# Technological Development Timeline

**T**ECHNOLOGY is used daily, and we often don't think about how much it impacts our lives. Many of the things we use regularly in our personal lives were first designed to fix a problem or satisfy a need in the business world. In this lesson, you will explore the advancement of technology, from the Stone Age to the Internet of Things (IoT).



#### **Objective:**

 $\checkmark$ 

Describe historically significant technological developments.

#### **Key Terms:**



3D displays artificial intelligence augmented reality binary number system brain-computer interfaces computer-aided design (CAD) communication fax machine fiber optic cable FORTRAN graphical user interface (GUI) integrated circuit microprocessor perceptual computing real-time translation device technology transistor universal internet videoconference virtual reality

# **The Development of Technology**

According to the Oxford Dictionary (<u>https://en.oxforddictionaries.com/definition/</u> <u>technology</u>), **technology** is "the application of scientific knowledge for practical purposes, especially in industry." In its most basic form, technology is the development of tools that



make tasks easier. This E-unit will look at how technology has evolved from the beginning, especially in relation to communications equipment, computers, and the Internet.

#### HISTORICALLY SIGNIFICANT TECHNOLOGICAL DEVELOPMENTS

In this section, you will look at how technology has developed through history, from the Stone Age to the Computer Age.

#### **Early Ages**

The earliest forms of technology from the Stone Age included things like stone, wood, bones, and antlers that were formed to make blades. Eventually, those instruments became tools for drawing and then writing. After the invention of the wheel, the world became more industrious. Boats, homes, and irrigation systems were created. With travel and construction possible, large populations began seeking more land and power over other civilizations. Bronze

and iron came into play, being used for weaponry, construction, and decoration (the Bronze Age and the Iron Age).

Once ancient civilizations had an infrastructure, technologies used for communication and scientific endeavors were sure to arrive. During this period, languages and symbols for those languages started being written down. Mathematical, industrial, and governmental achievements were found in ancient Egypt, Greece, and Rome.



FIGURE 1. Hieroglyphics from an ancient Egyptian tomb show the beginnings of communication tools.

#### The Middle Ages

The manufacturing of metals and glass became possible, and a curious spirit lead to the advancements that would come in the Middle Ages. New ways to support large populations and protect cities were needed. Large castles with surrounding communities emerged. Eventually, dynasties stopped trying to conquer each other, and humans had time to become interested in arts, leisure, and the conveniences of an urban life. Although battles still raged on throughout many cultures, the inventive spirit of humankind was able to shine through. Windmills were invented in the Middle East. The Chinese invented gun powder, fireworks, and eyeglasses. The ancestor to the modern toilet was invented by an Arabic engineer in the middle ages. During the Middle Ages, weapons had evolved from the carved bone and wood (knives and arrows) of the Stone Age to catapults and cannons.



With the need to communicate information to larger areas, written language and reading became more important. In 1450, the ancestor of the printing press was developed. Eventually, the world would start moving quickly into artistic and scientific revolutions that would be most evident in the eighteenth and nineteenth centuries; however, all of this came about at the end of the Middle Ages, during a time known as the Renaissance. This is a time when individual thought and creativity became more popular. People like Da Vinci blended science and art, and wealthy landowners found more power through imagination and science. For example, the compound microscope was developed in 1590 by a Dutch spectacle maker, Zacharias Janssen. During the 1600s thermostats, pendulum clocks, telescopes, and modern microscopes were developed.

#### **The Industrial Revolution**

As discussed earlier, the end of the Middle Ages (around 1600 to 1750 CE) brought about major changes to modern society. Throughout human



FIGURE 2. Leonardo Da Vinci is a famous artist from the late 1400s. Not only did he create amazing artwork, he was constantly sketching ideas for new inventions. Many of these became realized hundreds of years later.

existence, there have been many periods of technological breakthroughs, but the Industrial Revolution from 1750 to 1900 CE showed an explosion of ideas and inventions that are still used today. Some of these inventions lead directly to the creation of the modern computer.

#### 1700s

In the 1700s, steam engines, speech synthesizers, and titanium were discovered. The horsedrawn seed drill and the steam engine were created. In addition, the concept for the internal combustion engine was conceived. Several advances were also made in nautical navigation, pushing the boundaries of travel. The binary number system that is now used for computer programming was developed. The **binary number system** is a numbering system that represents all numeric values using only the digits 0 and 1.



#### 1800s

During the nineteenth century, the battery was created. In addition, several advancements related to machinery and equipment happened, such as the automated loom, the development of steam and gas energy, gasoline engines, and eventually, the electric engine. Nikola Tesla developed the alternating-current (AC), electric-induction motor. The first power plant was opened. X-rays, photographs, phonographs, and film were developed in the 1800's.



FIGURE 3. A Serbian immigrant, Nikola Tesla came to the United States in the late 1800s and innovated the world of electronics. Many of his pattens were sold to other inventors, so it would not be until years later that he would get credit for things like the alternating-current (AC) electrical system that we still use today. Pictured is a transformer at a power station, something Tesla would have had in his lab.

#### The 20th Century

During the early twentieth century (1900 to 1950 CE), technology seemed to focus on fuel, power, and weapons. With world wars being waged, the need for efficiency increased. After the wars, home conveniences and communication devices became important to those wanting to live in a modern world.

#### Fuel

The development of crude oil into fuel allowed engines and machinery to operate at greater capacities. The development of wiring and electrical systems (alternators and generators) allowed for the expansion of electricity into public buildings and private homes. Nuclear reactions and the splitting of an atom gave way to nuclear energy and the atom bomb.

#### **Manufacturing and Flight**

With the onslaught of electricity and engine developments, people like Henry Ford began creating modern manufacturing. Automobiles started being made on moving assembly lines. As cars became more prevalent, the Wright brothers built the first engine-powered airplane. Several electric machines for personal use were also developed, including the vacuum cleaner, clothes washer, air conditioner, refrigerator, and the television. Plastics and celluloids were developed.

#### Communications

Many advances in communications technology occurred during this period. The telephone, typewriter, rotary press, and wireless communication were all invented during this period. The electron microscope and cathode ray tube (CRT) paved the way for not only medical advance-



ments (such as modern X-rays), but also television and radio broadcasting. Transistors and microprocessors were developed which later played a significant role in computer development. The photocopier was created during this time period. Since their inception in the 1950's, photocopiers have evolved from machines that reproduce images on paper to ones that can also scan, fax, and Email images. Not only are copiers smaller than the originals, but most of them are integrated with Wi-Fi and computer technology.

#### **Computer Age**

During the mid-twentieth century, government agencies and scientists made advancements in communication equipment, computer components, and internet technology. Globally, these developments spilled over into personal, industrial, and office environments.

#### **Personal Computers**

In 1981, IBM came out with the first personal computer. Originally, computers were large machines used to break down numbers and mathematical equations (compute). Organizations such as NASA, the government, and large scientific institutions were the only ones developing or using them. Then, IBM found out that people needed to process information as well. After word processing was developed, computers began evolving more and more quickly to keep up with the demand for faster, more efficient business and personal use. Programs were developed that made log books, typewriters, filing systems, and other office paraphernalia obsolete.



FIGURE 4. IBM created the first personal computer (PC) in 1981. This is the IBM 5160 that was brand new in 1983.

#### The Internet

An internal network to share information between computers was an interest of multiple government agencies around the world. In the '60s, the first networked "web" was created through the United States Defense Department. ARPANET became the basis for universities to try and connect their servers to share information. The World Wide Web was created in 1989 by a scientist at Cern (a European scientific collective) named Tim Berners-Lee. He wanted to have a way for scientists and universities around the world to be able to communicate and share research. He had no idea what would happen next.



#### Innovation

With the creation of the Internet, communication and information were now available with a few key strokes. Email and messaging soon made it possible to connect with people all over the world for free. Apple and Microsoft were formed. They competed for programming dominance, so advancements in computer technology and microprocessing increased yearly. With the development of wireless technology and the battle to find the next great thing, businesses are sure to keep innovating. A more in-depth look at the advancement of this technology will be explored in the next section.

# THE DEVELOPMENT OF COMMUNICATIONS, COMPUTER, AND INTERNET TECHNOLOGIES

Communication refers to the ability to convey information from one party to another. The development of communication equipment, computers, and the Internet have changed the way businesses and people are connected today. Most likely, future advances in communication will be closely linked to advancements in computer and Internet technology.

#### **Communications Equipment**

Typically, administrative offices manage a good deal of a business's operational communications using technology. Most of this technology is taken for granted, but where did it come from?

#### **Telephones**

Telephones are a crucial part of business communication. A timeline shows how long it took them to become wireless cell phones.

- <u>1831</u>: The first electric telegraph was invented.
- <u>1843</u>: The first long-distance telegraph line was invented.
- <u>1876</u>: The first electric telephone was patented.
- <u>1889</u>: The first direct-dial telephone was patented.
- <u>1914</u>: The first cross-continental call was placed.
- <u>1973</u>: The first portable cell phone made a call. Martin Cooper of Motorola called his lab.
- <u>1977</u>: The first fiber-optic system of telephone cables was installed 1.5 miles under Chicago.
- <u>1979</u>: The first Japanese cellular network was established.
- <u>1983</u>: The first U.S. cellular network was established.
- <u>2000 to Present</u>: By 2000, more than 100 million cell phones were in use. Today, more homes in the United States use cell phones than ever before. Landline telephones (hardwired telephone lines) are becoming more and more obsolete.



#### **Faxes**

A **fax machine (fax)** is a device that electronically sends and receives reproductions of documents through telecommunication lines. The fax was the first device that allowed users to scan a document and send it to a different physical location. The machine at the other location could receive the data and print a hard copy of the document. Although many documents in the business world are scanned and emailed digitally, fax machines are still used in many offices. Since they generally operate through landlines, sensitive information can be transferred without being subject to email hackers.

#### **Fiber Optics**

To increase the speed and clarity of signals used to make phone calls or watch cable tv, companies started researching better transmitters. Thick cables with copper wiring were not only expensive, but were inefficient in the face of more and more information being communicated every minute of the day. Then came the fiber optic cable. A **fiber-optic cable** is a cord containing tiny glass or plastic filaments that carry light beams consisting of high-speed data transmissions. Rapid pulses of light transmit data through the cable. By 2010, 80% of all long-distance calls on a landline were conveyed through fiber optic cables. There are 15.5 million miles networked underground throughout the world, which is enough fiber optic wire to circle the globe nearly four times. These cables are used in homes for cable and internet connections, as well in cell towers.

#### **Cell Phone Apps**

Cell phones are now used in business and at home to video conference, share images, purchase items, and conduct basic financial operations. In addition, cell phones run a variety of applications (apps). Apps are designed to accomplish various tasks, such as to make or collect payments (including the organization of sales and customer information), play games, read books, organize calendars, schedule appointments, purchase items, and manage bank accounts. In the last decade, businesses have seen cell phones transition from being mobile telephones to becoming handheld computers that organize the lives of their employees.

#### Videoconferencing

A **videoconference** is a meeting of participants from different locations through the use of audio and video technology. Videoconferencing is used in the global business environment to meet with executives from around the world instantly. In personal lives, videoconferencing may be as simple as a video chat through an app on a cell phone.

#### **Future Communications**

What might communication equipment look like in the future? Scientists are working to develop a **brain-computer interface**, a technology that allows the communication of thoughts directly to a computer.

Anyone who watches *Star Trek* would be interested in what scientists are working on to get rid of language barriers. They are trying to develop real-time translation devices. A **real-time** 



**translation device** is a computer-programmed gadget that provides an immediate translation of a foreign language. In this scenario, people speaking different languages will understand each another. Time lags in the words being translated by a human translator will be erased. If this were to be paired with braincomputer interfacing, speaking wouldn't be necessary. The computer would know what is being thought and send it to someone's earpiece in the correct language.



FIGURE 5. The first electric telegraph was invented in 1831. That led to the invention of the telephone. Can you imagine life without a cell phone?

#### **Computer Technology**

Computer technology has seen exponential growth since the 1930s.

#### **Timeline**

The evolution of modern computers can be seen from the 1930s to today.

- <u>1936</u>: Konrad Zuse invented the first programmable computer, the Z1. This computer was a series of intertwined calculators, and it was developed to compute long engineering equations.
- <u>1951</u>: The Census Bureau funded two University of Pennsylvania professors to build the UNIVAC. The UNIVAC became the first commercial computer available for business and government usage.
- <u>1953</u>: International Business Machines (IBM) entered the commercial industry with the IBM 701 EDPM computer.
- <u>1954</u>: FORTRAN was created by IBM. FORTRAN is a computer programming language named from "formula translation." It was the first, high-level, programming language made up of human words and syntax, rather than only numbers. It revolutionized how computer programs were written.
- <u>1958</u>: When the microchip was invented, many electronic interconnections could be housed on one "chip," contributing to the shrinkage of computer technology.
- <u>1964</u>: The first computer mouse and prototype of windows (framed areas on the computer) appeared, enabling people to more easily use a computer.
- <u>1970</u>: Intel created the first random-access memory (RAM) chip, which remembered larger amounts of short-term instructions.



- ◆ <u>1971</u>: Intel created the first microprocessor chip, contributing to further downsizing of computer technology. The microprocessor stored all of the computer's "thinking" abilities onto chips.
- <u>1971</u>: IBM created the floppy disk, enabling the mobile storage of data.
- <u>1973</u>: Xerox created Ethernet, enabling multiple computers within a building to be networked.
- <u>1974</u>: Consumer computers started being sold to the general public.
- <u>1975</u>: Bill Gates and Paul Allen created the BASIC language. They then formed their own software company, Microsoft.
- <u>1976</u>: Steve Jobs and Steve Wozniak started Apple Computers on April Fool's Day. They created the first computer with a single-circuit board, the Apple 1.
- <u>1981</u>: IBM created the first "personal computer (PC)," using an MS-DOS operating system. This is where the term PC comes from.
- <u>1983</u>: Apple released the first computer with a graphical user interface. A graphical user interface (GUI) is a program that enables a user to easily interact with a computer. Their GUI introduced a window screen with pull-down menus and a mouse cursor.
- <u>1985</u>: Microsoft offered Windows for the first time. This was a GUI that could work on any non-Apple computer. Their hope was to become the only GUI used by computer creators (like IBM, HP, and Commodore) and it worked. Apple became a top company, but their GUI is only used on their equipment. Microsoft Windows is now used with most computer manufacturers, such as Dell, HP, Acer, Lenovo, and multiple others.
- <u>1996</u>: Handheld devices were released as personal digital assistants.
- <u>1999</u>: Wi-Fi was introduced.
- <u>2010</u>: Apple released its first touchscreen computer, the iPad. From this point, the word "tablet" refers to a notebook-sized, touchscreen computer.

#### **Computer Advancements**

As computer technology continues to advance, companies have taken advantage of the increased productivity and profitability found through in computer programs. Computer technology has allowed businesses to collect, calculate, search, and store data at much quicker speeds using less storage space. This all started with the transistor. A **transistor** is a device that regulates current or voltage flow and acts as a switch or gate for electronic signals.

With the development of a transistor, multiple electronic components could be linked together in miniature form. The **integrated circuit (microchip)** is a single, microscopic unit made up of multiple electronic components that work together as a collective. Once the microchip was invented, computer science experts looked into creating a computer that processed information through these mini chips. A **microprocessor** is a microchip that contains the central processing functions of a computer.

• Due to microchips and microprocessors, businesses now store large amounts of information digitally, rather than with hard copies in filing cabinets.



Technology advancements have improved manufacturing production lines through robotics technology and CAD systems. **Computer-aided design (CAD)** is a design software for creating a visual of the specifications needed to build items. CAD is used in engineering, architecture, and building to streamline and improve design processes. It can create 3D models, building specs, or structural diagrams.

#### **Future Computer Technology**

There is much speculation regarding the future of computer technology and AI.

#### AI

**Artificial intelligence (AI)** is a computer operating system that is able to perform human-like tasks that require decision-making, visualization, and speech recognition. AI advancements are being made daily, and common, everyday items already have AI incorporated into them. Many phone systems and security software use audio, visual, and decision-making technology. AI is also in use for certain manufacturing tasks performed by robots and autonomous (self-driving) cars.

#### **Virtual Reality**

**Virtual Reality** is a simulated, 3D, computer-generated environment that a user can interact with. It is presented so that the user suspends belief and accepts the simulated environment as a reality. Using software from a computer program, virtual reality is primarily experienced through sight and sound. Virtual-reality tech frequently requires users to wear a helmet, goggles, and/or other special equipment fitted with sensors. Someday, this might could be developed into entire rooms that scan and react to the user, instead of being limited to specific equipment.

#### **Augmented Reality**

Another innovation of the future may be augmented reality. An **augmented reality** is a computer-generated, superimposed overlay that allows users to see images or text on top of the



FIGURE 6. From the large computing systems of the 1950s to the handheld devices we use today, computers have come a long way.



real world. This could happen through hand-held devices used to share information, design plans, read maps, or display diagrams and other information in 3D. Augmented-reality tech is currently being developed for video games, but it has potential as a training device or realworld aid. In the near future, someone could walk down the street and see the names of people and places displayed on a mirrored image (on their phone or tablet) as they come into viewing range.

#### **Wireless Charging**

Advancements in wireless charging are continually developing. This makes it easier for computers and peripherals to be more mobile. Wireless charging allows people to charge the batteries of tablets, laptops, cell phones, and other electronics without being physically attached to a charging device. Eventually, devices may be charged without restricting a user's proximity to a power source.

#### The Internet

Progress is constantly being made to improve the speed, storage capacity, and image quality of computer technology. Many of these improvements can be linked to internet applications. The Internet is an internationally connected network of information provided through communication equipment and computers. A personal computer is able to access the "Web" for any type of information.

#### Timeline

Internet technology has increased in its size and scope through the years.

- <u>1969</u>: ARPANET, the precursor to the Internet, was created by the United States military after the Cold War. The intention was to distribute information between geographically dispersed computers, establishing a control center that could avert a nuclear attack. However, they were unable to send and receive information. It took UCLA students to develop the ability for packets of information to be sent between two computers. They started connecting to other universities using ARPANET.
- <u>1972</u>: Electronic mail (email) was created by Ray Tomlinson.
- <u>1979 to 1982</u>: Multiple networks started popping up around the world during this time. USENET was the first networked discussion group, but others (CSNet and BITNET) started to develop into something similar to the modern Internet.
- <u>1982</u>: Internet technology protocols (ITP) were created, making it easier for personal computers to connect to networks.
- <u>1989 to 1991</u>: Tim Berners-Lee created the World Wide Web, hypertext markup language (HTML), hypertext transfer protocol (HTTP), and universal resource locators (URLs), enabling the creation of hosted/visited websites.
- <u>1992 to 1995</u>: The development of Mosaic, the first web browser, allowed people to look for information and images throughout the Internet, as well as easily find and go to spe-



cific websites. This caused an explosion of website hosts. The number of new websites started growing at a rate of 341,634% annually.

- <u>1995 to 1997</u>: Video streaming technology appeared.
- <u>1995</u>: Internet Explorer was introduced as a browser.
- <u>1998</u>: Google was founded.
- <u>2000</u>: Electronic viruses (bugs) were developed by hackers (users that gain unauthorized data) and spread through the internet.
- <u>2004</u>: Facebook launched.
- <u>2005</u>: YouTube launched.
- <u>2006</u>: Twitter launched.
- <u>2010</u>: Facebook reached 400 million active users. Pinterest and Instagram launched.
- <u>2015 to Present</u>: Voice-activated, personal assistants, such as Siri and Alexa, arrived on the scene. They are becoming quite popular, and are now incorporated into the manufacturing of most phones and computers.

#### **Business and the Internet**

The advancement of the internet has exponentially increased the amount of information available (and the speed with which it can be accessed) for consumers and producers. Businesses provide product information, sales, and customer service through company websites on the Internet. They can share instructional videos on YouTube and complete direct marketing through email and social media (such as Facebook, Twitter, and Instagram). Businesses and individuals may store and share information electronically using the Internet and cloud storage. (The cloud is a network of servers that store and manage information for people and businesses, such as documents, pictures, and files. This information is uploaded through an Internet connection.) Voice-activated, personal assistants are used to complete internet research, schedule calendar events, and complete online shopping.

#### **Future Predictions**

Some computer scientists predict that the internet may become a more universal presence. A **universal internet** is the continuous, permanent streaming of Internet coverage with no



## **FURTHER EXPLORATION...**

#### **ONLINE CONNECTION: Technology Timeline**

Check out Chris Woodford's "Technology Timeline" list on the Explain That Stuff! website at <u>https://www.explainthatstuff.com/timeline.html.</u> Are there any inventions that happened earlier than you thought? Find the first time a steam engine was created. Can you imagine how modern life would have changed if steam power had continued to be developed at that point in history? What connections can you make between the first mathematical innovations and the computers of today?



disruptions. In the future, it is predicted that there will be no need for individual connections to the Web. In other words, the Internet will not be something to connect to, it will simply be something that is always running and integrated into all technology. It is also predicted that the internet will be embedded into the real world through augmented reality. This means that product updates, troubleshooting, and customer service may be available by a user simply looking at a device. These advancements may also lead to greater concerns about individual privacy, since a continuous connection between users allows piracy techniques to advance.

#### **Summary:**

Communications equipment, computers, and the Internet have evolved from early discoveries, starting with the Stone Ages. The earliest forms of technology from the Stone Age included things like stone, wood, bones, and antlers that were formed to make blades. Eventually, those instruments became tools for drawing and then writing.

The manufacturing of metals and glass became possible, and a curious spirit lead to the advancements that would come in the Middle Ages. New ways to support large populations and protect cities were needed. The end of the Middle Ages (around 1600 to 1750 CE) brought about major changes to modern society. Throughout human existence, there have been many periods of technological breakthroughs, but the Industrial Revolution from 1750 to 1900 CE showed an explosion of ideas and inventions that are still used today. Some of these inventions lead directly to the creation of the modern computer.

Communication refers to the ability to convey information from one party to another. The development of communication equipment, computers, and the Internet have changed the way businesses and people are connected today. Most likely, future advances in communication will be closely linked to advancements in computer and Internet technology. Typically, administrative offices manage a good deal of a business's operational communications using technology.

Computer technology has seen exponential growth since the 1930s. Progress is constantly being made to improve the speed, storage capacity, and image quality of computer technology. Many of these improvements can be linked to internet applications. The Internet is an internationally connected network of information provided through communication equipment and computers. A personal computer is able to access the "Web" for any type of information.

#### **Checking Your Knowledge:**

- $\Diamond$
- 1. What is the basic definition of technology?
- 2. Name three technological innovations from the Industrial Revolution.



- 3. What technology developed in the early twentieth century played a significant role in computer development?
- 4. Name three technological achievements from the Computer Age.
- 5. What technological advancements do scientists expect in the future?

#### **Expanding Your Knowledge:**

With your instructor's permission, interview a computer programmer. Discuss how technology has changed over the past decade and where technology is heading. Ask questions about AI and augmented reality. Share your findings with the class.

#### Web Links:



### Future of Visual Communication

https://blog.visme.co/future-of-communication/

#### History of Communication

https://www.revolvy.com/page/Timeline-of-communication-technology

#### **10 Futurists Predictions**

https://electronics.howstuffworks.com/future-tech/10-futurist-predictions-inthe-world-of-technology.htm

#### Things to Come

https://futurism.com/images/things-to-come-a-timeline-of-future-technologyinfographic/

