Key Terms:

The Abacus – consists of strings of beads strung on rods, which are mounted on a rectangular frame. As the beads are moved back and forth on the rod, their positions represent stored values. To carry out calculations, the abacus needs a human operator. The abacus must combine with a human to form a system whose primary purpose is carrying out additions.

The Leibniz Machine – was designed to perform basic arithmetic operations, and the algorithm for addition was embedded into the structure of the hardware itself.

Babbage's Analytical Engine – was designed to read instructions in the form of holes on paper cards. It was programmable. Is considered to be the world's first programmer.

Punched Cards - The idea of communicating instructions with punched cards originated in 1801 in a system specifying the steps of the weaving process. Different patterns of holes resulted in different woven designs.

Electromechanical Machine - Examples of this progress include the electromechanical machine of George Stibitz completed in 1940 at Bell Laboratories and Mark 1 completed in 1944 at Harvard University by Howard Aiken and a team of IBM engineers. These machines made heavy use of electronically controlled mechanical relays.

Fully Electronic Computer - In parallel to electromechanical machine efforts, the use of vacuum tubes gave way to fully electronic computers, such as the Atanasoff-Berry machine constructed at Iowa State College between 1937 and 1941, and Colossus built in England to decode German messages during the latter part of World War 2. Other more flexible machines, such as ENIAC (Electronic Numerical Integrator and Calculator) developed at the University of Pennsylvania, soon followed.

Computing System - The development of computer systems largely depended on advancements in technology such as the invention of the transistor. Later the invention of complete circuits allowed for integration of multiple circuits on one piece of semiconductor material such as silicon. These integrated circuits reduced the size of the early computing systems of the 1940s from room-sized machines to the size of a single cabinet. Processing power began to double every two years. The mass production of integrated circuits made computers less expensive and thus readily available in the market.

The ENIAC – was one of the earliest general-purpose electronic digital computers, developed during World War II. It used vacuum tubes for computation and was notable for its large size and significant computational power.

World Wide Web – a system by which documents stored on computers throughout the internet could be linked together producing a system of linked information.

Search Engines – use technologies to index pages so users can quickly search for resources based on keywords. Search engines help find web content. Example: Bing and Google

Browsers – is a software application used to access and view websites on the internet. Browsers are used to access and view that content. Examples are Edge and Chrome.

Desktop Computer - A major step in the popularization of computer systems was the development of desktop computers. Steve Jobs and Stephen Wozniak built the first viable home computer and established Apple Computer, Inc. (now Apple, Inc.) in 1976 to mass-produce their garage-built, home computer. Other companies such as Commodore offered similar solutions, but these smaller computers were not widely adopted by businesses who continued to use the well-established mainframe computers.

Personal Computer - In 1981, IBM introduced its first desktop computer called the personal computer, or PC, whose underlying software was developed by a newly formed company known as Microsoft. The term PC is now

widely used to refer to all machines that evolved from IBM's personal computer product, including desktops and laptops. Handheld

Internet - Toward the end of the twentieth century, the ability to connect individual computers in a world-wide system called the internet was revolutionizing communication. The British scientist Tim Bernes-Lee proposed a system by which documents stored on computers throughout the internet could be linked together producing a system of linked information called the World Wide Web. In order to make web pages more accessible to users, search engines (i.e. Bing and Google) and browsers (i.e. Edge and Chrome) were developed. Search engines use technologies to index and tag pages so users can quickly search for resources based on keywords.

Hand-Held Computers - Tiny computers are embedded in a wide variety of electronic appliances and devices. Because hardware components are continuing to reduce in size, the capabilities of smartphones continue to expand. These hand-held computers are much more than mobile telephones. They are equipped with a wide variety of sensors, including cameras, microphones, compasses, and touch screens, as well as a number of wireless technologies used to communicate with other smartphones and computers.

First Generation of Computers – used vacuum tubes for circuitry and magnetic drums for memory, and they were often enormous in size. They consumed a great deal of electricity and were expensive to operate. They often malfunction because of the excessive heat they generated. They relied on machine languages, the lowest-level programming languages understood by computers. Punch cards were used for input, and the computers printed out the outputs. Examples: EDVAC, UNIVACT, IBM-701, and IBM-650

Vacuum tubes – were the only electronic components available during the first generation of computers and a couple of complete calculations within milliseconds. They were large, had limited storage capacity, were unreliable, and required a lot of maintenance.

Second Generation of Computers – used transistors. Still relied on punched cards for input and printouts for output. Tapes and disks were used for storage purposes. Were built for the atomic energy industry. They were smaller in size, used less energy, and were easier to move, they were used for specific purposes and still required cooling systems and constant maintenance. Examples: Honeywell 400, IBM 7094, CDC 1604, CDC 3600, and UNIVAC 1108. Over 100 computer languages were developed to work with them. Machine language was replaced by assembly languages. Examples: FORTRAN and COBOL.

Transistors – replaced vacuum tubes. Were more reliable and economical. The smaller electronic components could maintain two states, "Off" and "On", represented by the binary digits of 0 and 1, respectively.

Machine Language – represents instruction in binary (0s and 1s).

Assembly Language – specified instructions using words.

Third Generation of Computers – Used integrated circuits. Users interact with computers using keyboards and monitors that communicate with other components of the hardware and operating systems. Operating systems made it possible for computers to run multiple applications at the same time and to share memory and other resources. The computational time was reduced from milliseconds to nanoseconds. Examples: PDP-9, PDP-11, ICL 2900, IBM 360, AND IBM 370.

Integrated Circuits – enabled the development of computer systems that were cheaper, faster, smaller, and more reliable. Miniaturized transistors and placed them on silicon chips called semiconductors. It increased computing power, but they were also complicated to manufacture, difficult to maintain, and required air conditioning to keep the computers cool enough to run.

Fourth Generation – Used microprocessors. Characterized by a significant reduction in processor size and, at the same time, a significant increase in capabilities. They also saw the development of graphical user interfaces, the mouse, and handheld devices. Operating Systems such as MS-DOS and Microsoft Windows, were developed

during this period. They were more reliable than their predecessors, calculated in picosecond (on a trillionth of a second), and used high-level languages, and were portable and economical.

Microprocessors – included thousands of integrated circuits on a single silicon chip.

Fifth Generation: Artificial Intelligence (Future) The fifth generation started in the early 1980s when microprocessor chips were able to accommodate tens of millions of electronic components using ultra large-scale integration (ULSI). These systems are capable of running multiple programs concurrently and are based on artificial intelligence (AI). Fifth-generation computers will support the development of artificial intelligence and natural language processing while using principles of robotics, neural networks, expert systems, and natural language understanding and generation.

Artificial Intelligence - is a branch of computer science focused on creating systems capable of performing tasks that typically require human intelligence. These tasks include learning, reasoning, problem-solving, understanding natural language, perception, and adapting to new situations. AI encompasses various subfields, including machine learning, neural networks, robotics, and natural language processing.

Quantum Computing – is the study of a non-classical model of computation. More efficient than modern computing through the use of quantum tunneling. They are expected to reduce power consumption from 100 to 1,000 times and will allow computing to surpass any and all limits that traditional computing has set.

Nanotechnology - involves the use of nanoscale (extremely small) tools and nonbiological processes to build structures, devices, and systems at the molecular level.

Acronyms

ENIAC – Electronic Numerical Integrator and Calculator

PC – Personal Computer

FORTRAN – FORmula TRANslation

COBOL – Common Business-Oriented Language

AI – Artificial Intelligence

ULSI – Ultra-large-scale integration

Vacuum Tube   Transistors   Integrated Circuit   Microprocessor

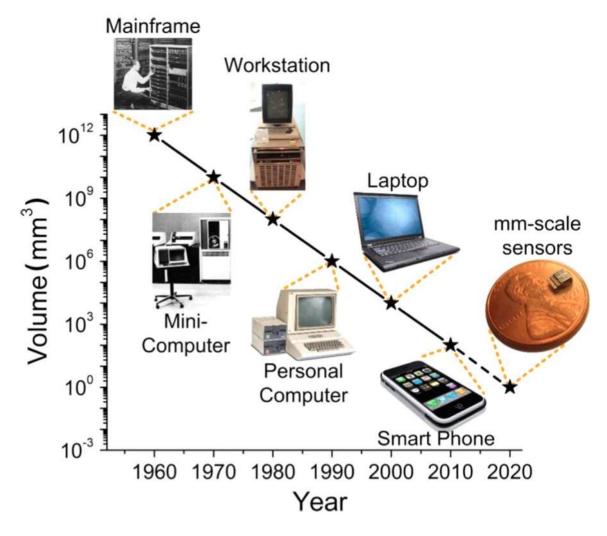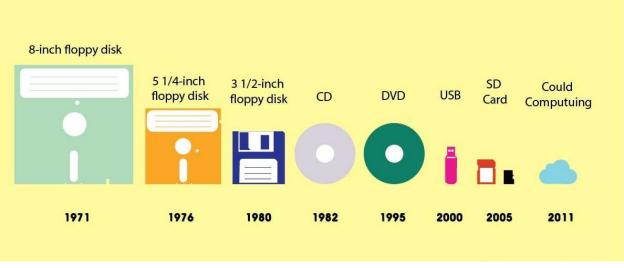1st Generation Computer   2nd Generation Computer   3rd Generation Computer   4th Generation Computer
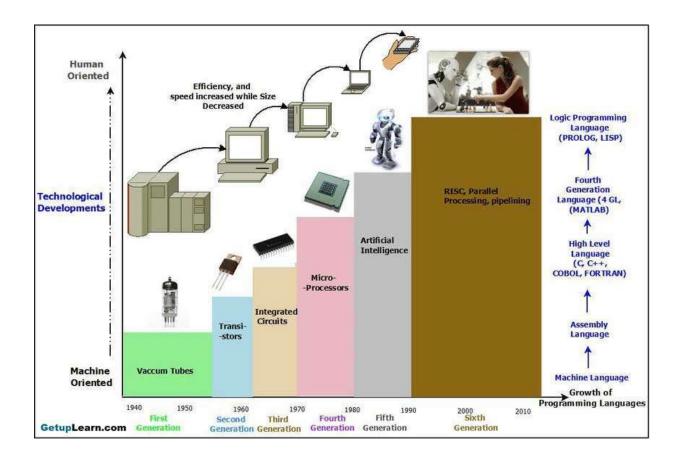
GetupLearn.com

Timeline

First Generation (1946 – 1959)

1948 – Manchester Mark 1 – 1st ever stored-program computer. Written to search for Mersenne primes and ran continuously for 9 hours straight.

1954 – IBM – popular in universities where a generation of students first learned computer programming. Direct keyboard input was introduced to replace punched cards and paper tape input.

1958 – Used to detect incoming Soviet bombers and direct interceptor aircraft to destroy them.

Second Generation (1959 – 1965)

1960 – Intrigued early hackers at MIT who wrote the 1st computer video game. Spacewar! And programs to play music well.

Third Generation (1965 – 1971)

1971 – Intel introduces the 1st microprocessor. The first laser printer was launched by Xerox launching a new era in printing.

Fourth Generation (1971 – Present)

1976 – Steve Wozniak & Steve Jobs created the 1st Apple I.

1977-1978 – Apple II sold with keyboard, case, manual game paddles, and cassette tapes contain the game breakout. Artai launces the Model 400 and 800 computers – Slogan "Computers for People."

1981 – MS-DOS – the most licensed operating system. Introduces the floppy drive and diskettes, which became the microfloppy standard for portable storage.

1982-1983 – CD-Roms are developed by Philips. Microsoft Word became a global word processing standard.

1984 – Apple launches Macintosh, the first successful mouse-driven computer with a graphical user interface (GUI) and a 68000 microprocessor.   Compaq Computer Corporation introduces the first 100% compatible computer.

1990 – Tim Berners-Lee invents the World Wide Web in CERN in Switzerland. The web is made public in August 1991. Microsoft delivers Windows 3.0 providing the ability to run multiple programs simultaneously on the Intel Chip.

1992 – JPEG creates a set of standards for digital images.

1993 – Mosaic, the first popular browser for the web, is created. Online ads begin.

1994 – CompactFlash memory storage is introduced by SanDisk. Sony releases the PlayStation console.

1997 – IBM's Deep Blue chess computer defeats world chess champion Gary Kasparov. Text messaging becomes the norm with the introduction of the Nokie, Blackberry, and other mobile phones.

2000 – 1st camera phones are introduced. USB flash drives are introduced for storage and backing up as well as transferring files between devices. Honda introduces ASIMO humanoid robot.

2001 – iTunes is released for the Mac Operating System only a media play and management tool. Microsoft launched the Xbox

2006 – "to google" was added to the dictionary. Amazon Web Services launches cloud-based servers allowing users to rent virtual time on the cloud to scale server capacity. Similar services like Google Drive to follow.

2007 – Amazon Kindle is released. Apple iPhone is released with apps available from the Apple Store. Google's Android mobile platform followed.

2010 – Apple iPad is released. Apple Retina display for MacBooks offers a screen resolution of up to 220 pixels per inch. IBM Watson beats from Jeopardy Champion contests. In 2011, Watson beat two form champions.

2011 – Adobe Creative Cloud is announced as a subscription model of distribution for its major software products.

2012 – Raspberry Pi, a small single-board computer, is released as a tool to promote science education.

2013 – Microsoft Office 365 is announced offering Microsoft's product suite online for a subscription.

2014 – Apple Pay mobile payment system is introduced into Apple's product ecosystem.

2015 – Apple Watch is released incorporating Apple iOS operating system with sensors for environment and health monitoring.

2019 – Oculus releases the Oculus Rift S and one more camera facing upwards.