translation. It was created by a team of programmers at IBM led by John Backus. The language “shortened the process of programming and made computer programming more accessible.”. Previous programming was written in machine (first generation) or assembly (second generation) language which involved the programmer writing instructions in binary or hexadecimal arithmetic. FORTRAN was a third-generation language which was a more efficient and natural language compared to the others at that time. It was the programming language of choice in the late 1950s and was updated many times in the 1960s to keep up with competition. (Britannica, 2019)

In 1958, the integrated circuit, known as the computer chip, was invented by Jack Kilby. At the time “electronics still meant mostly vacuum tubes.”, and transistors that had been invented a decade earlier were not widely used. Kilby had the idea to use the same block of semiconductor material for all the components of a circuit. This idea would not only cut out wires and faulty connections but also “make the entire circuit much more compact.” Kilby demonstrated his integrated circuit on September 12th in 1958. Six months later, Robert Noyce came up with his own integrated circuit which was “better suited to be manufactured in large numbers”. This led to the first chip-based computer built in 1961 and then to Moore’s Law put forward by Intel co-founder Gordan Moore in the 1960s. This says that the processing power of a chip doubles every two years while the price falls by half. (Das, 2008)

In 1964 a prototype of the modern computer, “with a mouse and a graphical user interface (GUI)” was shown by Douglas Engelbart. This changed the computer from a “specialized machine for scientists and mathematicians” to a more accessible piece of technology for the general public. (Zimmermann, 2017)

We now move into the 70s and begin with Intel 1103, the first Dynamic Access Memory chip (DRAM), developed by the newly formed company, Intel, in 1970. The DRAM chip was very successful and was “the first chip to store a significant amount of information.”. The same year, the chip was purchased by Honeywell Incorporated and replaced “the core memory technology” in their computers. The DRAM chip quickly took the computer world by storm as the “standard memory device in computers worldwide”, as they were cheaper and used less power than core memory. (Hall, 2020)

The first DRAM chip was released in October 1970 by Intel who were a new company back then. This chip was very important in the history of computer science as it was very small in size and cost a lot less in comparison to anything else that was on the market at the time. The 1103 did not become widely available to people until 1971 when a lot more began to get produced.

The creation of the floppy disk was a very important moment in the history of computer science. A floppy disk is a type of disk storage composed of a disk of thin and flexible magnetic storage medium. The floppy disk was invented in ‘60s but became available for purchase by the general public in 1971. It was invented by a man named Alan Shugart. (Fletcher, 2007)

Apple was founded by Steve Jobs and Steve Wozniak on April 1 1976. Their first product was named the Apple I and it was the very first computer to only feature a single circuit board. The specs included a MOS 6502 CPU running at just 1 MHz. This is a stark comparison to today where most chips usually run above 2/2.5 GHz on the low end of things. (Williams, 2015)

The Apple II was released in 1977 by Wozniak and Jobs once again. This time the computer was equipped with colour graphic which was unheard of at the time and was a major leap forward in computing.

The first computer to actually have a GUI was the Lisa computer by Apple. This was the first of its kind and even though it did not do so well it was a very important creation for the future on computers. Lisa paved the road for the birth of Apples Macintosh.

In response to Apple introducing their GUI, Microsoft created Windows in 1985. This would be the beginning of the MacOS vs Windows battle which still continues to this day. This would also pave the way for all of our computers and laptop operating systems which we all use today.

HTML was developed by Tim Berners-Lee in 1990. HTML stands for HyperText Markup Language and is used in order to program websites. This language is still used all the time to this day and has been updated many times since 1990. This development was massively important in the history of computer science and the fact that the language is still used by millions to this day proves that. (Berners-Lee, 1990)

The first intel Pentium processor was released in March 1993. This was a massive leap forward in processing power compared to previous chips. It also meant that graphics could now be much, much better in computers which was important for a lot of things, one of them being gaming. (Intel (Intel.com))

Gaming arrived on computers in 1962 when the game “Spacewar!” was released. This was a very primitive game and was played on the PDP-1. It was a space combat game and was created by a man named Steve Russel. Games as we know them today arrived on PC properly in 1996 when games such as ‘Command and Conquer’ and ‘Theme Park’ became available on PC. “Command and Conquer” is a real-time strategy game This is monumental in the history of computer science as PC gaming is now the most popular platform for games to be played and brings in the majority of revenue for games companies.

Google was created in 1996 by two people at Stanford university, Larry Page and Sergey Brin. On September 15 1997, they registered the domain google.com. Google began to grow rapidly in popularity and they had an index of over 60 million pages by the end of 1998. Google was nearly sold in 1999 for only 1 million dollars which was actually rejected by the buyer and was then nearly sold for only 750 thousand dollars. To put that in perspective google is worth about 927 billion dollars today. Google is named after the number googol it is just spelled incorrectly on purpose. The number googol is a 1 followed by one hundred 0s. The 2 creators of google wrote in their first paper “*We chose our systems name, google, because it is a common spelling of googol and it fits well with our goal of building very large-scale search engines”.* (Google, 2012) (Fletcher, 2007)

Java was created in January of 1996 by a man named James Gosling. Java took about 5 years to develop as work on it began in 1991. Java was initially meant to be used for set top boxes for televisions but developers then realised that the language was too sophisticated for the set top boxes to understand Java is now one of the most popular programming languages and is very versatile. It is used in everything such as games such as Minecraft which is one of the most played games in the world and Bejewled which is also another popular game. A lot of googles servers are also java based as it is very reliable. (Byous, 1998)

C language was created in 1972 by a man by the name of Dennis Ritchie. C is based on another language which is called B. It is the improved version of B language. It was originally developed on the Unix operating system. C is still used widely today. Mac and Linux are mostly programmed in C. 3D movies are written in a mixture of C and C++. C is very popular as it is a very versatile language and the code size is a lot smaller than a lot of other programming languages. The language is also very efficient and great at manipulating memory. (Johnson, 1978) (Ritchie)

The first website which used the most popular domain of ‘.com’ at the end was made in 1985 when the website called Symbolics.com was made by a computer manufacturer from Massachusetts. It took a long time for the ‘.com’ domain to take off but today there are over 137 million registered ‘.com’ domains on the World Wide Web.

On March 24th 2001, Apple revealed to the world the Mac OS X 10.0 operating system, which provided users the benefits of protected memory architecture and pre-emptive multi-tasking, among other benefits. Holding a hefty 1500 mb hard drive space, it was not uncommon for Mac OS X 10.0 to take a substantial time to boot. Shortly after in October 25th of the same year, Microsoft rolled out their revolutionary Windows XP, which had a significantly redesigned GUI, and many benefits including a built in firewall.

On September 23rd 2003 AMD released Athlon 64 to the global consumer markets, the Athlon 64 was the first 64-bit processor in history, as well as having the option to be backward compatible with 32-bit instructions.

On November 9th 2004, Mozilla challenged Microsoft's dominant Web browser, Internet Explorer, by introducing Firefox 1.0, a new web browser which included multi-tab browsing. In February of 2004, Mark Zuckerberg and his Harvard University acquaintances started Facebook, a brand new social media website.

On February 14th 2005, a brand new video sharing service, called Youtube, was born. Youtube allows users to upload, download, watch, like, dislike, report and share videos, as well as adding them to playlists. Youtube is used by both independent users and multinational companies alike. Later in the year, Google bought Android, a startup Linux based mobile phone OS, which begun the ‘boom’ in Googles success.

Early January of 2006 saw the release of Apple’s MacBook Pro, a portable computer which was Apple’s first Intel-based, dual-core portable computer. In September, Mark Zuckerberg and his colleagues released Facebook to the public, amassing 12 million users by the end of the year. Towards the end of 2006, in November, Nintendo had once again, provided the market with a brand new gaming console, the Wii. It is composed of C++ and bolstered an internal flash memory of 512mb, as well as having the option for extra memory storage, via SD card.

Apple shook the world with the iPhone, or as Steve Jobs called it, the “revolutionary mobile phone”, which was released in June of 2007. Although it was not the first smartphone, with phones such as LG Prada and Nokia N95, already being in the market, the iPhone, however, exceeded all of its competition. The iPhone had essentially become a mobile phone, camera, mp3 player and computer all in one. It was the beginning of the data boom, which still holds true to this day. From the release date of the first gen iPhone until this very moment, more people use smartphones to listen to music than mp3 players, more people use mobile data to speak to people than cellular calls, more people browse the web using smartphones than using computers. It truly changed the whole market.

Microsoft released Windows 7 in 2009. Users were now able to pin their apps to the taskbar, giving more space across the screen. There was also an improvement on touch, as well as handwriting recognition. Also included in Windows 7 was the action centre, which would notify the user of the system message queue, however, it was programmed so that the user could tend to the system messages in their own time, and not be forced to do so by windows, adding more freedom to Windows 7.

Apple once again made a statement to the tech world in 2010 with the release of the iPad. In appearance it looked like a very large iPhone, but with a deeper look into its specs, it would function like a computer. Spreadsheets, emailing, web browsing and many, many more computer functions were available on the iPad. The brilliance of it all is that it was essentially a computer, yet everything but a computer. A touch screened mobile device with a wide screen and a touch keyboard, mimicking its relative, the iPhone physically, but on a larger scale, as well as a significantly larger storage space, with a 64GB flash memory option. It was very easy to use and inevitably boomed the tablet market for years to come. Facebook purchased Instagram, a social media app in October 2010.

The iPhone 4s in 2011 saw the introduction of Siri, a built in function in the iPhone 4s and for all successors of this iPhone. Siri was a voice activated assistant AI. It had many functions such as providing answers to users questions (by searching the web), and voiced directions by using the web or the iPhone’s built in navigation system, as well as many other helpful functions.

Mark Zuckerberg’s Facebook had gained 1 billion users as of October 4th 2012, a long way from its initial 12 million users 6 years prior.

2013 saw the release of two colossal gaming consoles, the Xbox One from Microsoft, and the PlayStation 4 from Sony. Microsoft’s Xbox One had a unique Kinect movement-based gaming option, by using a wide time of flight type camera, it would also process 2 gigabits of data every second to understand the location and exact movement of the user. Both the Xbox One and PlayStation 4 had the options of streaming videos on the internet, as well as sharing videos on the internet. As well as the option to play games on hard disk, or to download them from the respective online stores for both consoles. Unlike Sony’s PlayStation 4, the Xbox One had no backward compatibility for Microsoft’s previous game console titles.

HTML 5 was finally released after the 27 year reign of HTML 4, standard for web markup languages. These languages explain how websites function and appear. It was intended to be simple to read for the human eye. It also had better error handling than HTML 4, as well as supporting multimedia, like streaming videos into websites.

Apple’s iOS OS was implemented into a watch in 2015. The Apple Watch hosted sensors for health monitoring, as well as the options to check your mail and Siri, just to name a few. As great as it was, it did however have quite a poor battery life.

In 2016, we saw the birth of the very first reprogrammable quantum computer. It had the ability to program an infinite amount of new algorithms to its system.

2017 had DARPA ( Defense Advanced Research Projects Agency  ) Developing a new Molecular informatics which used molecules from chemistry as computers, offering a “rich palette of molecular diversity that may yield a vast design space to enable dense data representations and highly versatile computing concepts outside of traditional digital, logic-based approaches” – Dr. Anne Fischer.

NextMind, a new TV remote which is worn on the head, it tracks electric pulses and brain activity in the users brain. By processing the brain waves, it translates them into commands, allowing the user to essentially think if what they want to do, be it switch channels, turn up the volume, etc. and NextMind will read the brain waves, and perform the instructed command.

# References

Kopplin, J. (2002). An Illustrated History of Computers. *An Illustrated History of Computers*,

Cruz, F. d. (2001). Herman Hollerith. *Columbia University Computing History*.

Hom, E. J. (2013). Alan Turing Biography. *Live Science Contributor*.

Dorovski, T. (Unknown). John Vincent Atanasoff. *Shneider and Gersting*.

Swaine, M. A., & Freiberger, P. A. (2018). ENIAC. *Encyclopaedia Britannica*.

Freiberger, P. A., & Swaine, M. R. (2011). UNIVAC. *Encyclopaedia Britannica*.

Levine, A. G. (2008). Bell Telephone Laboratories. *APS Physics*.

Howell, E. (2016). Grace Hopper: 'First Lady of Software'. *Space.com*.

Britannica. (2019). FORTRAN. *Encyclopaedia Britannica*.

Das, S. R. (2008). The chip that changed the world. *The New York Times*.

Zimmermann, K. A. (2017). History of Computer: A Brief Timeline. *Live Science Contributor*.

Hall, M. (2020). Intel. *Encyclopaedia Britannica*.

*Apple chronology*. (n.d.). Retrieved 5 10, 2020, from CNNMoney: http://money.cnn.com/1998/01/06/technology/apple\_chrono/

Byous, J. (n.d.). *Java technology: The early years*. Retrieved 5 10, 2020, from Sun Microsystems: https://java.sun.com/features/1998/05/birthday.html

Fletcher, R. (2007, January 30). Pc World announces the end of the floppy disk . *Telegraphy UK* .

*Intel Timeline: A History of Innovation*. (n.d.). Retrieved 5 10, 2020, from Intel Corp.: http://www.intel.com/content/www/us/en/history/historic-timeline.html

Intel.com. (n.d.). Intel Timeline: A history of Innovation .

*R.I.P. Floppy Disk*. (n.d.). Retrieved 5 10, 2020, from BBC News: http://news.bbc.co.uk/1/hi/uk/2905953.stm

Ritchie, D. M. (n.d.). The Development of the C Language. *ACM SIGPLAN Notices, 28*(3), 201–208. Retrieved 5 10, 2020, from http://www.bell-labs.com/usr/dmr/www/chist.html

Williams, R. (2015, July 9 ). "Apple celebrates 39th Year on April 1".