CSC 211

Assignment 0

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Topics: Invention of integrated circuits, ARPANET, UNIX operating system

Integrated Circuits

Prior to the first hybrid integrated circuit, which was created prior to the first monolithic integrated circuit demonstrated in 1960, there were ideas forming around the invention starting in 1949 when Werner Jacobi patented the first known integrated transistor amplifiers in 1949. A transistor, which is vital to integrated circuits, is a semiconductor device used to amplify or switch electronic signals and electrical power. This paves the way for us to give instructions to computers using binary system communication. More patents were created in the 1950s but it wasn’t until 1958 and 1959 that big step forwards were achieved.

First, Jack Kilby invented a hybrid integrated circuit which is different from a monolithic integrated circuit in that a hybrid Integrated circuit is fabricated by inter-connecting a number of components a number of components on a substrate aka a printed circuit board instead of monolithic integrated circuits are fabricated in a series of steps entirely on a single wafer which is then diced into chips. In layman this means that the hybrid is installed with components as a whole and more hard-wire interconnected than monolithic IC’s, which are plugged into the motherboard more individually while still communicating with other components.

Shortly after Kurt Lehovec discovered p-n junction isolation, which is the method used to electrically isolate electronic components, such as transistors, on an integrated circuit by surrounding the components with reverse biased p-n junctions. Without this ability to isolate components via a insulating counter electrical charge, the components wouldn’t be able to live in the same work environment (motherboard for example) without electrical issues.

Lastly, Robert Noyce, after these advances, was able to invent the first monolithic IC chip using improved insulation of components based on planar process, which is a process that builds individual components of a transistor and then connects the transistors together. A key component of the planar process that is also important for the length of the integrated circuits life span in way of surface passivation, which is a chemical coating technique used to make components less susceptible to environmental effects. Since the invention of this first monolithic IC, there have been many advances throughout the years, exponentially increasing their efficiency. But in the annals of history, Kilby and Noyce both share most of the credit for the invention of integrated circuits.

ARPANET

ARPANET aka the Advanced Research Projects Agency network was the first wide-area packet-switched network with distributed control and one of the first networks to implement the TCP/IP protocol suite. The former being a method of organizing data into packets prior to being sent from a source in a network to the desired receiver of said packet. Picture a file that is compressed into a header, which gives surface information to the contents of the packet, and a payload that contains the more detailed information that will later on be extracted by application software. An example in this that is pertinent to our class is sending in our MC challenges. Main\_1.cpp was the header of our packet. The actual coding using the C++ language is extracted via our chosen program (VSCode, CS50IDE, etc.) to show the meat of the information that we are sending from one computer to the next.

The ARPANET project was initiated by Bob Taylor, who’s contributions earned him awards including the National Medal of Technology and Innovation and the Draper Prize, in 1966. He proposed to his boss the ARPAnet, a network that will connect the different projects that ARPA was sponsoring. At the time, each project had its own terminal and special set of user commands. It wasn’t until 1969 though, that computers were first successfully connected. One year later the Network Control Protocol was implemented. NCP being a protocol that used users email addresses to establish connections for all communications. It continued to expand in throughout the 70s and early to mid-80s and TCP/IP was installed in the ARPANET for production use in 1983 after the Department of Defense made it standard for all military computer networking. However, ARPANET, was decommissioned in 1990 after the introduction of a world-wide network, also known as the Internet.

UNIX

UNIX (Uniplexed Information and Computing Service) was born in the year 1969. Ken Thompson and Dennis Ritchie both worked at Bell Labs and were tired of using the Multics system. Multics (Multiplexed Information and Computing Service) was a time-sharing operating system that was being developed in the mid-1960s jointly by MIT, General Electric, and Bell Labs. While Multics did have innovative concepts that would later be used on more efficient technologies later on, Ken and Dennis thought that Multics was overly complicated in its format and clunky. So, they started to create an operating system that suited their needs. Their aim was to make UNIX a much more simple, easy, approachable, and inexpensive alternative to the predecessors.

It first saw light in the PDP-7 microcomputer. Innovation continued once implemented. Text-formatting and text-editing programs were added and in 1972, Dennis Ritchie wrote the C programming language that improved upon Ken Thompson’s B language. Until this time, there were a very small amount of people with access to this indie adaptation of Multics. That would change drastically in 1974 when the duo published a CACM article about UNIX, it hit the internet was ablaze after hearing the praise that the Association for Computing Machinery had for this new system. Universities and start up companies were in love with the price point, simplicity, and amiability of this system. Source programs were readily available and easily modified online, allowing the program to evolve over time. It was a true tool for innovators, not to bogged down by financial barriers of entry. Unix continued to soar and adapt into the 1980s into different variations, which led to some business difficulties, but dominated the operating system world for a long time. It wasn’t until 1993 that Microsoft unloaded Windows NT operating system that innovatively competed with UNIX. After that UNIX had to share its space and Windows gained traction and later stole the spotlight. Both systems are still very prevalent today. Linux operating system, which began in 1991, was a kernel (computer program at the core of a computer’s operating system that has control over everything in the system) based off of UNIX and still very popular today. Most, if not all operating systems to date, have taken something away from UNIX and its, at the time, revolutionary change of computers and how users can easily evolve the tech space through accessible, collaborative innovation.

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