

UNIT 1: UNDERSTANDING COMPUTERS

What Actually Counts as a Computer?

I can identify different types of computers and explain the hardware, software, and firmware that allow them to operate.

*same job.
different shape.*



Computers looked like computers.



The computer did not disappear. The parts simply moved.

Before we start opening computer cases, replacing components, installing operating systems, or troubleshooting hardware, we need to answer a surprisingly difficult question:

What exactly is a computer?

And if that feels a little strange, good.

IMAGINE THIS...

Someone places four objects on a table.

A desktop PC. A smartphone. A smartwatch. A smart light bulb.

Then they ask you:
Which ones are computers?



Then something disappeared...

Computers Used to Be Easier to Spot

Travel back to the 1980s for a moment. Walk into a room and see an Apple II sitting on a desk with its large case, black-and-green display, keyboard, and external floppy disk drive.

Nobody asks: **"Is that a computer?"** Of course it is. Computers looked like computers.

That setup became so common that many people still picture it whenever someone says the word "computer."

But computers stopped cooperating with that definition.



Something Disappeared

Look at a modern iMac. Where is the tower?

There isn't one.

The monitor is still there, but the processing components that once lived inside a separate tower have been moved behind the display.

This design is known as an **all-in-one computer**.

The computer did not disappear. The parts simply moved. And then things became even more interesting.

A BETTER DEFINITION

The Four-Function Test

Stop.

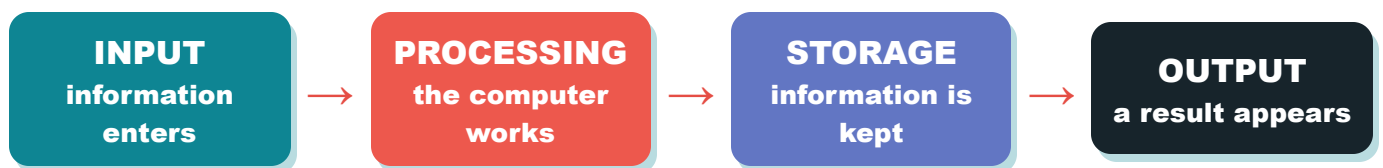
Take out your phone. Do not unlock it yet. Just look at it.

Where is the mouse? Where is the keyboard? Where is the tower? Where is the monitor?

We need a better definition.



A computer performs four fundamental functions:



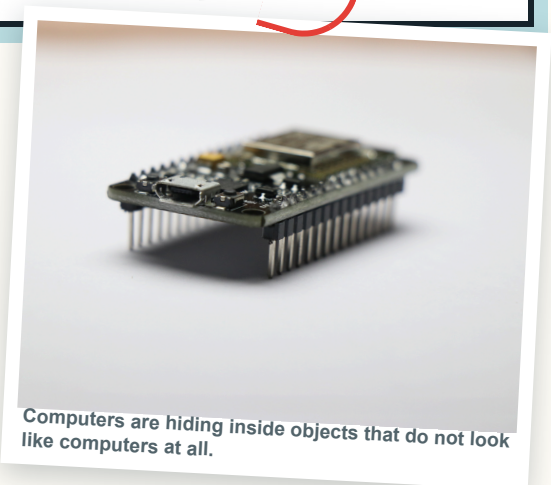
That's the key.

Still a computer?

If a device can receive information, process that information, store information, and produce some kind of result, it can meet the basic definition of a computer.

A smartphone receives input when you tap the touchscreen. Its processor handles instructions. It stores apps, photos, and other data. Then it produces output through its screen, speakers, vibration motor, or other components.

The shape changed. The basic job did not.



NOTEBOOK

IPSO

Input → Processing → Storage → Output

SO HOW MANY KINDS OF COMPUTERS ARE THERE?

A lot.

For A+, we organize computers into categories. They all perform the same basic computing functions. What changes is **how they are built and what they are designed to do.**

Workstation

Think **desktop PC**: a tower or all-in-one computer designed for direct interaction with a user.

Server

Provides services, resources, or data to other computers, often from a server room or data center.

Laptop

A portable workstation with a display, keyboard, pointing device, and battery in one case.

Tablet

A highly portable, touchscreen-focused mobile computer.

Smartphone

A pocket-sized computer that combines computing and communication.

Smart Device

A specialized computer that may use voice, touch, or another focused interface.

IoT Device

A network-connected computing device that may not fit another category.

Same four functions. Very different shapes and jobs.

STANDARDS LENS

3A-CS-01: Explain how abstractions hide implementation details of computing systems embedded in everyday objects.

3A-CS-02: Compare levels of abstraction and interactions between application software, system software, and hardware layers.

3A-CS-03: Develop guidelines that convey systematic troubleshooting strategies that others can use to identify and fix errors.

WHAT IF YOU NEED TO TAKE THE COMPUTER WITH YOU?

Your workstation just came with you.



Laptop

A laptop fits workstation components into a compact case and adds a battery. It can run full desktop operating systems such as **Windows, macOS, and Linux**.

Close the lid. Put it in a bag. Move somewhere else. Open it again.

Tablet

A tablet uses a **touchscreen** as its primary interface and commonly runs **iOS or Android**.

Tap. Swipe. Pinch. Drag.

Smartphone

Make the tablet smaller, add cellular communication, and make it fit in your pocket.

One computer. Many jobs.

Wait.

A touchscreen is input... **AND output?** Exactly. When you tap the screen, it receives input. When the screen displays an image, it produces output.

One physical component can perform more than one role. A+ loves situations where something refuses to fit neatly into only one category.

NOW MEET THE COMPUTER THAT USUALLY DOESN'T HAVE A PERSON SITTING IN FRONT OF IT

A server is also a computer.

Servers handle many requests, usually from a server room or data center. Technicians commonly manage them remotely.

WORKSTATION

Computer A spends most of its day running Word, browsing websites, and playing videos for one person.

SERVER

Computer B spends its day responding to requests from hundreds of other computers.



BUT THE LIGHT BULB STILL SEEMS SUSPICIOUS

Internet of Things

IoT devices connect to a network but do not always fit cleanly into traditional computer categories.

Many of these devices contain small computers that quietly perform very specific jobs.

They are still computing devices. They're simply very specialized ones.

Your refrigerator probably does not need PowerPoint. Your light bulb probably does not need a web browser.

NOTEBOOK

The Computer-Type Field Guide

Use the job and interface—not just the shape—to classify a computer.

Computer Type	Main Idea	Technician Clue
Workstation	Desktop computer used directly by a person	Tower or all-in-one; keyboard, mouse, and monitor
Server	Provides services or resources to other computers	Often rack-mounted, remotely managed, and built for many requests
Laptop	Portable workstation with a battery	Full desktop OS in a foldable, mobile case
Tablet	Touchscreen-focused mobile computer	Touch is the primary interface; often iOS or Android
Smartphone	Pocket-sized mobile computer with communication capabilities	Cellular service plus apps, storage, sensors, and a touchscreen
Smart Device	Specialized computer using interfaces such as voice or touch	May lack a keyboard, mouse, or traditional display
IoT Device	Network-connected device that may not fit another category	Computing hidden inside an appliance, sensor, light, or other object

Quick Test

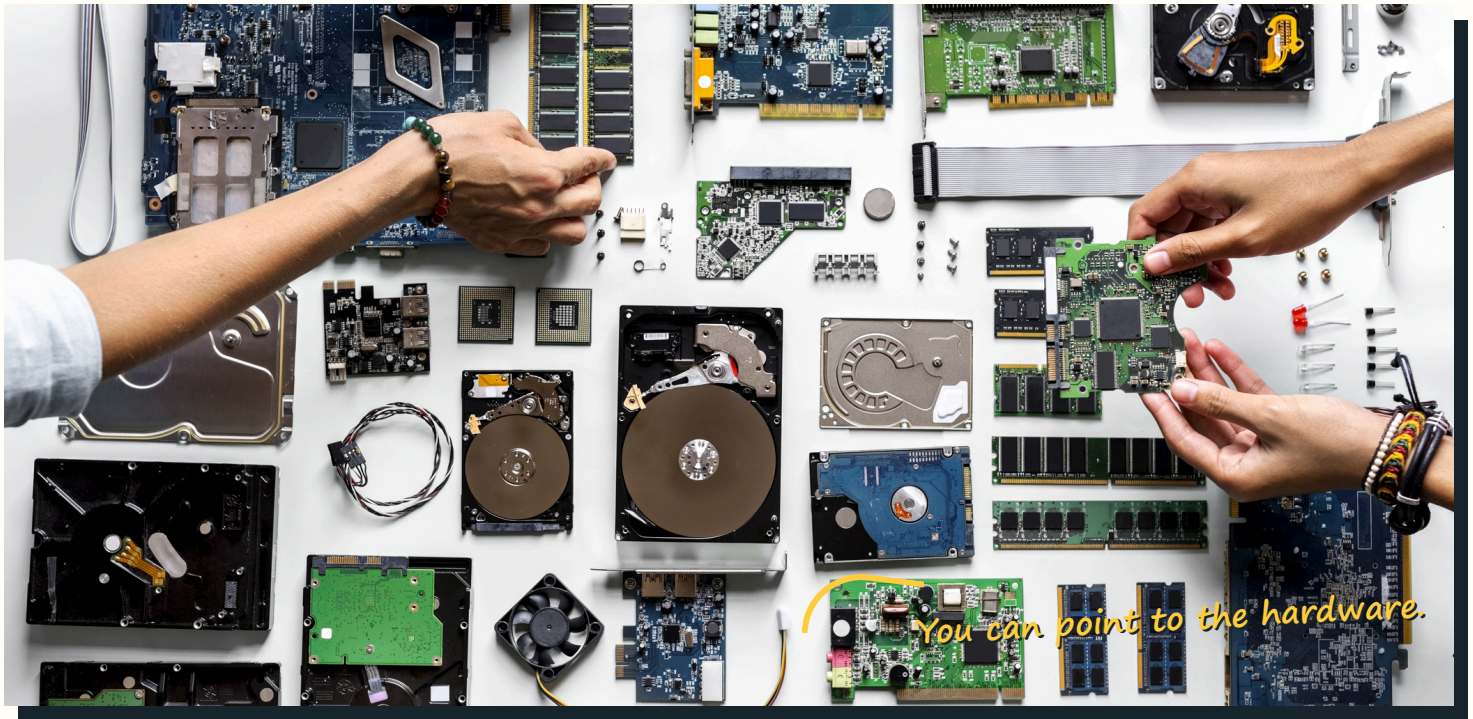
A smart thermostat receives temperature readings, processes them, stores settings, and activates heating or cooling.

Computer.

*A wooden chair has no computing input, processing, storage, or output.
Not a computer.*

READY FOR SOMETHING COOL?

Hardware. Software. Firmware.



Hardware

Hardware is the physical part of a computer.
If you can physically touch it, there is a good chance you're dealing with hardware.

Software

Software consists of programs and instructions that tell computer hardware what to do.
Unlike hardware, software is not something you physically hold in your hand.

Firmware

Firmware is software embedded inside a hardware component.
You may hear it described as:
software on a chip.

NOTEBOOK

Hardware = physical device

Software = instructions the computer runs

Firmware = software built into hardware

HARDWARE: THE STUFF YOU CAN TOUCH

Every function has physical helpers.



Input

Sends information into the computer.

- Keyboard
- Mouse
- Touchscreen
- Microphone
- Camera

Processing

Performs calculations and executes instructions.

- **CPU** - Central Processing Unit
- **GPU** - Graphics Processing Unit

Storage

Holds information for current or future use.

- RAM
- Hard disk drive
- Solid-state drive

Output

Presents information or produces a result.

- Monitor
- Speakers
- Printer

NOTEBOOK

Hardware = Physical components of a computer

Input: keyboard, mouse **Processing:** CPU, GPU **Storage:** RAM, HDD, SSD **Output:** monitor, speaker, printer

BUT HARDWARE BY ITSELF IS PRETTY USELESS

A very expensive collection of electronic parts.



Beautiful processor. Plenty of RAM. Fast SSD. Excellent display.

You turn it on...

and there is nothing telling the hardware what to do.
Hardware needs instructions.

Those instructions come from software.

Software: The Instructions

Software consists of programs and instructions that tell computer hardware what to do. Unlike hardware, software is not something you physically hold in your hand. You interact with it through the hardware.

Operating System

Manages the computer and provides the environment where other software can run.

Windows, macOS, Linux

Application

Helps the user perform a specific task.

Word, PowerPoint, browsers, photo editors, games

Driver

Helps the operating system communicate with hardware.

Think: translator.

DRIVERS: THE TRANSLATORS

The printer speaks printer. Windows speaks Windows.

Somehow those two need to communicate.

That's where a driver comes in.

A driver is software that helps the operating system communicate with a hardware device.

Missing, incompatible, or malfunctioning drivers can cause perfectly good hardware to behave as though something is broken.

THREE IMPORTANT TYPES OF SOFTWARE

Operating System: Manages the computer and its resources.

Application: Helps the user perform a specific task.

Driver: Helps the operating system communicate with hardware.

*Hardware. Software. We're done...right?
Not quite.*

FIRMWARE: SOFTWARE THAT LIVES ON HARDWARE

Software on a chip.



Closely connected to the device itself.

Firmware is software embedded inside a hardware component. It helps control the basic operation of hardware.

Routers have firmware. Printers have firmware. Motherboards have firmware. SSDs may have firmware.

Flashing firmware

Updating or replacing firmware is commonly called **flashing**.

Nothing is catching fire. Please do not set the computer on fire.

Why update it?

- Correct problems
- Improve compatibility
- Add features
- Address security issues

Technician caution

Firmware is closely connected to hardware operation. Follow the manufacturer's instructions carefully when updating it.

NOTEBOOK

Hardware = physical device

Software = instructions the computer runs

Firmware = software built into hardware

THINK LIKE A TECHNICIAN

Welcome to troubleshooting.

Mini Mystery

A computer has a perfectly good printer connected to it. The printer turns on. The USB cable works. The computer detects that *something* is connected...

but Windows cannot properly use the printer.

Which category should you investigate first?

☐ Hardware?☐ Application software?☐ Driver?☐ Firmware?

Think about it.

**The best
starting answer
is the driver.**

Hands-On Lab: Computer Classification Challenge

Purpose

You will classify modern computing devices and identify the hardware, software, input, processing, storage, and output involved in each system.

At least one should not look like a traditional computer.

Locate or research three very different computing devices.

- Desktop PC
- Laptop
- Smartphone
- Tablet
- Smartwatch
- Smart TV
- Game console
- Smart speaker
- Smart appliance

HANDS-ON LAB

Part 1: Find Three Computers That Don't Look Alike

Locate or research three very different computing devices. At least one should **not** look like a traditional computer.

Possible devices

Desktop PC

Laptop

Smartphone

Tablet

Smartwatch

Smart TV

Game console

Smart speaker

Smart appliance



Some computers hide in plain sight.

Device	Input	Processing	Storage	Output
Example: Smartphone	Touchscreen, microphone	Processor	Internal storage	Screen, speakers

Do not classify by appearance alone. Use the four-function test.

HANDS-ON LAB

Classify it. Hunt for it. Explain it.

2 Classify It

For each device, determine whether it is best described as a workstation, server, laptop, tablet, smartphone, smart device, or IoT device.

Explain your reasoning.

3 Hardware Hunt

Using a desktop or laptop, identify hardware without disassembling the device.

- Keyboard
- Touchpad or mouse
- Display
- USB ports
- Camera
- Speakers
- Storage indicators
- Power connector

For each item, decide:

Does it perform input, processing, storage, output—or more than one function?

4 Software Hunt

On the same computer, identify:

1. The operating system
2. Three installed applications
3. One hardware device that probably requires a driver
4. One device that probably contains firmware

EXPLAIN THE DIFFERENCE

Operating system:

Application:

Driver:

Firmware:

JOURNAL PROMPT

“A smartphone isn't really a computer...”

“...because it doesn't have a keyboard, mouse, or tower.”

Explain why that statement is incorrect.

Your response should use the four functions of a computer and at least two concepts from this lesson.

YOUR RESPONSE

Use evidence. Explain the reasoning—not just the answer.

DID YOUR BRAIN CATCH THAT?

Try these without looking back.

1. What four functions define a computer?

2. What does **workstation** mean in this course?

3. How is a server different from a typical workstation?

4. Why is a laptop considered a portable workstation?

5. What is the primary interface of most tablets?

6. Which mobile operating systems are common on tablets and smartphones?

7. What makes an IoT device different from a traditional PC?

8. What is hardware?

9. What three software categories did we discuss?

10. What does a driver do?

11. What is firmware?

12. What does **flashing firmware** mean?

13. Give one example of input hardware.

14. Give one example of processing hardware.

15. Give one example of storage hardware.

16. Give one example of output hardware.

If you missed something, do not memorize the answer yet. Find the section where it was explained and see if you can explain **why** the answer is correct.

That is how you learn A+.

MODULE WRAP-UP

A computer is no longer defined by what it looks like.

Traditional desktop PCs may use a tower, monitor, keyboard, and mouse. All-in-one computers hide the processing hardware behind the display. Laptops make workstations portable. Tablets and smartphones combine computing into compact touchscreen devices. Servers provide resources and services to other systems. Smart devices and IoT equipment put computing into everything from speakers to refrigerators and light bulbs.

Four functions

Input, processing, storage, and output.

Three ingredients

Hardware, software, and firmware.

One technician mindset

Understand the role before diagnosing the problem.

Hardware gives the computer physical components. Software provides instructions. Firmware provides software embedded into hardware. Drivers help the operating system communicate with physical devices.

In the next module, we're taking the case off.

What exactly is hiding inside a PC—and what does each part actually do?