

TOPIC 4 – EVOLUTION OF COMPUTING FIELDS

LEARNING OUTCOMES

By the end of this topics, you will be able to:

1. Identify the evolution of computing fields
2. Discuss the importance of computer
3. Explain any issues that will be impact towards computing

INTRODUCTION

The basic ideas of computing and calculating are very old, going back thousands of years. However, the computer in the form in which it is recognized today is a fairly recent invention. In fact, personal computers have only been around since the late 1970s. The history of computers is often referred to in terms of generations, with each new generation characterized by a major technological development. The next sections summarize some early calculating devices and the different computer generations.

4.1 Brief history of generation of computer

a) Pre-computers and Early Computers (before approximately 1946) Based on archeological finds, such as notched bones, knotted twine, and hieroglyphics, experts have concluded that ancient civilizations had the ability to count and compute. The abacus is considered by many to be the earliest recorded calculating device; it was used primarily as an aid for basic arithmetic calculations. Other early computing devices include the slide rule, the mechanical calculator, and Dr. Herman Hollerith's Punch Card Tabulating Machine and Sorter. This latter device (see Figure 1-7) was the first electromechanical machine that could read punch cards—special cards with holes punched in them to represent data. Hollerith's machine was used to process the 1890 U.S. Census data and it was able to complete the task in two and one half years, instead of the decade it usually took to process the data manually. Consequently, this is considered to be the first successful case of an information processing system replacing a paper- and-pen-based system. Hollerith's company eventually became International Business Machines (IBM).



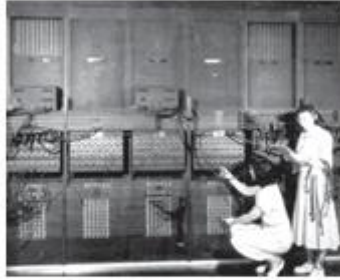
PRECOMPUTERS AND EARLY COMPUTERS
Dr. Herman Hollerith's Punch Card Tabulating Machine and Sorter is an example of an early computing device. It was used to process the 1890 U.S. Census data.

Figure 4

b) First-Generation Computers (approximately 1946–1957)

The first computers were enormous, often taking up entire rooms. They were powered by thousands of vacuum tubes—glass tubes that look similar to large light bulbs—which needed replacing constantly, required a great deal of electricity, and generated a lot of heat. First-generation computers could solve only one problem at a time because they needed to be physically rewired with cables to be reprogrammed (see Figure 4.1), which typically took several days (sometimes even weeks) to complete and several more days to check before the computer could be used. Usually paper punch cards and paper tape were used for input, and output was printed on paper.

Two of the most significant examples of first-generation computers were ENIAC and UNIVAC. ENIAC, shown in Figure 4.1, was the world's first large-scale, general-purpose computer. Although it was not completed until 1946, ENIAC was developed during World War II to compute artillery-firing tables for the U.S. Army. Instead of the 40 hours required for a person to compute the optimal settings for a single weapon under a single set of conditions using manual calculations, ENIAC could complete the same calculations in less than two minutes. UNIVAC, released in 1951, was initially built for the U.S. Census Bureau and was used to analyze votes in the 1952 U.S. presidential election. Interestingly, its correct prediction of an Eisenhower victory only 45 minutes after the polls closed was not publicly aired because the results were not trusted. However, UNIVAC became the first computer to be mass produced for general commercial use.



FIRST-GENERATION COMPUTERS
First-generation computers, such as ENIAC shown here, were large and bulky, used vacuum tubes, and had to be physically wired and reset to run programs.

Figure 4.1

c. Second-Generation Computers (approximately 1958–1963)

The second generation of computers began when the transistor—a small device made of semiconductor material that acts like a switch to open or close electronic circuits—started to replace the vacuum tube. Transistors allowed second-generation computers to be smaller, less expensive, more powerful, more energy-efficient, and more reliable than first-generation computers. Typically, programs and data were input on punch cards and magnetic tape, output was on punch cards and paper print-outs, and magnetic tape (see Figure 1-7) was used for storage. Hard drives and programming languages (such as FORTRAN and COBOL) were developed and implemented during this generation.



SECOND-GENERATION COMPUTERS
Second-generation computers, such as the IBM 1401 mainframe shown here, used transistors instead of vacuum tubes so they were smaller, faster, and more reliable than first-generation computers.

Figure 4.2

d. Third-Generation Computers (approximately 1964–1970)

The replacement of the transistor with integrated circuits (ICs) marked the beginning of the third generation of computers. Integrated circuits incorporate many transistors and electronic circuits on a single tiny silicon chip, allowing third-generation computers to be even smaller and more reliable than computers in the earlier computer generations. Instead of punch cards and paper printouts, keyboards and monitors were introduced for input and output; hard drives were typically used for storage. An example of a widely used third-generation computer is shown in Figure 4.3.



THIRD-GENERATION COMPUTERS
Third-generation computers used integrated circuits, which allowed the introduction of smaller computers such as the IBM System/360 mainframe shown here.

Figure 4.3

e. Fourth-Generation Computers (approximately 1971–present)

A technological breakthrough in the early 1970s made it possible to place an increasing number of transistors on a single chip. This led to the invention of the microprocessor in 1971, which ushered in the fourth generation of computers. In essence, a microprocessor contains the core processing capabilities of an entire computer on one single chip. The original IBM PC (see Figure 4.4) and Apple Macintosh computers, and most of today's traditional computers, fall into this category. Fourth generation computers typically use a keyboard and mouse for input, a monitor and printer for output, and hard drives, flash memory media, and optical discs for storage. This generation also witnessed the development of computer networks, wireless technologies, and the Internet.



FOURTH-GENERATION COMPUTERS
Fourth-generation computers, such as the original IBM PC shown here, are based on microprocessors. Most of today's computers fall into this category.

Figure 4.4

f. Fifth-Generation Computers (now and the future)

Fifth-generation computers are most commonly defined as those that are based on artificial intelligence, allowing them to think, reason, and learn (see one example in Figure 4.5). Some aspects of fifth-generation computers—such as voice and touch input and speech recognition—are being used today.

In the future, fifth-generation computers are expected to be constructed differently than they are today, such as in the form of optical computers that process data using light instead of electrons, tiny computers that utilize nanotechnology, or as entire general-purpose computers built into desks, home appliances, and other everyday devices.



FIFTH-GENERATION COMPUTERS
Some aspects of fifth-generation computers, such as the natural language input and artificial intelligence used by the IBM Watson computer shown competing on Jeopardy! here, already exist.

Figure 4.6

4.2 Improvements of computer over time period

Technology affects the way individuals communicate, learn, and think. It helps society and determines how people interact with each other on a daily basis. Technology plays an important role in society today. It has positive and negative effects on the world and it impacts daily lives. Example Nowadays, youth can definitely be called the computing generation. From handheld gaming devices to mobile phones to computers at school and home, most children and teens today have been exposed to computers and related technology all their lives.

Although the amount of computer use varies from school to school and from grade level to grade level, most students today have access to computers at school—and some schools have completely integrated computers into the curriculum, such as by adopting e-book (electronic) textbooks that run on school-owned portable computers, or allowing students to bring in devices to use in class (referred to as BYOD or Bring Your Own Device). Many schools (particularly college campuses) today also have wireless hotspots that allow students to connect

their personal computers or mobile devices wirelessly to the Internet from anywhere on campus. Today, students at all levels are typically required to use a computer to their personal, family, and work commitments, as well as allows individuals located in very rural areas or stationed at military posts overseas to take courses when they are not able to attend classes physically.

4.3 Social Impacts of computer evolutions

Although computers have been used on the job for years, their role is continually evolving. Computers were originally used as research tools for computer experts and scientists and then as productivity tools for office workers. Today, computers are used by all types of employees in all types of businesses—including corporate executives, retail store clerks, traveling sales professionals, artists and musicians, engineers, police officers, insurance adjusters, delivery workers, doctors and nurses, auto mechanics and repair personnel, and professional athletes. In essence, the computer has become a universal tool for on-the-job decision making, productivity, and communications.

Computers are also used extensively for access control at many businesses and organizations, such as authentication systems that allow only authorized individuals to enter an office building, punch in or out of work, or access the company network via an access card or a fingerprint or hand scan, as shown in Figure 4.7. In addition to jobs that require the use of computers by employees, many new jobs have been created simply because computers exist, such as jobs in electronics manufacturing, online retailing, Internet applications, and technology-related computer support.



DECISION MAKING
Many individuals today use a computer to help them make on-the-job decisions.



PRODUCTIVITY
Many individuals today use a computer to perform on-the-job tasks efficiently and accurately.



OFF-SITE COMMUNICATIONS
Many individuals use portable computers or mobile devices to record data, access data, or communicate with others when they are out of the office.



AUTHENTICATION
Many individuals are required to use authentication systems to punch in and out of work, access facilities, or log on to company computers.

Figure 4.7

4.4 Health Issues

Despite their many benefits, computers can pose a threat to a user's physical and mental well-being. Repetitive stress injuries and other injuries related to the workplace environment are estimated to account for one-third of all serious workplace injuries and cost employees, employers, and insurance companies in lost wages, healthcare expenses, legal costs, and workers' compensation claims. Other physical dangers (such as heat burns and hearing loss) can be associated with computers and related technology, and there are some concerns about the long-term effect of using computers and other related devices. Stress, burnout, computer/Internet addiction, and other emotional health problems are more difficult to quantify, although many experts believe computer-related emotional health problems are on the rise. While researchers are continuing to investigate the physical and emotional risks of computer use and while researchers are working to develop strategies for minimizing those risks, all computer users should be aware of the possible effects of computers on their health, and what they can do today to stay healthy.

4.4.1 Ergonomics

Ergonomics is the science of fitting a work environment to the people who work there. It typically focuses on making products and workspaces more comfortable and safe to use. With respect to computer use, it involves designing a safe and effective workspace, which includes properly adjusting furniture and hardware and using ergonomic hardware when needed. A proper work environment—used in conjunction with good user habits and procedures—can prevent many physical problems caused by computer use. A proper work environment is important for anyone who works on a computer or mobile device, including employees using a computer, media tablet, or smartphone on the job, individuals using one of these devices at home, and children doing computer activities or texting while at home or at school.

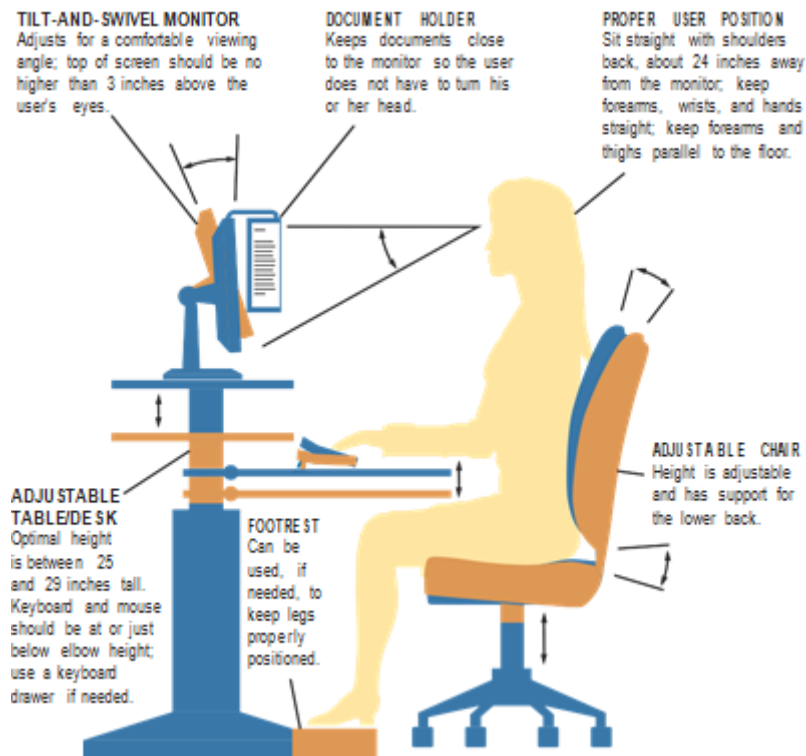


Figure 4.8

4.5 Environmental Issues

The increasing use of computers in our society has created a variety of environmental concerns. The amount of energy used to power personal computers, servers, and computer components, as well as the heat generated by computing equipment, is one concern. Another is our extensive use of paper, CDs, and other disposables, and how much of it ends up as trash in landfills. The hazardous materials contained in computer equipment or generated by the production of computers and related technology, as well as the disposal of used computing products, are additional concerns. With an increasing amount of attention being focused on energy usage and carbon emissions, businesses and individuals are paying more attention to energy costs and their carbon footprint (the amount of carbon dioxide produced to support activities), as well as the carbon footprints of their suppliers and business partners.

4.7 Legal Issues

Legislation regarding ethics has been more difficult to pass-or to keep as law once it has passed. For example, the Communications Decency Act that was signed into law in 1996 and made it a criminal offense to distribute patently indecent or offensive material online was eventually

declared unconstitutional on the basis of free speech. The courts so far have had difficulty defining what is “patently offensive” and “indecent,” as well as finding a fair balance between protection and censorship. Consequently, very few ethically oriented laws have been passed in recent years. The most significant recent legislation regarding accessibility has been the 1998 amendment to Section 508 of the Rehabilitation Act requiring federal agencies to make their electronic and information technology accessible to people with disabilities. This act applies to all federal Web sites, as well, creating a trend of Web sites that are Section 508 compliant. While there are currently no federal computer recycling laws in the United States, federal agencies are required to purchase energy-efficient electronic products. In addition, some federal laws (such as the Sarbanes-Oxley Act and HIPAA) have established privacy and data protection standards for companies disposing of computer hardware that contained specific types of data and some states have implemented laws related to electronic waste.