

Internet and Information Technology

Lecture 4

ITC202

Input and Output

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Chapter 4: Input and Output

Keyboards

Pointing and Touch Devices

Mice

Touch Screens

Scanners, Readers, and Digital Cameras

Scanners

Readers

Digital Cameras

Audio Input

Display Devices

Display Device Characteristics

Liquid Crystal Displays (LCDs)

Organic Light Emitting Diode (OLED) Displays

Printers

Laser Printers

Ink-Jet Printers

Thermal printer

Dot matrix printer

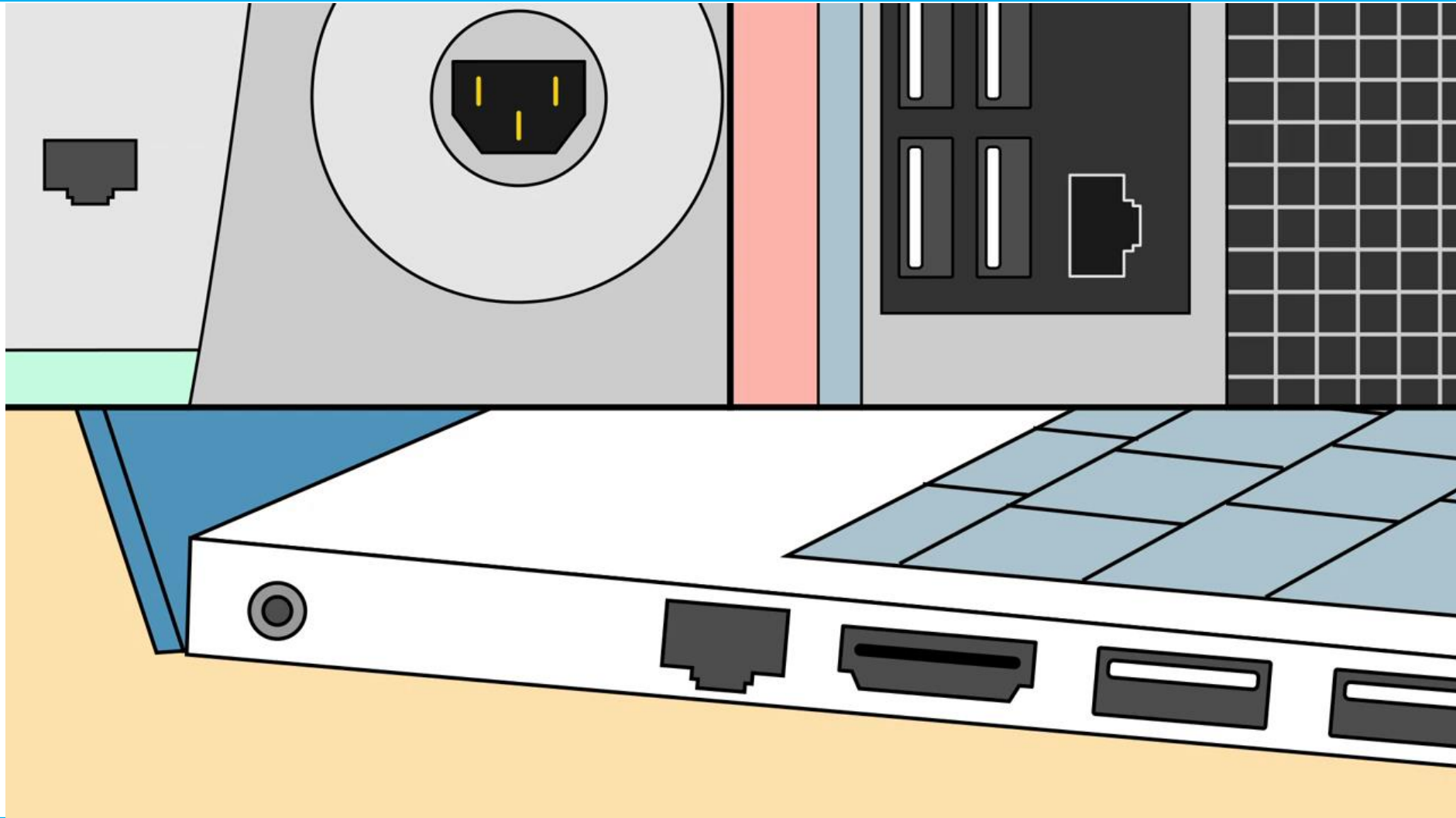
Learning Objectives

1. List different types of ports.
2. Explain the purpose of a computer keyboard and the types of keyboards widely used today.
3. List several different pointing devices and describe their functions.
4. Describe the purposes of scanners and readers and list some types of scanners and readers in use today.
5. Explain what digital cameras are and how they are used today.

Learning Objectives

6. Describe the characteristics of a display device and explain some of the technologies used to display images.
7. List several types of printers and explain their function.

Ports and Connectors



USB



USB (Universal Serial Bus)

- **USB** is a widely adopted industry standard for connecting peripherals to computers and other electronic devices, enabling data transmission and power delivery through cables and connectors.
- **Plug-and-Play:** USB allows devices like keyboards, mice, and flash drives to be connected to computers and used **immediately** without complex setup.



USB (Universal Serial Bus)

- **USB 1.x:** The first generation, offering a maximum data transfer rate of 12 Mbps. **White**
- **USB 2.0:** The next major release, increasing the speed to a maximum of 480 Mbps.
- **USB 3.x (including USB 3.2):** This series introduced more complex numbering and capabilities.
 - **USB 3.0 :** Also known as SuperSpeed USB 5 Gbps
 - **USB 3.1:** 10 Gbps
 - **USB 3.2 :** Utilizes two data lanes to achieve speeds of up to 20 Gbps.
- **USB 4:** The latest generation, offering speeds of up to 40 Gbps and a unified USB-C connector to reduce confusion.

USB (Universal Serial Bus)



USB TYPE A



USB TYPE B



USB TYPE C



USB MINI A



USB MINI B



USB MICRO A



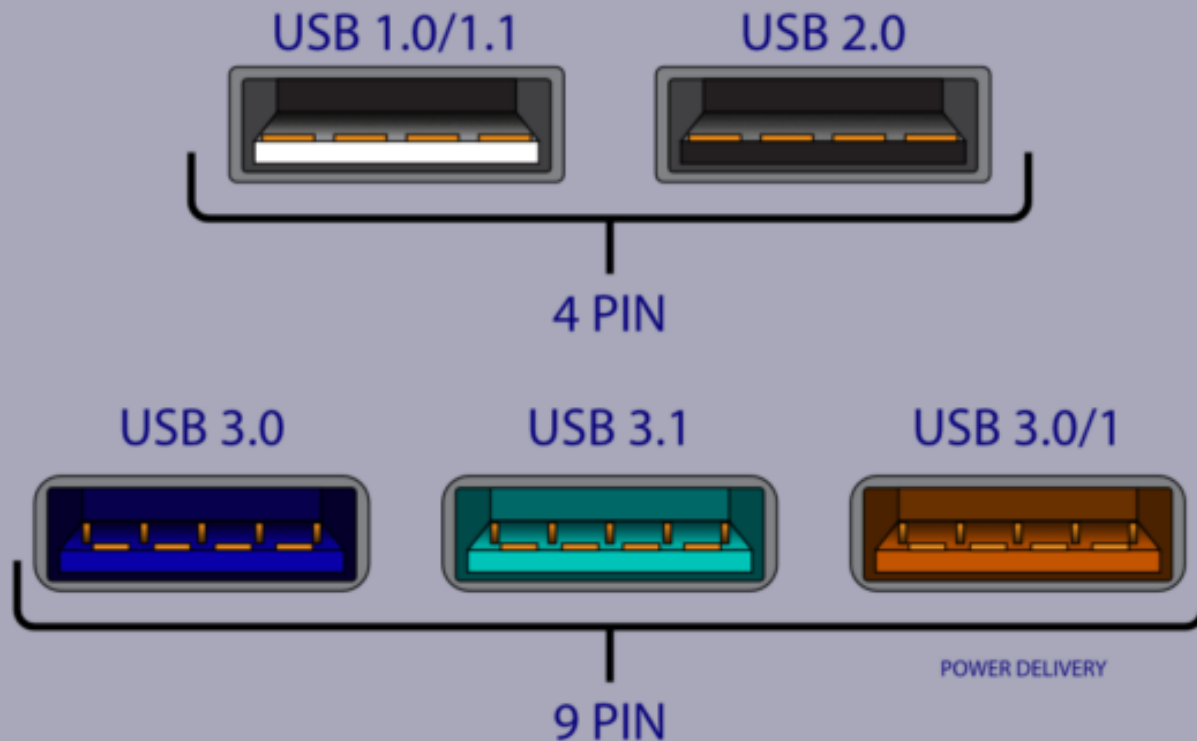
USB MICRO B



USB MICRO B SUBER SPEED

USB Connections

USB TYPE-A

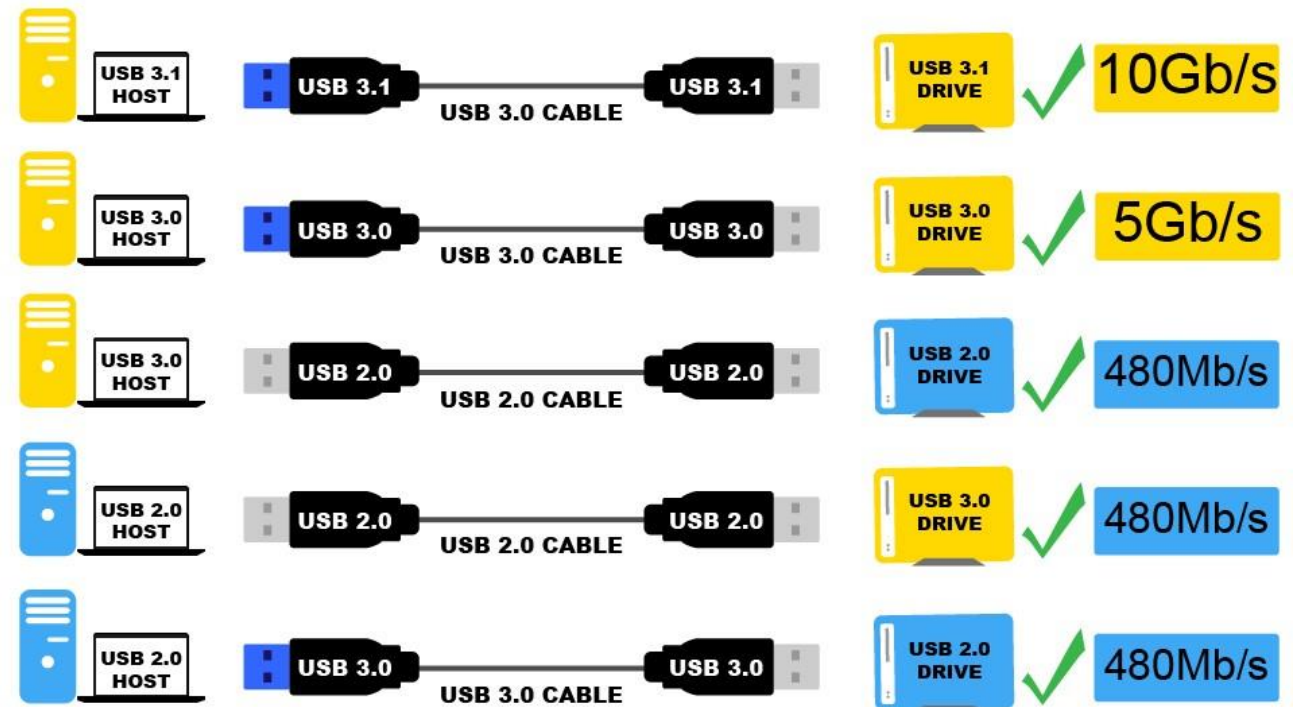


USB TYPE-C



USB

Receptacles Types		USB 2.0	USB 3.1 Gen1	USB 3.1 Gen2
Type-C				
Type-B	Standard			N/A
	Mini		N/A	N/A
	Micro			
Type-A	Standard			
	Mini		N/A	N/A
	Micro		N/A	N/A



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Keyboards

- **Keyboard:** An input device used to enter characters at the location marked by the insertion point or cursor.
 - Can be wired or wireless.
- Typically contains:
 - ❖ Standard alphanumeric keys.
 - ❖ Numeric keypad.
 - ❖ Function keys.
 - ❖ Delete and Backspace keys.
 - ❖ Control and Alternate keys.
 - ❖ Arrow directional keys and special keys.



FUNCTION KEYS
Perform a different command or function in each program designed to use them.

KEYBOARD DISPLAY
Displays images, videos, communication and gaming data, etc.

ENTER KEY
Used to enter commands into the computer, end paragraphs, and insert blank lines in documents.

BACKSPACE KEY
Erases one character to the left of the insertion point.

ALPHANUMERIC KEYS
Usually arranged in the same order as the keys on a standard typewriter.

MEDIA KEYS
Control music, videos, and images.

SCROLL WHEEL
Scrolls through documents.

INSERT KEY
Toggles between inserting text and typing over text in many programs.

NUMERIC KEYPAD
Used to efficiently enter numerical data.

PAGE UP AND PAGE DOWN KEYS
Move up or down one page or screen in most programs.

ARROW KEYS
Move the cursor around a document without disturbing existing text.

DELETE KEY
Deletes one character to the right of the insertion point.

SHIFT KEY
Produces uppercase letters and symbols on the upper part of certain keys when the Caps Lock key is not on.

SPACE BAR
Enters a blank space.

CONTROL AND ALTERNATE KEYS
Used in combination with other keys to enter commands into the computer.

USER PROGRAMMABLE KEYS
Perform functions as defined by the user.

WINDOWS KEY
Opens the Windows Start menu.

CAPS LOCK KEY
Turns all caps on or off.

TAB KEY
Moves to the next tab location.



Pointing Devices

- **Pointing devices:** Used to select and manipulate objects.
 - Used to input data.
 - Used to issue commands to the computer.
- Common types of pointing devices:
 - Mouse.
 - Touch screen.

Pointing Devices

- **Mouse:** A common pointing device that the user slides along a flat surface to move a pointer around the screen and clicks its buttons to make selections.

POINT

Move the mouse until the mouse pointer is at the desired location on the screen.



CLICK

Press and release the left mouse button.



RIGHT-CLICK

Press and release the right mouse button.



DOUBLE-CLICK

Press and release the left mouse button twice, in rapid succession.



DRAG-AND-DROP

When the mouse pointer is over the appropriate object, press and hold down the left mouse button, drag the object to the proper location on the screen by moving the mouse, and then drop the object by releasing the mouse button.

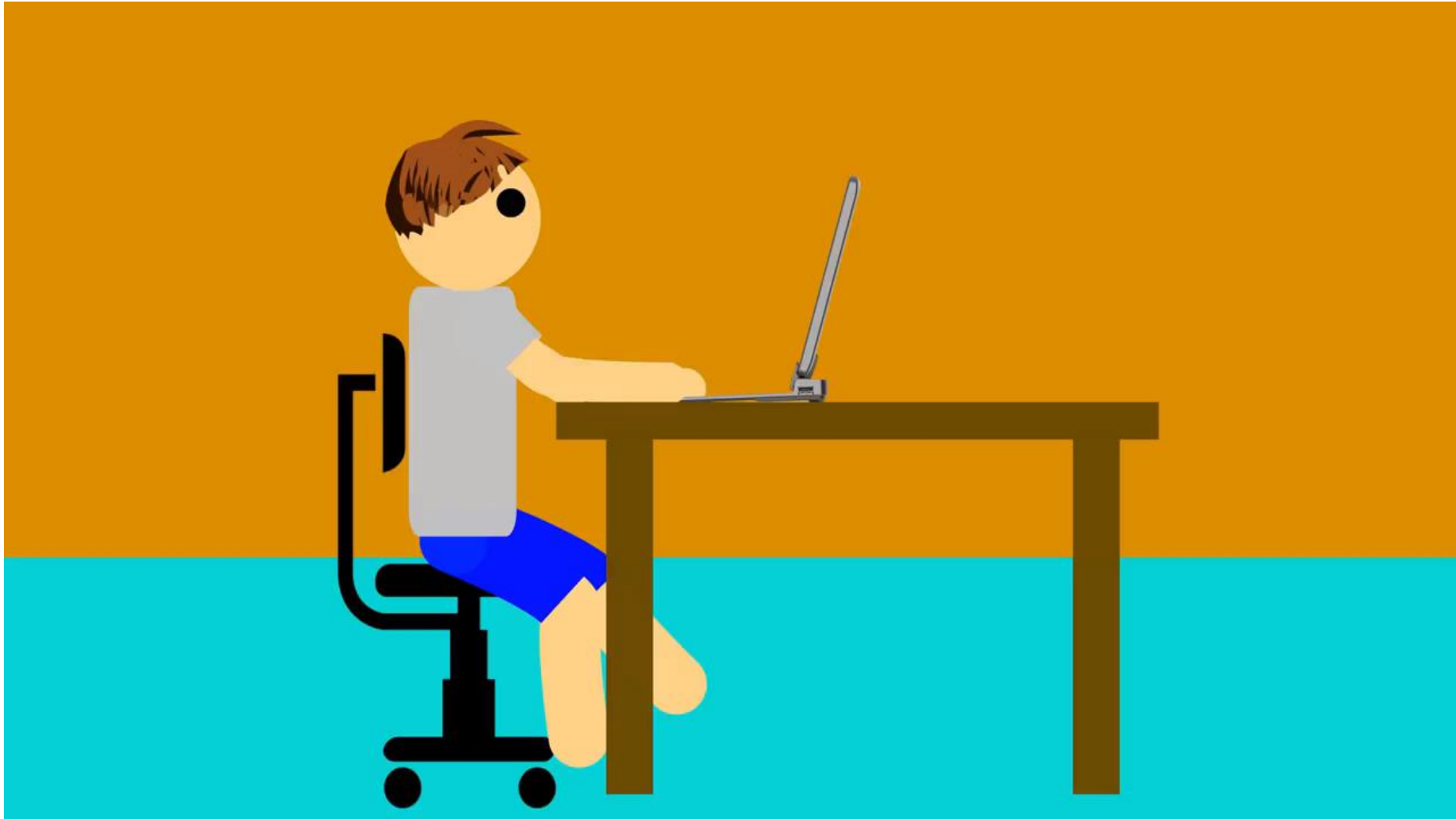


SCROLL WHEEL/BUTTON

If your mouse has a wheel or button on top, use it to scroll through the displayed document.



How does Mouse works



Touch Screens

- **Touch screen:** Display device that is touched with the finger to select commands or otherwise provide input to the computer.
- Used with:
 - Desktop and portable computers.
 - Mobile phones and mobile devices.
- All modern mobile screens are multi-touch.



Capacitive touchscreen



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Scanners

- **Scanner (optical scanner):** Input device that captures an image of an object and transfers them to a computer in digital form.
 - Can scan photos, documents, drawings, (flat objects).
 - Data is typically input as a single image.
- Types of scanners:
 - Flatbed.
 - Portable.
 - 3D.
 - Integrated (ATMs, etc.)



FLATBED SCANNERS

Used to input photos, sketches, slides, book pages, and other relatively flat documents into the computer.



PORTABLE SCANNERS

Used to capture small amounts of text; the text is typically transferred to a computer at a later time.

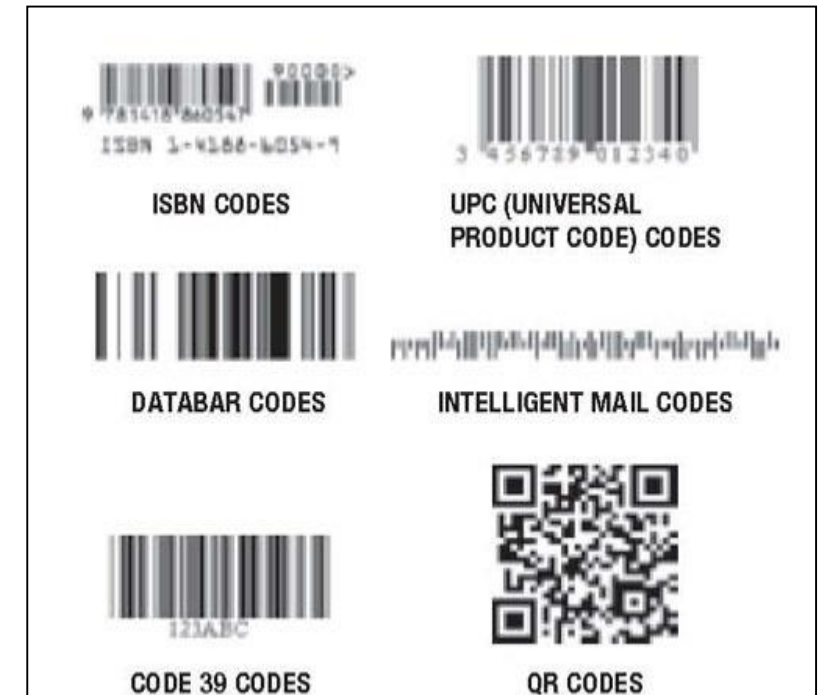


INTEGRATED SCANNERS

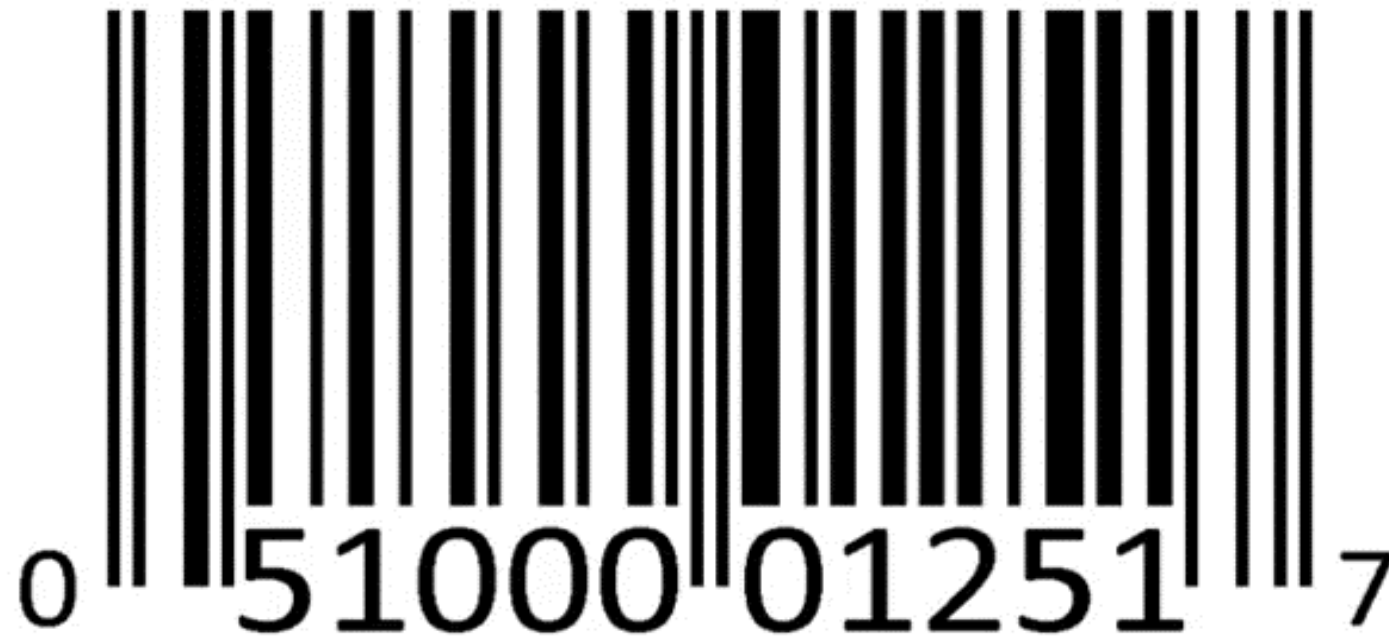
Built into other devices, such as into the ATM machine shown here to capture images of deposited checks.

Barcode Readers

- **Barcode readers:** Input devices that read barcodes.
- Barcode: Machine-readable code that represents data as a set of bars.
 - Common types:
 - Universal Product Code (UPC).
 - ISBN.
 - 2D (QR) – hold more data.



How barcode read



QR codes



Biometric Readers

- **Biometric data:** Based on unique physiological characteristics or personal trait.
 - Fingerprint.
 - Hand or face geometry.
 - Iris of the eye.
 - Voice or signature.
- **Biometric readers:** Used to input biometric data.
 - Can be stand-alone or built into another piece of hardware.
 - Used to allow access only by authorized individuals.
 - Most often used for access control and to verify transactions.

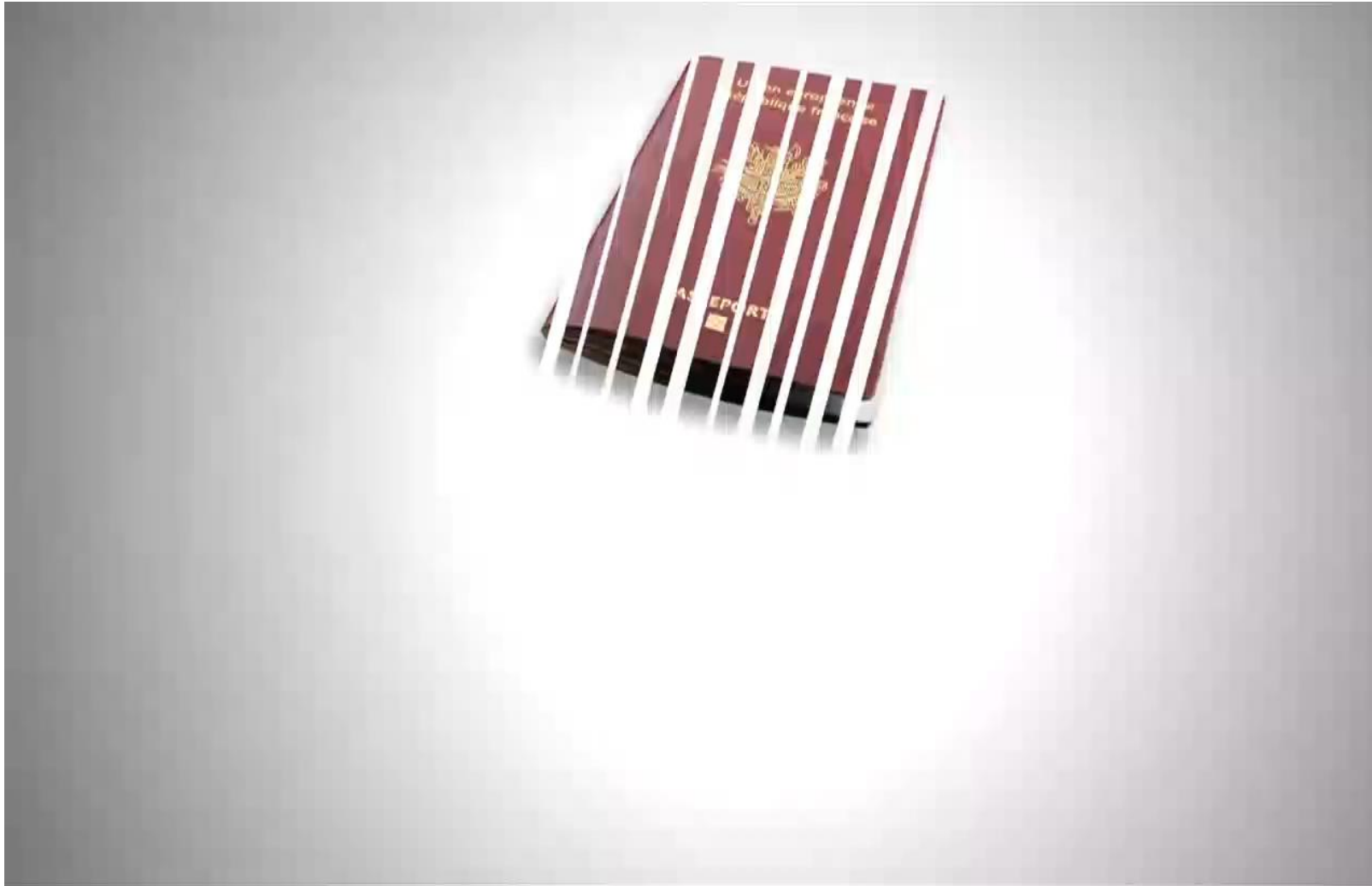


STAND-ALONE FINGERPRINT READERS
Often used to control access to facilities or computer systems, such as to the notebook computer shown here.



BUILT-IN FINGERPRINT READERS
Typically used to control access to the device into which the reader is built, such as to the external hard drive shown here.

Biometric

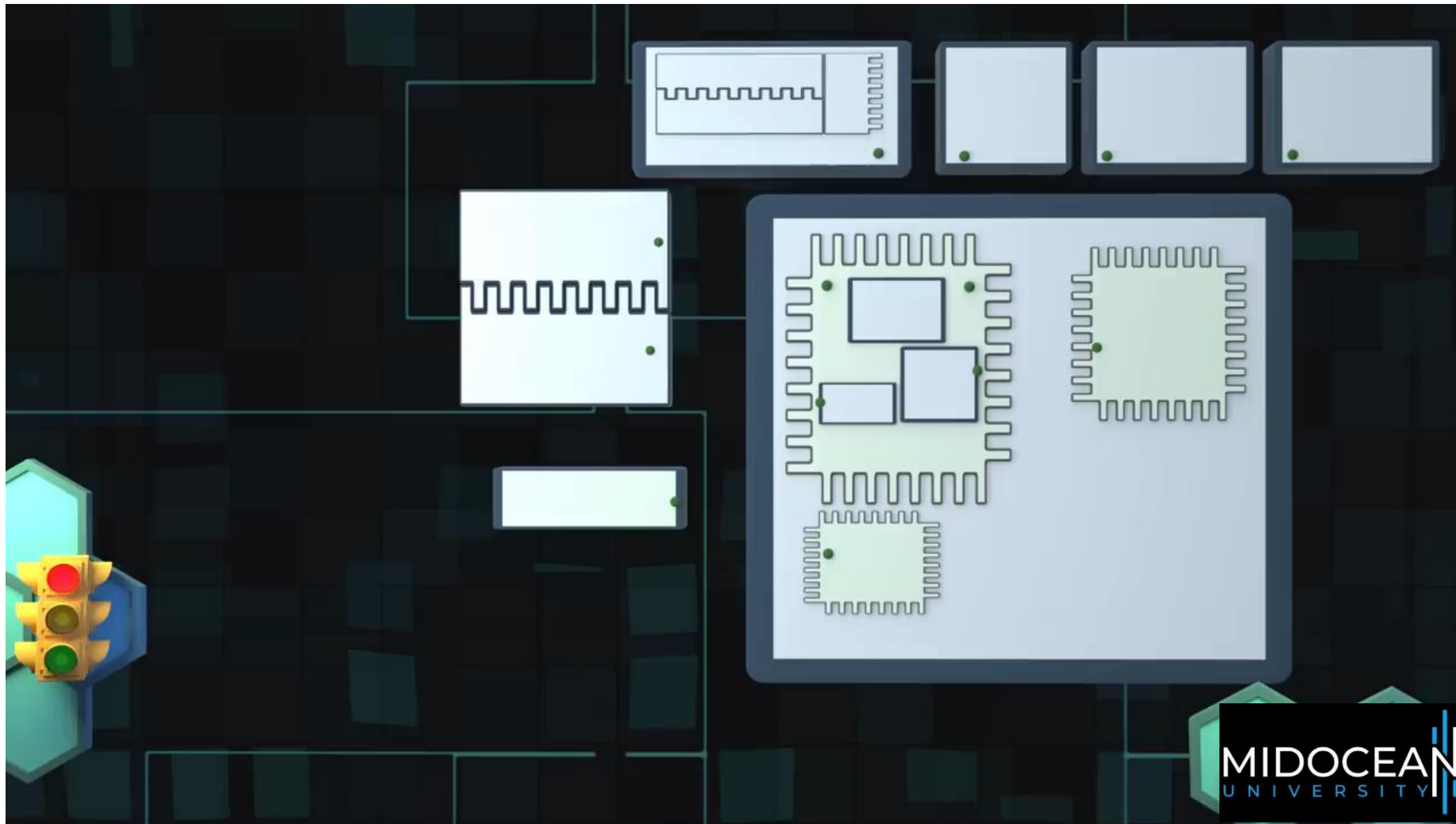


Digital Cameras

- **Digital cameras:** Record images on digital storage medium rather than film.
 - Can either be still cameras or video cameras.
 - Integrated into many portable computers and mobile phones.
- Digital still cameras:
 - Available in a wide variety of sizes and capabilities.
 - Primary appeal is images **immediately** available.
 - Camera quality is measured in **megapixels**.
 - Typically use flash memory for storage.
 - Camera phones can be used to read barcodes, for mobile deposit, etc.



HOW DOES A CAMERA WORK?



Audio Input

- **Audio input:** The process of entering audio data into the computer
- **Voice input:** Inputting spoken words and converting them to digital form.
 - Via microphone or headset.
 - To provide spoken instructions to computer (speech recognition systems).
- Music input systems are used to input music.
 - Microphones.



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Display Devices

- **Display device:** Presents output visually
 - Monitor: Display device for a desktop computer.
 - Display screen: Screen built into a variety of devices:
 - Notebook and other portable computers.
 - Mobile phones and mobile devices.
 - Handheld gaming devices, home entertainment devices.

Display Devices

- **Screen Resolution:** display device is divided into a fine grid of tiny pixels,. The number of pixels used on a display screen determines the *screen resolution*, which affects the amount of information that can be displayed on the screen at one time.
- When a higher resolution is selected, such as 1,280 pixels horizontally by 1,024 pixels vertically, more information can fit on the screen, but everything will be displayed smaller than with a lower resolution, such as $1,024 \times 768$.

Screen Resolution Explained

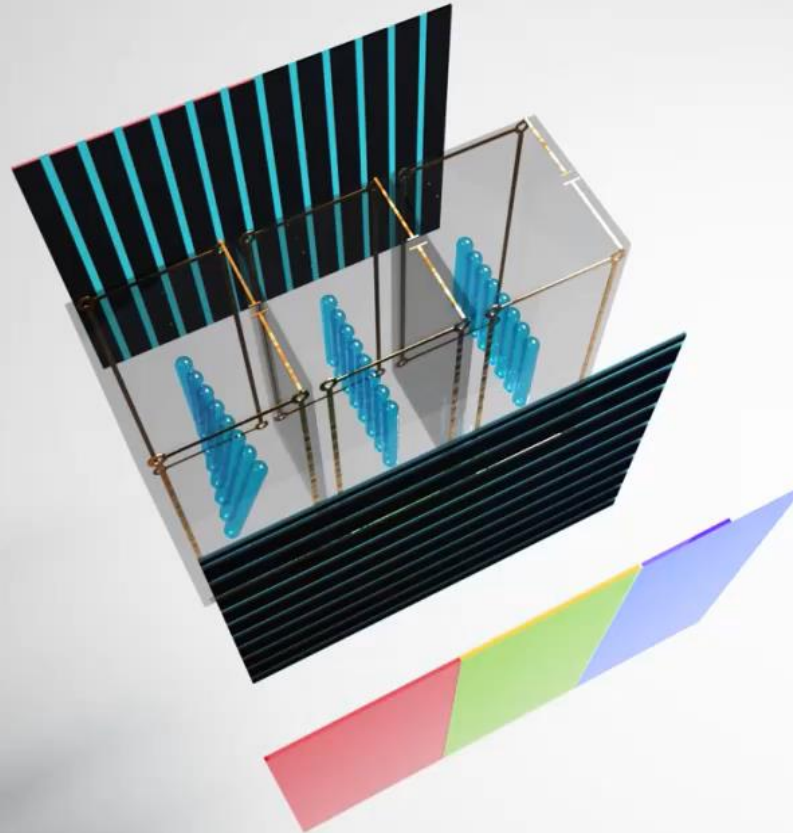


RESOLUTION

Liquid Crystal Displays (LCDs)

- **liquid Crystal Display (LCD)** uses charged liquid crystals located between two sheets of clear material (usually glass or plastic) to light up the appropriate pixels to form the image on the screen.
- In their normal state, the liquid crystals are **aligned** so that light **passes** through the display. When an electrical charge is applied to the liquid crystals, the liquid crystals **change** their **orientation** so that light **cannot** pass through the display
- LCD panels used with computer monitors typically include a **light** inside the panel, a technique referred to as backlighting.
- LEDs are also beginning to be used to **backlight** LCD panels.

LCD



Organic Light Emitting Diode (OLED) Displays

- **Organic Light Emitting Diode (OLED)** displays do not use backlighting
- OLED material emits visible light.
- This characteristic makes OLEDs more energy efficient than LCDs
- OLEDs are thinner than LCDs,
- OLEDs have a wider viewing angle than LCDs and so displayed content is visible from virtually all directions,
- OLEDs images are brighter and sharper than LCDs.



LCD vs. LED

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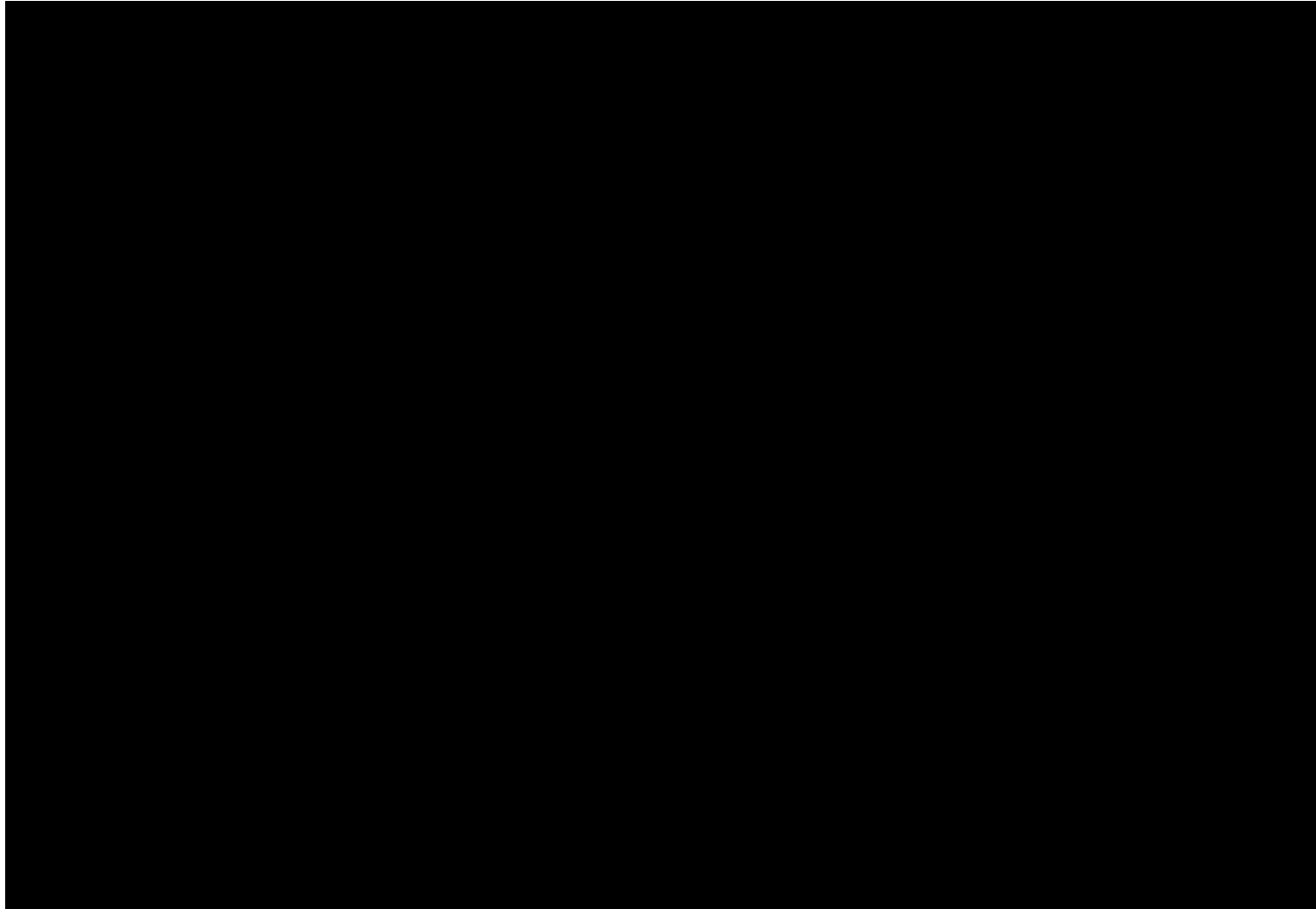
Dot matrix printer

Printer Characteristics

- **Print resolution:** The number of dots per inch (dpi). Printers form images with dots of liquid ink or flecks of toner powder.
- **Guidelines** for acceptable print resolution are typically 300 dpi for general-purpose printouts, 600 dpi for higher-quality documents, 1,200 dpi for photographs, and 2,400 dpi for professional applications.
- **Print speed** is measured in pages per minute (ppm). How long it takes a document to print depends on the actual printer being used, the selected print resolution, and the content being printed.
- **Common speeds** for personal printers today range from about 15 to 35 ppm; network printers typically print from 40 to 100 ppm.



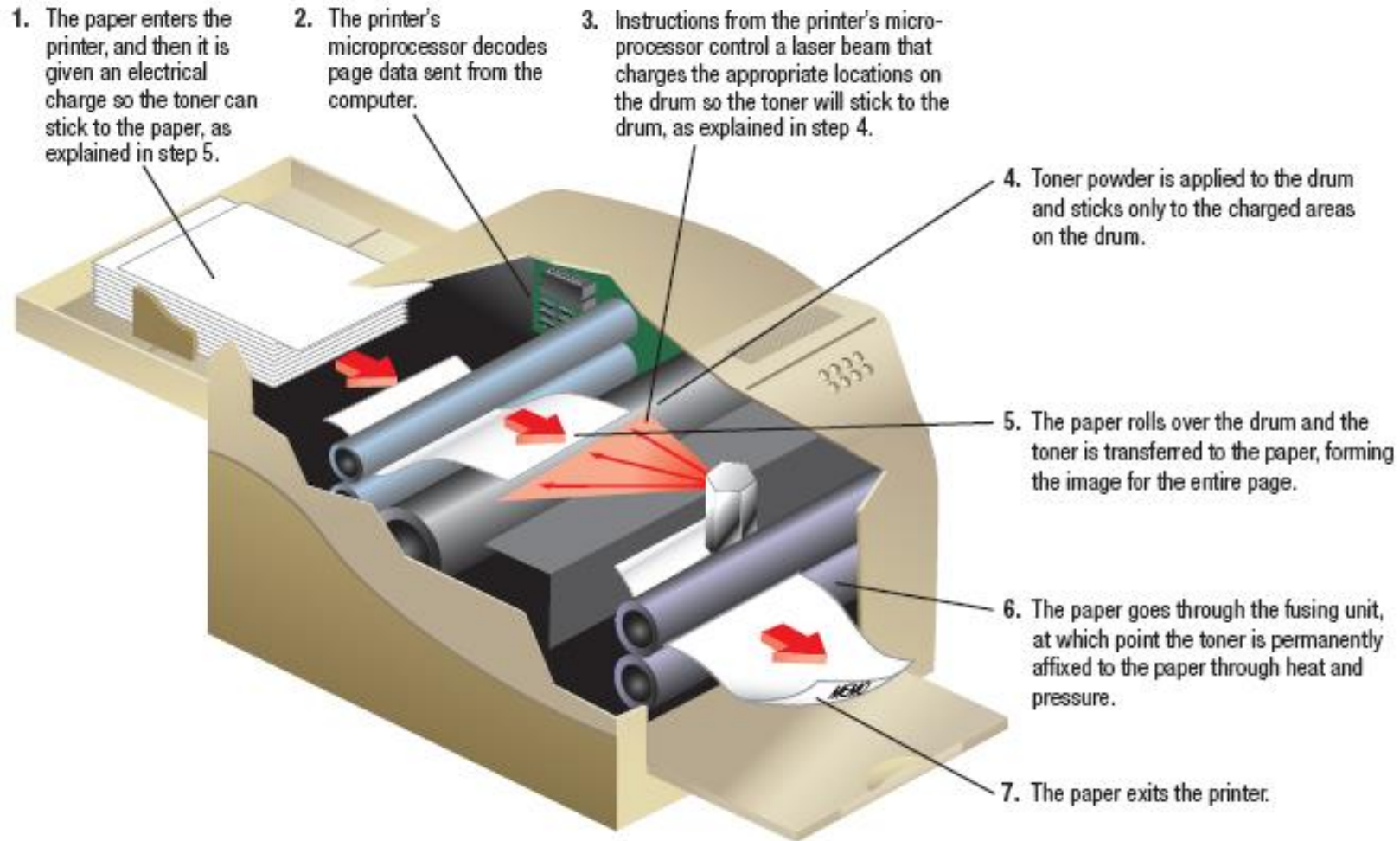
Types of Printers



Laser Printers

- To print a document, the laser printer first uses a **laser** beam to **charge** the appropriate locations on a **drum** to form the page's image, and then toner powder (powdered ink) is released from a toner cartridge and **sticks** to the **drum**. The toner is then transferred to a piece of paper when the paper is rolled over the drum, and a heating unit **fuses** the toner powder to the paper to permanently form the image.
- Generally faster and have better quality than ink-jet printers.

Laser Printers



Ink-Jet Printers

- **Ink-jet printer:** Sprays droplets of ink to produce images on paper.
 - Often the choice for home use.
 - Print fairly slowly, one line at a time.
 - Quality not quite as good as a laser printer.
 - Use ink-jet cartridges.
- Newer printers with full width printheads are much faster.
- Potential applications for the future.
 - Dispensing liquid metal, aromas, computer chips and other circuitry, “printing” human tissue.

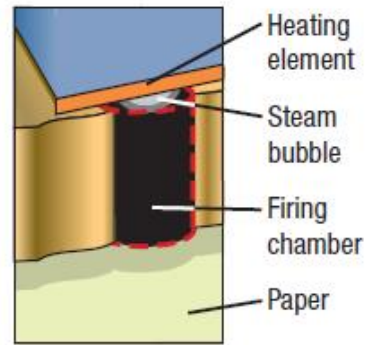
Ink-Jet Printers



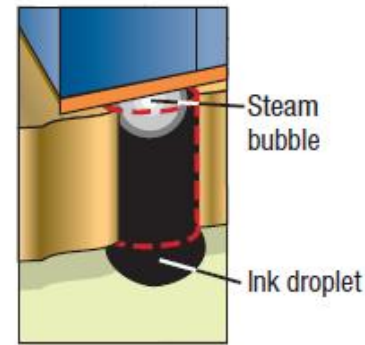
Each ink cartridge is made up of multiple tiny ink-filled firing chambers; to print images, the appropriate color ink is ejected through the appropriate firing chamber.



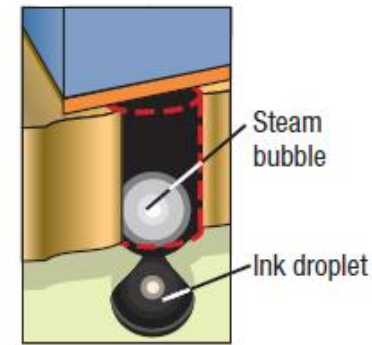
Ink-jet printer



1. A heating element makes the ink boil, which causes a steam bubble to form.



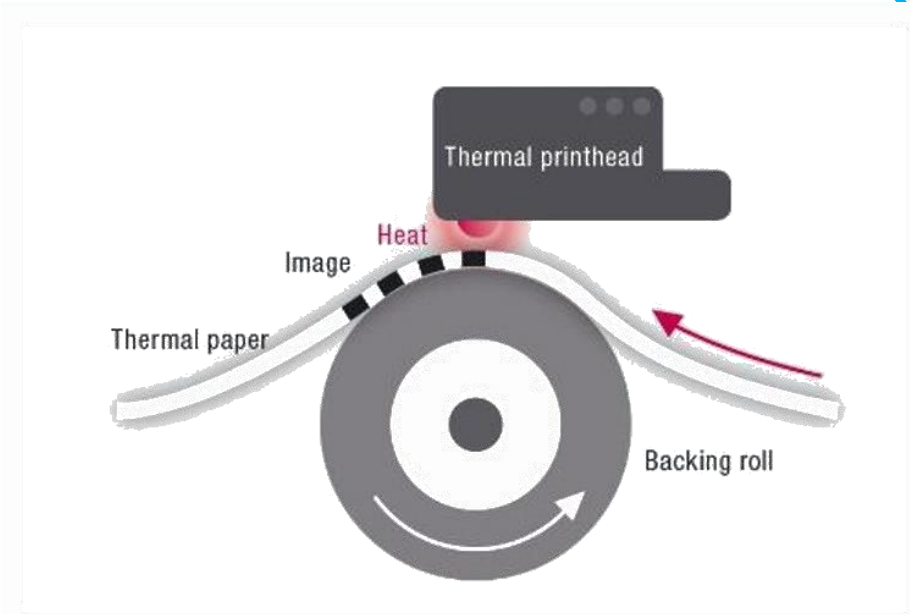
2. As the steam bubble expands, it pushes ink through the firing chamber.



3. The ink droplet is ejected onto the paper and the steam bubble collapses, pulling more ink into the firing chamber.

Thermal printer

- **Thermal printers** use special print paper called thermal paper and on this thermal paper is wax based ink and when heat is applied to this ink, it turns black.
- In a thermal printer the only thing the printhead does is apply heat to the areas where ink should be printed.
- Then when the ink is cooled, it becomes permanent and because of this technology, thermal printers are very **quiet**.
- Thermal printers are commonly used for printing labels and barcodes.



Dot matrix printer

- **Dot matrix printer** is an impact printer that creates an image by striking an ink-soaked ribbon with a print head containing pins.
- These pins form characters and graphics as dots on the paper.
- Known for their ability to print on **multi copy documents**, low operating costs, and durability in harsh environment
- Dot matrix printer are characterized by their slower speeds, noisier operation, and lower print quality compared to modern printers.

Audio Output

- Audio output: Output in the form of voice, music, and other audible sounds.
 - Speakers.
 - Headphones and headsets.
 - Earphones and earbuds.



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Smart Managerial Utilization of Input and Output Devices

Why Should Business Students Understand These Devices?

- In today's digital business environment, technology is not just a support tool—it's a strategic asset. Input and output devices are the gateways through which organizations interact with data, systems, and people. For managers, understanding these devices is essential because they directly impact:
 - ❖ **Operational efficiency**
 - ❖ **Employee productivity**
 - ❖ **Customer experience**
 - ❖ **Cost management**
 - ❖ **Sustainability and compliance**
- Choosing the right devices is no longer a technical decision—it's a managerial one that affects the bottom line.

How Can Managers Make Smart Decisions?

1. Operational Needs Assessment

- Before selecting any device, managers must ask:
 - ❖ What type of data is being entered or processed daily?
 - ❖ Are employees printing reports, invoices, or contracts regularly?
 - ❖ Is there direct customer interaction requiring touchscreens or microphones?

2. Performance vs. Cost Evaluation

- Not all high-performance devices are suitable for every organization. Managers must balance:
 - ❖ **Speed and accuracy** (e.g., printer speed, screen resolution)
 - ❖ **Initial cost vs. long-term maintenance**
 - ❖ **Device lifespan and reliability**

How Can Managers Make Smart Decisions?

3. Sustainability and Environmental Impact

- Modern organizations are expected to be environmentally responsible. Managers should consider:
 - ❖ Energy consumption
 - ❖ Recyclable materials
 - ❖ Eco-friendly certifications



4. Ease of Use and Training Requirements

- Complex devices can reduce productivity. Managers should prioritize:
 - ❖ User-friendly interfaces
 - ❖ Minimal training needs
 - ❖ Multilingual support if necessary

How Can Managers Make Smart Decisions?

5. System Integration and Compatibility

- ❖ Devices must work seamlessly with existing systems:
- ❖ HR platforms
- ❖ Point-of-sale systems
- ❖ Inventory and CRM tools

Real-World Business Applications

Sector	Relevant Devices	Managerial Impact
Accounting	Scanners, Laser Printers	Faster invoice processing and audit readiness
Marketing	OLED Displays, Digital Cameras	Enhanced visual content creation
Retail Sales	Barcode Readers, Thermal Printers	Streamlined checkout and inventory tracking
Customer Service	Touchscreens, High-quality Microphones	Improved customer interaction and satisfaction

Case Study: Walmart's Strategic Use of Input and Output Devices to Drive Operational Excellence

Company Background

- Walmart is the world's largest retail chain, known for its low prices and operational efficiency. One of the key drivers behind its success is the strategic use of **input and output devices** to streamline inventory management, enhance customer service, and reduce costs.



Case Study: Walmart's Strategic Use of Input and Output Devices to Drive Operational Excellence

Input and Output Devices in Action

- **Input Devices:**

- ❖ **Barcode Scanners:** Used at checkout counters to quickly and accurately register products.
- ❖ **RFID Tags and Readers:** Enable real-time tracking of inventory across warehouses and stores.
- ❖ **Touchscreens:** Used by employees for inventory updates and customer service tasks.
- ❖ **IoT Sensors:** Monitor environmental conditions like temperature in storage areas.

- **Output Devices:**

- ❖ **Digital Displays:** Show promotions and product information to customers in-store.
- ❖ **Receipt Printers:** Provide fast and accurate billing.
- ❖ **Dashboards and Monitors:** Used by managers to visualize sales, inventory levels, and performance metrics in real time.



Case Study: Walmart's Strategic Use of Input and Output Devices to Drive Operational Excellence

Managerial Impact

- **A. Inventory Optimization**
 - ❖ Real-time data from input devices ensures accurate stock levels.
 - ❖ Output dashboards help managers make timely restocking decisions.
- **B. Cost Efficiency**
 - ❖ Automation reduces labor costs and human error.
 - ❖ Faster checkout processes improve customer throughput.
- **C. Enhanced Customer Experience**
 - ❖ Accurate pricing and product availability.
 - ❖ Faster service and personalized promotions.

Case Study: Walmart's Strategic Use of Input and Output Devices to Drive Operational Excellence

Lessons for Business Students

- “Input and output devices are not just technical tools—they are strategic assets.
- Walmart’s success shows how thoughtful integration of these devices can improve efficiency, reduce costs, and enhance customer satisfaction.
- For future managers, understanding these technologies is essential for making informed operational decisions.”

Final Message to Business Students

- As future managers, your role is not just to lead teams or analyze data—you must also make strategic decisions about the tools your organization uses. Understanding input and output devices gives you a competitive edge. It enables you to:
 - ❖ Optimize workflows
 - ❖ Reduce operational costs
 - ❖ Enhance employee and customer experiences
 - ❖ Align technology choices with business goals
- **Technology is not just hardware—it's a managerial decision that shapes organizational success.**

Summary

- **KEYBOARDS** Most people use a keyboard to input data into a personal computer. Keyboards typically include the standard alphanumeric keys, plus other keys for special purposes. Many mobile phones and other mobile devices include a keyboard today—if not, a portable keyboard can often be used. Wireless keyboards are also available.

Summary

- **POINTING AND TOUCH DEVICES** Pointing devices are hardware devices that move an on-screen mouse pointer or similar indicator.
- The most widely used pointing device is the **mouse**.
- **Touch screens** are monitors that are touched with the finger to select commands or provide input.

Summary

- **SCANNERS, READERS, AND DIGITAL CAMERAS:** There are many different input devices that can be used to convert data that already exists (such as source documents) to digital form or to initially capture data in digital form.
- A **scanner** allows users to input data that exists in physical form, such as photographs, drawings, and printed documents, into a computer.
- Most scanners are flatbed scanners or portable scanners.
- **Barcode readers** read barcodes to identify products in many retail stores.

Summary

- **Digital cameras** work much like conventional film cameras, but they record digital images on a digital storage medium (such as a flash memory card, digital tape cartridge, built-in hard drive, or DVD disc), instead of on conventional film or videotape.
- The images are immediately available without processing and can be transferred to a computer for manipulation or printing, or sent directly to some printers for printing.

Summary

- **Display devices** (also called monitors and display screens) are the most common type of output device for a computer; they are also incorporated into a wide variety of other electronic devices.
- Flat-panel displays are most often liquid crystal displays (LCDs) or organic light emitting diode (OLED) displays
- Regardless of the technology used, the screen of a display device is divided into a fine grid of small areas or dots called **pixels**.

Summary

- **Printers** produce hard copy output through either impact or nonimpact printing technology.
- Most printers today form images as matrices of dots, although with many technologies, the dots are too small to be visible.
- Printer quality is usually measured in dots per inch (dpi); speed is typically measured in pages per minute (ppm).
- The most common printers are **Laser printers** (which use toner powder), **Ink-jet printers** (which use liquid ink), **Thermal printers** use special wax based ink thermal paper, and **Dot matrix printer** striking an ink-soaked ribbon with a print head containing pins.

Reference

15th Edition

Understanding Computers

Today and Tomorrow

Comprehensive



Deborah Morley