

2.5: Other Computing Devices

A personal computer is designed to be a general-purpose device. It can be used to solve many different types of problems. As the technologies of the personal computer have become more commonplace, many of the components have been integrated into other devices that previously were purely mechanical. We have also seen an evolution in what defines a computer. Ever since the invention of the personal computer, users have clamored for a way to carry them around. Here we will examine several types of devices that represent the latest trends in personal computing.

2.5.1: Portable Computers

In 1983, Compaq Computer Corporation developed the first commercially successful portable personal computer. By today's standards, the Compaq PC was not very portable: weighing in at 28 pounds, this computer was portable only in the most literal sense – it could be carried around. But this was no laptop; the computer was designed like a suitcase to be lugged around and laid on its side to be used. Besides portability, the Compaq was successful because it was fully compatible with the software run by the IBM PC, which was the standard for business.

In the years that followed, portable computing improved, giving us laptop and notebook computers. The “luggable” computer has given way to a much lighter clamshell computer weighing 4 to 6 pounds and running on batteries. The most recent technological advances give us a new class of laptops that is quickly becoming the standard: these laptops are incredibly light and portable and use less power than their larger counterparts. The screens are larger, and some can weigh less than three pounds.

The DELL XPS 13 Laptop is a good example of this. Its specification is:

- CPU: 12th Gen Intel; Core i7-1250U (12MB cache, 10 cores)
- Graphics: Intel Iris Xe Graphics
- RAM: 8GB - 32GB
- Screen: 13.4-inch Full HD
- Storage: 256GB - 1TB SSD
- Thunderbolt™ 4 (USB Type-C™) with DisplayPort and Power Delivery x2
- Weight: 1.17 kg (2.59 pounds)
- The body is razor thin at 0.55%
- it can recharge in less than an hour with ExpressCharge.

This is simply amazing!

Finally, as more and more organizations and individuals are moving much of their computing to the Internet or cloud, laptops are being developed that use “the cloud” for all of their data and application storage. These laptops are also extremely light because they have no need for a hard disk at all! A good example of this type of laptop (sometimes called a netbook) is Samsung's Chromebook.

2.5.2: Smartphones

The first modern-day mobile phone was invented in 1973. Resembling a brick and weighing in at two pounds, it was priced out of reach for most consumers at nearly four thousand dollars. Since then, mobile phones have become smaller and less expensive; today, mobile phones are a modern convenience available to all levels of society. As mobile phones evolved, they became more like small walking computers. These smartphones have many of the same characteristics as a personal computer, such as an operating system and memory. The first smartphone was the IBM Simon, introduced in 1994.



Figure 2.5.1: Smartphone. Image by Syaibatul Hamdi from

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In January of 2007, Apple introduced the iPhone. Its ease of use and intuitive interface made it an immediate success and solidified the future of smartphones. Running on an operating system called iOS, the iPhone was a small computer with a touch-screen interface. In 2008, the first Android phone was released, with similar functionality.

Consider the following data regarding mobile computing :

- There are 6.7 billion global mobile Internet users in 2028. (Statista, 2023)
- It is expected by 2024, approximately 187.5 million U.S. users will have made at least one purchase via a web browser or mobile app on their mobile device.(Statista, 2021)
- By 2023, consumer electronics retail sales in the United States will reach 485 billion U.S. dollars. (Statista, 2023)
- The average order value for online orders placed on desktop in the second quarter of 2022 is \$155.75, while the average order value for orders placed on cellphones is \$112 and Tablets is less than \$100.00.(Statista, 2022)
- In 2022, there are 4.9 billion active social media users in the world and it is projected to increase near 6 billion in 2027. (Statista, 2023)
- In the first quarter of 2023, internet users spent six hours and forty minutes online daily (Statista, 2023)
- In 2023, Mobile accounts for about half of the web traffic worldwide. (Statista, 2023)
- The time spent on websites still favors desktop over 50% of the time. (Broadbansearch, 2023)

2.5.3: Tablet Computers

The tablet is larger than a smartphone and smaller than a notebook. A tablet uses a touch screen as its primary input and is small enough and light enough to be easily transported. They generally have no keyboard and are self-contained inside a rectangular case. Apple set the standard for tablet computing with the introduction of the iPad in 2010 using iOS, the operating system of the iPhone. After the success of the iPad, computer manufacturers began to develop new tablets that utilized operating systems that were designed for mobile devices, such as Android.

Global market share for tablets has changed since the early days of Apple's dominance. Apple iPad has about 37%, Samsung at 20.6% as of the second quarter of 2023 (Statista, 2023). The market popularity of the tablet has been steadily declining in recent years.

2.5.4: Integrated Computing and Internet of Things (IoT)

IoT stands for Internet of Things. It refers to the growing network of physical objects embedded with sensors, software, and technologies to connect and exchange data over the internet. IoT enables physical things to be detected and controlled remotely across existing network infrastructure, integrating the physical world and computer systems.

Along with advances in computers themselves, computing technology is being integrated into many everyday products such as security systems, thermostats, refrigerators, airplanes, cars, electronic appliances, lights in the household, alarm clocks, speaker systems, vending machines, and commercial environments, to name a few. Integrated computing technology has enhanced the capabilities of these devices and added capabilities to everyday lives, thanks in part to IoT.

These three short videos highlight some of the latest ways computing technologies are being integrated into everyday products through the Internet of Things (IoT):

- The video gives an explanation of what the Internet of things is and how they are connected.: [The Internet of Things](#) [video file: 3:21 minutes] Closed Captioned



- This video is an example how users can update their home to a smart home. [How to start a Smart Home in 2023](#) [video file: 10:04 minutes] Closed Captioned



2.5.5: The Commoditization of the Personal Computer

Since the late 1970's, the personal computer has gone from a technical marvel to part of our everyday lives; it has also become a commodity. The PC has become a commodity because there is very little differentiation between computers, and the primary factor that controls their sale is their price. Hundreds of manufacturers all over the world now create parts for personal computers. Dozens of companies buy these parts and assemble the computers. As commodities, there are no differences between computers made by these different companies. Profit margins for personal computers are razor-thin, leading hardware developers to find the lowest-cost manufacturing.

Apple has differentiated itself from the pack and achieved a competitive advantage in a challenging market. The cost of their product is significantly higher, but you are buying a high-quality product and design. Apple designs both the hardware as well as its software in-house. The hardware and software design of the Mac works seamlessly with its other products, such as the iPhone and iPad. The engineers at Apple are constantly updating software apps and hardware to remain a leader in the PC world.

Smartphone vendors are highly competitive and release updates or new models annually. Here is an interesting article on what we can expect coming next in Smartphone (Zdnet, 2023). Smartphone shipments peaked at 1.56 billion units between 2011 and 2017 and has decreased to 1.23 millions units in 2022 (Statista, 2023.)

2.5.6: The Problem of Electronic Waste

Personal computers have become a common fixture in households since the early eighties. The average life span of many of these devices is between three to five years. Recycling has become a hot subject for companies who want to be viewed by consumers as Green companies. Consumers are demanding companies make a commitment to the environment. Worldwide, almost 45 million tons of electronics were tossed out in 2016. Out of that staggering amount of electronic waste, only 20% has been recycled in some shape or form. The remaining 80% made its way to a more environmentally damaging end at the landfill. Mobile phones are now available in even the remotest parts of the world and, after a few years of use, they are discarded. Where does this electronic debris end up?



Figure 2.5.2 **Electronic Waste**. Image by [George Hotelling](#) from [Flicker](#) is

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Many developing nations accept this e-waste. Abroad, these recyclers re-purpose parts and extract minerals, gold, and cobalt from these devices. These dumps have become health hazards for those living near them.

Proper safe practices are ignored, and whatever waste is not usable is dumped improperly. Consumers are trying to change this common practice by demanding companies be transparent about how they address e-waste. Though many manufacturers have made strides in using materials that can be recycled, electronic waste is a problem with which we must all deal.

In 2006 the Green Electronics Council launched the Electronic Product Environmental Assessment Tool (EPEAT). This tool helps purchasers of electronics to evaluate the effect of products on the environment. They rank companies' performance in gold, silver, and bronze levels. When the first began, three PC and electronic equipment manufacturers participated with 60 products. The US government in 2007 then created the U.S. Federal Acquisition Regulations (FAR), requiring federal agencies to make purchases based on EPEAT status. In 2015 EPEAT added in Imaging Equipment and Television categories. Today many large companies are using EPEAT standards such as Amazon and Apple. EPEAT systems are widely accepted, and over 43 countries are participating, and the number continues to grow.

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