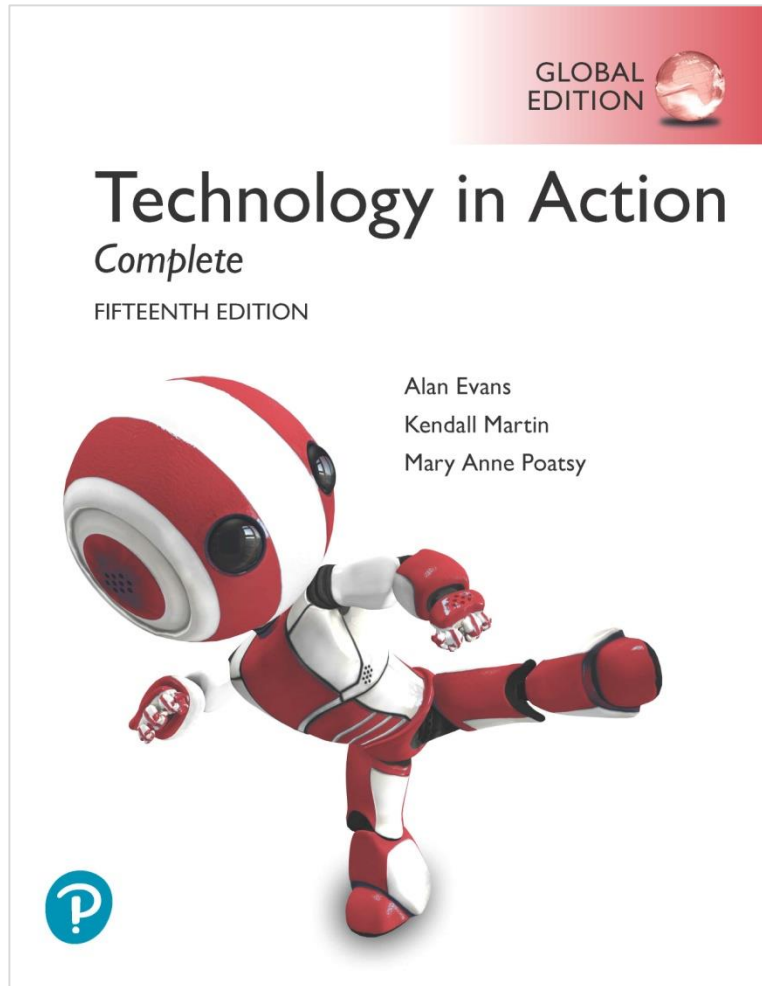


Technology in Action

15th Edition, Global Edition



Chapter 2 Looking at Computers: Understanding the Parts

Learning Objectives (1 of 3)

- 2.1 Describe the four main functions of a computer system and how they interact with data and information.
- 2.2 Define bits and bytes, and describe how they are measured, used, and processed.
- 2.3 List common types of computers, and discuss their main features.
- 2.4 Identify the main types of keyboards and touch screens.
- 2.5 Describe the main types of mice and pointing devices.
- 2.6 Explain how images, sounds, and sensor data are input into computing devices.

Learning Objectives (2 of 3)

- 2.7 Describe options for outputting images and audio from computing devices.
- 2.8 Describe various types of printers, and explain when you would use them.
- 2.9 Describe the functions of the motherboard and RAM.
- 2.10 Explain the main functions of the CPU.
- 2.11 Describe the various means of storing data and information with computing devices.

Learning Objectives (3 of 3)

2.12 Describe common types of ports used today.

2.13 Describe how to manage power consumption on computing devices.

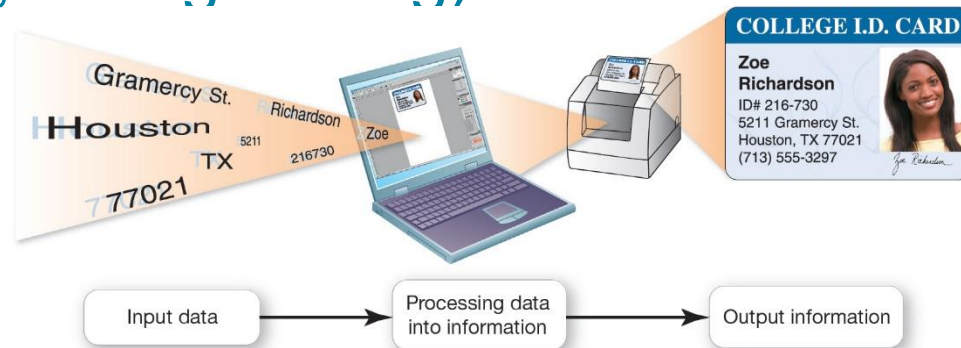
2.14 Define ergonomics, and discuss the ideal physical setup for using computing devices.

Understanding Your Computer

Computers are Data Processing Devices

(Objective 2.1)

- Perform four major functions
 - Input: Gathers data, allows entering data
 - Processing: Manipulates, calculates, or organizes data
 - Output: Displays data and information
 - Storage: Saves data and information
- Computers are excellent at processing (manipulating, calculating, or organizing) data into information.



Understanding Your Computer

Computers are Data Processing Devices

(Objective 2.1)

- What's the difference between data and information?
 - **Data** is a representation of a fact, a figure, or an idea. Data can be a number, a word, a picture, or even a recording of sound. For example, the number 7135553297 and the names Zoe and Richardson are pieces of data. Alone, these pieces of data probably mean little to you.
 - **Information** is data that has been organized or presented in a meaningful fashion. When your computer provides you with a contact listing that indicates that Zoe Richardson can be reached at (713) 555-3297, the data becomes useful—that is, it becomes information.

Understanding Your Computer

Binary: The Language of Computers

(Objective 2.2)

- Unlike humans, computers work exclusively with numbers (not words). To process data into information, computers need to work in a language they understand. This language, called binary language, consists of just two digits: 0 and 1.

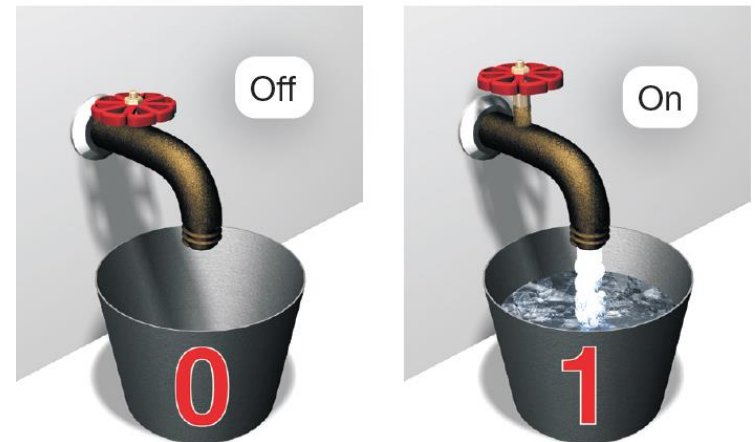
- Bit

- Binary digit
- 0 or 1

- Byte

- Unique combinations of 8 bits of 0s and 1s

- Kilobytes(KB), megabytes(MB), gigabytes(GB), terabytes, and petabytes(PT). 1KB = 1024 Byte, 1MB = 1024KB, ...etc.



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Understanding Your Computer

Binary: How Much Is a Byte?

1 Byte (B)

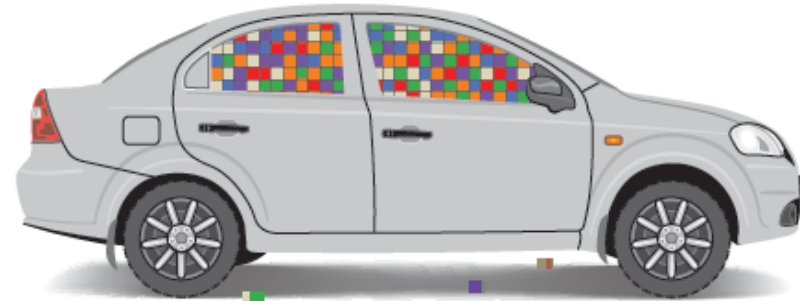
= a single letter

= a single wood block

1-inch cube



1 tweet = **280 Bytes**
= a shoebox of blocks
(Source: Twitter)

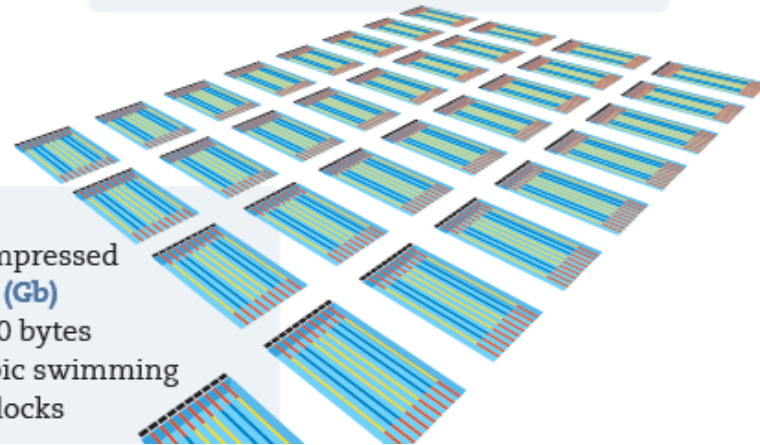


1 small Instagram picture
≈ **50 Kilobytes (Kb)**
≈ 50,000 bytes
≈ a typical car's cabin filled with blocks



3 minute MP3 song
≈ **5 Megabytes (Mb)**
≈ 5,000,000 bytes
≈ a standard shipping container full of blocks

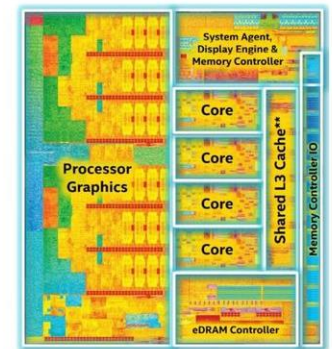
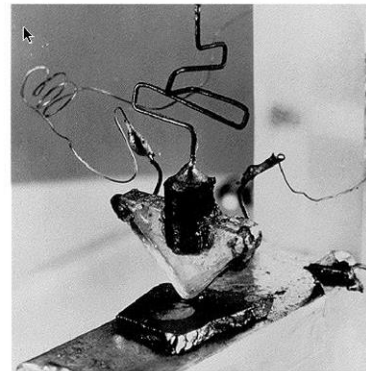
1 movie,
1080p HD, compressed
≈ **5 Gigabytes (Gb)**
≈ 5,000,000,000 bytes
≈ 32.75 Olympic swimming
pools full of blocks



Understanding Your Computer

How does a computer keep track of bits and bytes?

- Computers understand only two states of existence: on and off. Inside a computer, these two states are defined using the numbers 1 and 0. Electrical switches are the devices inside the computer that are flipped between the two states of 1 and 0, signifying on and off.
- The electrical switches used in inside computers are called transistors. **Transistors** are electrical switches built out of layers of a special type of material called a **semiconductor**. A semiconductor is any material that can be controlled either to conduct electricity or to act as an insulator (to prohibit electricity from passing through).
- Advances in technology began to require more transistors than circuit boards could handle. Something was needed to pack more transistor capacity into a smaller space. Thus, **integrated circuits** were developed..
- **Integrated circuits** (or chips) are tiny regions of semiconductor material that support a huge number of transistors.



<https://www.computershopper.com/computex-2015/performance-preview-desktop-broadwell-a>

- The first transistor
 - One workbench at AT&T Bell Labs
 - 1947
 - Bardeen, Brattain, and Shockley
- Intel Broadwell
 - 7.2 billion transistors, 14nm
 - 456 square millimeters
 - Up to 22 processing cores

Understanding Your Computer

Types of Computers

(Objective 2.3)

- There are two basic designs of computers:

- Portable:

- Cell phones
- Tablets
- Laptops and their variants

- Stationary computers

- Choosing a portable device



Sean Gallup/Getty Images; Josep Lago/AFP/Getty Images; Ethan Miller/Getty Images; Chris Tzou/Bloomberg/Getty Images; Peter Dazeley/Photographer's Choice/Getty Images

Processing Power?

Screen Size?

Battery life?

Weight?

Understanding Your Computer

Types of Computers: Smartphones

(Objective 2.3)

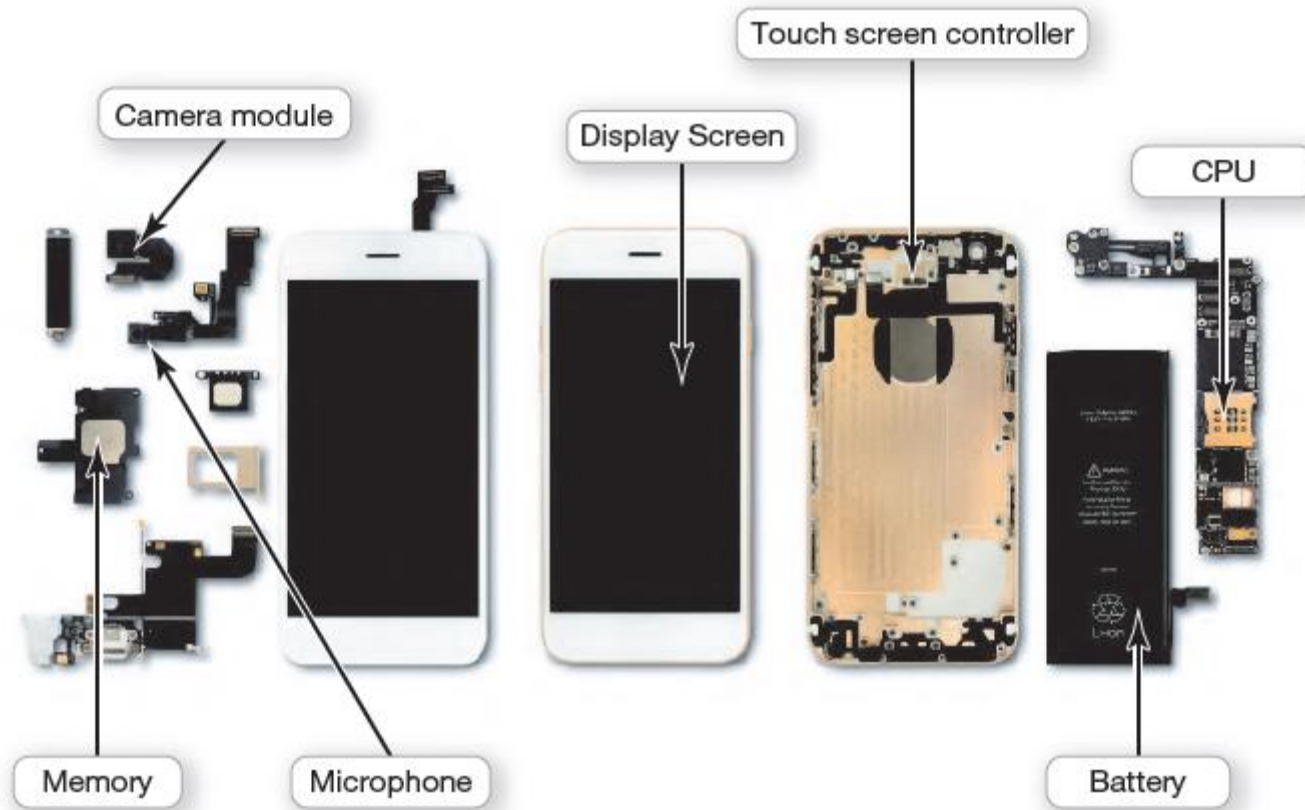


Figure 2.5 Inside your cell phone, you'll find a CPU; a memory chip; input devices such as a microphone and a touch screen; and output devices such as a display screen. (iFixit)

Understanding Your Computer

Types of Computers: Stationary Computers

(Objective 2.3)

- A **desktop computer** is intended for use at a single location, so it's stationary. Most desktop computers consist of a separate **case or tower** (called the **system unit**) that houses the main components of the computer and to which peripheral devices are attached. A peripheral device is a component, such as a *monitor* or *keyboard* that connects to the computer.
- An **all-in-one computer**, such as the Apple iMac, eliminates the need for a separate tower because these computers house the computer's processor and memory in the monitor (see Figure 2.9b). Many all-in-one models also incorporate touch-screen technology.



Understanding Your Computer

Types of Computers: Are there any other types of computers?

- A **mainframe** is a large, expensive computer that supports many users simultaneously. Mainframes are often used in businesses that manage large amounts of data, such as insurance companies, where many people are working at the same time on similar operations, such as claims processing. Mainframes excel at executing many computer programs at the same time.
- A **supercomputer** is a specially designed computer that can perform complex calculations extremely rapidly. Supercomputers are used when complex models requiring intensive mathematical calculations are needed (such as weather forecasting). Supercomputers are designed to execute a few programs as quickly as possible, whereas mainframes are designed to handle many programs running at the same time but at a slower pace.
- An **embedded computer** is a specially designed computer chip that resides in another device, such as your car, a drone, or the electronic thermostat in your home. Embedded computers are self-contained computer devices that have their own programming and that typically don't receive input from you or interact with other systems.

Input Devices

Physical Keyboards and Touch Screens

(Objective 2.4)

- An input device lets you enter data (text, images, and sounds) and instructions (user responses and commands) into your computer.

- Examples

- Keyboard
- Touch screen
- Stylus
- Virtual keyboard



Input Devices

Physical Keyboards and Touch Screens

(Objective 2.4)

- How does a touch screen work?
 - When you place your finger or stylus on a screen, it changes the physical state of the screen and registers your touch.
 - The location of your touch is then translated into a command.

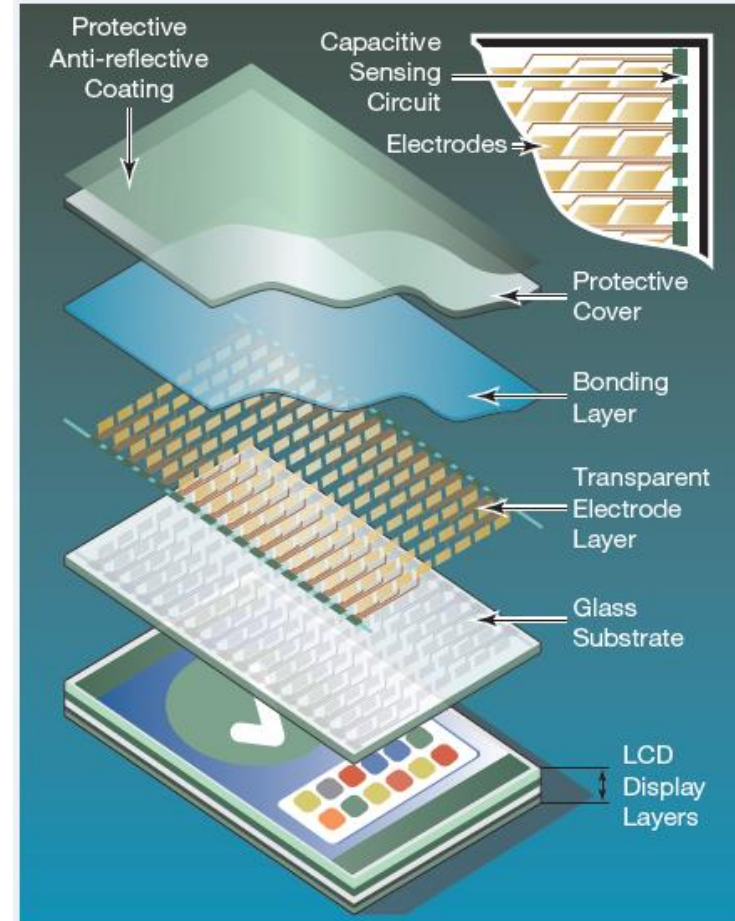


Figure 2.18 Multitouch screens use a coordinate-based grid to arrange the capacitors so the circuitry can detect and respond to multiple touches occurring at the same time.

Input Devices

Mice and Other Pointing Devices

(Objective 2.5)

- Mouse
- Touch pad (trackpad)
- Game controllers



Mad Catz, Inc.

Input Devices

Image, Sound, and Sensor Input

(Objective 2.6)

- Popular for images
 - Digital cameras
 - Camcorders
 - Mobil device cameras
 - Flatbed scanners
 - Webcams
- Popular for sound
 - Microphone with voice recognition software
- **Sensors:** Magnetometer, Proximity sensor, Accelerometer, Gyroscope

Input Devices

Types of Microphones

Microphone Type

Attributes

Best Used For

Close Talk



- Attached to a headset (allows for listening)
- Leaves hands free

- Videoconferencing
- Phone calls
- Speech recognition software

Omnidirectional



- Picks up sounds equally well from all directions

- Conference calls in meeting rooms

Unidirectional



- Picks up sounds from only one direction

- Recordings with one voice (podcasts)

Clip-on (Lavalier)



- Clips to clothing
- Available as wireless

- Presentations requiring freedom of movement
- Leaves hands free for writing on white boards

Output Devices

Image and Audio Output (1 of 3)

(Objective 2.7)

- Send data out of the computer in the form of:
 - Text
 - Pictures
 - Sounds
 - Video
- Examples
 - Monitors
 - Printers
 - Speakers and earphones

Output Devices

Image and Audio Output (2 of 3)

(Objective 2.7)

- Types of display screens

- Liquid crystal display (LCD)
- Light-emitting diode (LED)
- Organic light-emitting diode (OLED)

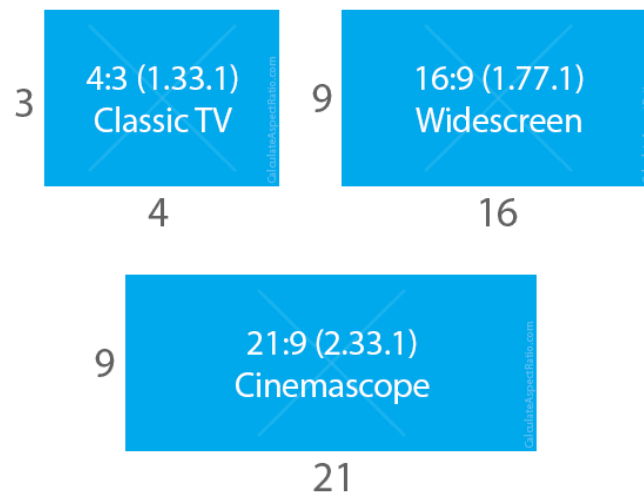


YONHAP/EPA/Newscom

- How they work

- Pixels
- Aspect ratio
- Resolution:

- 720p, 1080p, 4K



Output Devices

Image and Audio Output (3 of 3)

(Objective 2.7)

- Speaker

- Output device for sound
- Surround-sound speakers
- Wireless speaker systems



- Headphones or earbuds

- Keep from distracting others

Output Devices

Printers (1 of 2)

(Objective 2.8)

- Inkjet

- Affordable
- High-quality color
- Quick and quiet

- Laser

- Faster printing speed
- Higher-quality printouts
- More expensive



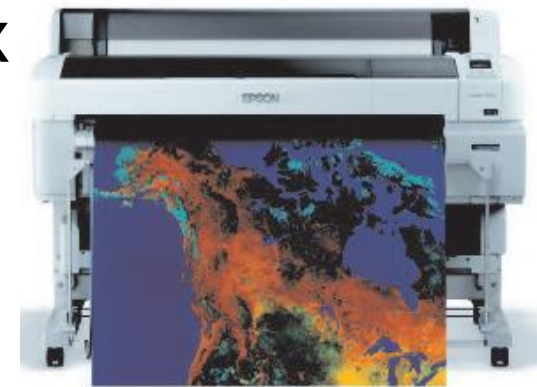
Tankist276/Shutterstock

Output Devices

Printers (2 of 2)

(Objective 2.8)

- Cloud-ready printers
- All-in-one printer
 - Printer, scanner, copier, and fax
- Large format printer
 - Prints oversize images
- 3D printer



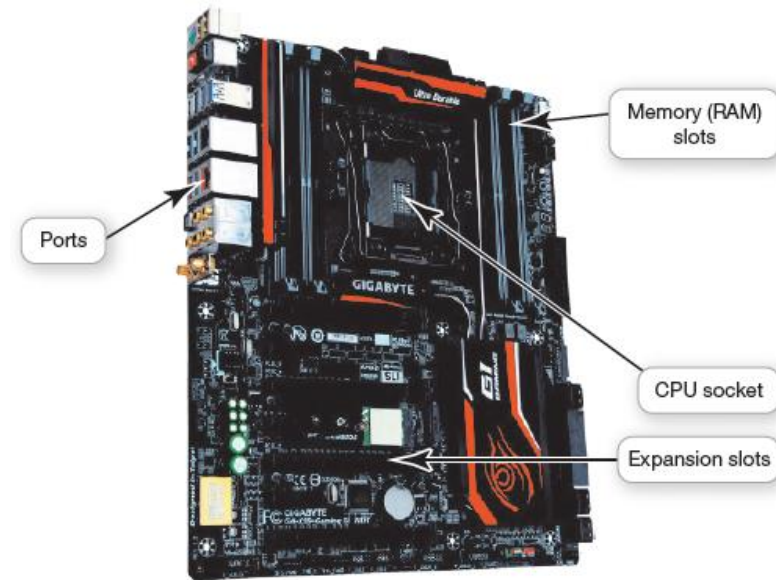
Processing and Memory on the Motherboard

The Motherboard and Memory

(Objective 2.9)

•Motherboard

- CPU
- ROM(read-only memory), RAM(Random access memory), and cache
- Slots for expansion cards
- Sound/Video cards
- Network interface cards (NIC)
- HDD(hard disk), SSD (solid-state drive)



RAM is volatile storage
ROM is nonvolatile storage
What is the difference?

Processing and Memory on the Motherboard

Processing (1 of 2)

(Objective 2.10)

- Central Processing Unit (CPU)

- CPU or processor

- “Brains” of the computer

- Controls all functions of the computer’s components

- Processes all commands and instructions

- Current systems run at speeds measured in Gigahertz (Billions of tasks per second)

Processing and Memory on the Motherboard

Processing (2 of 2)

(Objective 2.10)

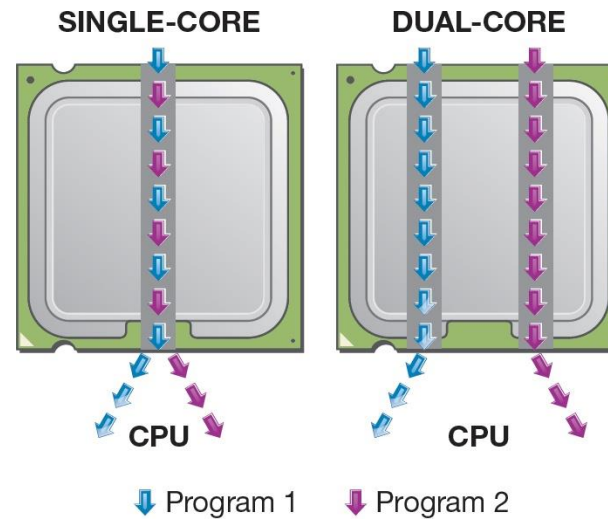
•CPU Performance Measures

–Processor speed measured in hertz (Hz)

- Megahertz (MHz) or gigahertz (GHz)

–Number of cores

- Single
- Dual
- Quad
- Ten



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Storing Data and Information

Storage Options on Computing Devices (1 of 4)

(Objective 2.11)

- Local Storage Devices

- Hard disk drive (HDD)

- Primary storage device
 - Nonvolatile storage
 - Internal drive
 - External hard drive

- Solid-state Drive (SSD)



Mbongo/Fotolia

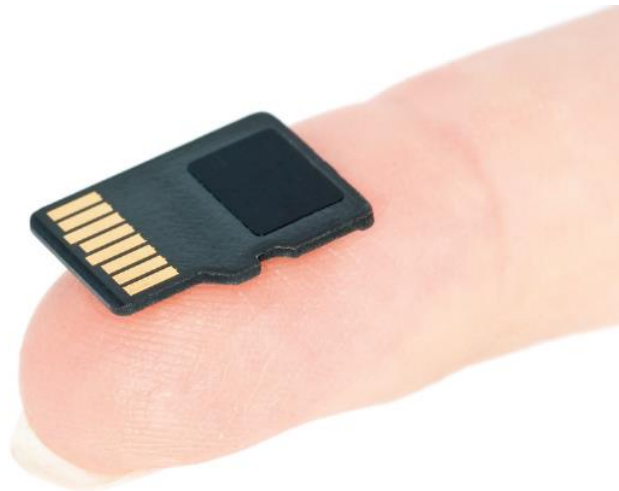
Storing Data and Information

Storage Options on Computing Devices (2 of 4)

(Objective 2.11)

- Portable Storage Options

- Flash drive
- Flash memory card



digitalr/123RF



Inga Nielsen/Shutterstock

Storing Data and Information

Storage Options on Computing Devices (3 of 4)

(Objective 2.11)

- Cloud storage

- Files stored on the Internet
- Some amount is free
- Can purchase additional storage

Storing Data and Information

Storage Options on Computing Devices (4 of 4)

(Objective 2.11)

- Optical storage

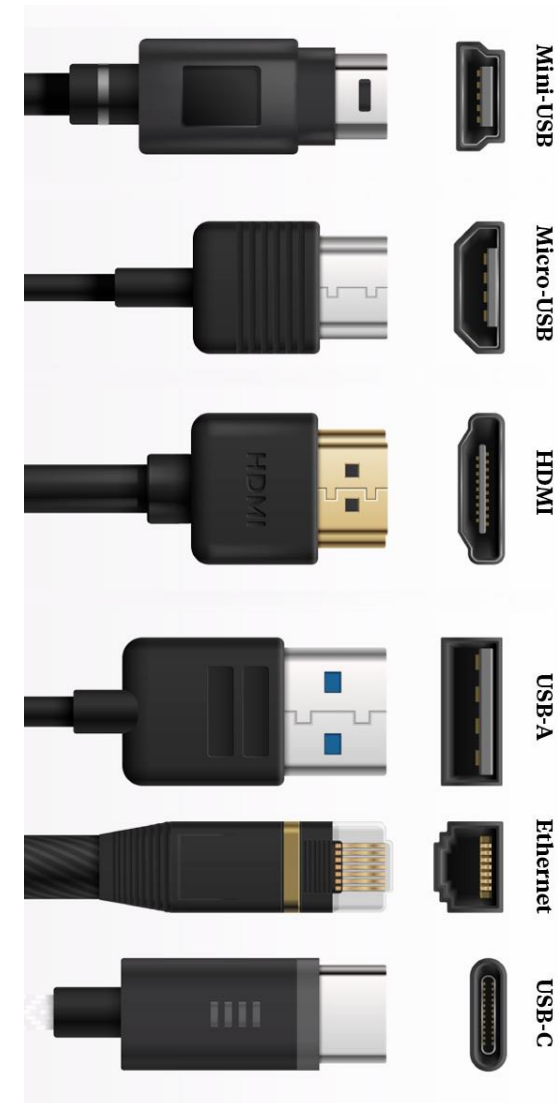
- Compact discs (CDs)
- Digital video discs (DVDs)
 - Store more data than CDs
- Blu-ray discs (BDs)

Connecting Peripherals to the Computer

Computer Ports

(Objective 2.12)

- Thunderbolt
 - Transfer speeds up to 20 Gbps
- Universal serial bus (USB)
 - USB 3.1 Transfer speeds of 10 Gbps
- Connectivity port
 - Ethernet port
 - Up to 10,000 Mbps
- HDMI port



Power Management and Ergonomics

Power Controls and Power Management

(Objective 2.13)

- **Battery drain:** For portable devices, it is important to know which devices drain the battery the most.
- **Power supply:** The power supply transforms the wall voltage to the voltages required by the battery or the computer chips.
- **Sleep mode:** all documents in RAM stay in RAM when the computer is put to sleep.
- **Warm / Cold boot:** When a computer is restarted it is called a warm boot. When the computer is started from a powered down state, it is referred to as a cold boot.
- **Hibernate:** stores all the documents from RAM on the hard drive.

Power Management and Ergonomics

Setting It All Up: Ergonomics

(Objective 2.14)

- Ergonomics
- Guidelines
 - Monitor position
 - Use Adjustable chair
 - Proper position while typing
 - Take breaks
 - Adequate lighting


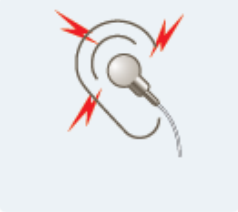
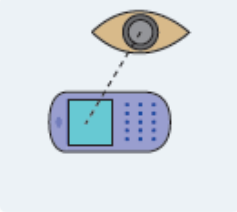




Phanie/Alamy

- **Assistive (adaptive) technologies:** are products, devices, equipment, or software that are used to maintain, increase, or improve the functional capabilities of individuals with disabilities.

Preventing Injuries While on the Go

Table 2.5 Preventing Injuries While on the Go

	Smartphone Repetitive Strain Injuries	Portable Media Player Hearing Damage	Small-Screen Vision Issues	Lap Injuries	Tablet Repetitive Strain Injuries
					
Malady	Repetitive strain injuries (such as de Quervain's disease) from constant typing of instant messages	Hearing loss from high-decibel sound levels in earbuds	Blurriness and dryness caused by squinting to view tiny screens on mobile devices	Burns on legs from heat generated by laptop	Pain caused by using tablets for prolonged periods in uncomfortable positions
Preventative measures	Restrict length and frequency of messages, take breaks, and perform other motions with your thumbs and fingers during breaks to relieve tension.	Turn down volume (you should be able to hear external noises, such as people talking), use software that limits sound levels (not to exceed 60 decibels), and use external, over-ear style headphones instead of earbuds.	Blink frequently or use eye drops to maintain moisture in eyes, after 10 minutes take a break and focus on something at least 8 feet away for 5 minutes, use adequate amount of light, and increase the size of fonts.	Place a book, magazine, or laptop cooling pad between your legs and laptop.	Restrict the length of time you work at a tablet, especially typing or gaming. Use the same ergonomic position you would use for a laptop when using a tablet.



Questions
