CS1010 Introduction to Computing

Lecture 05

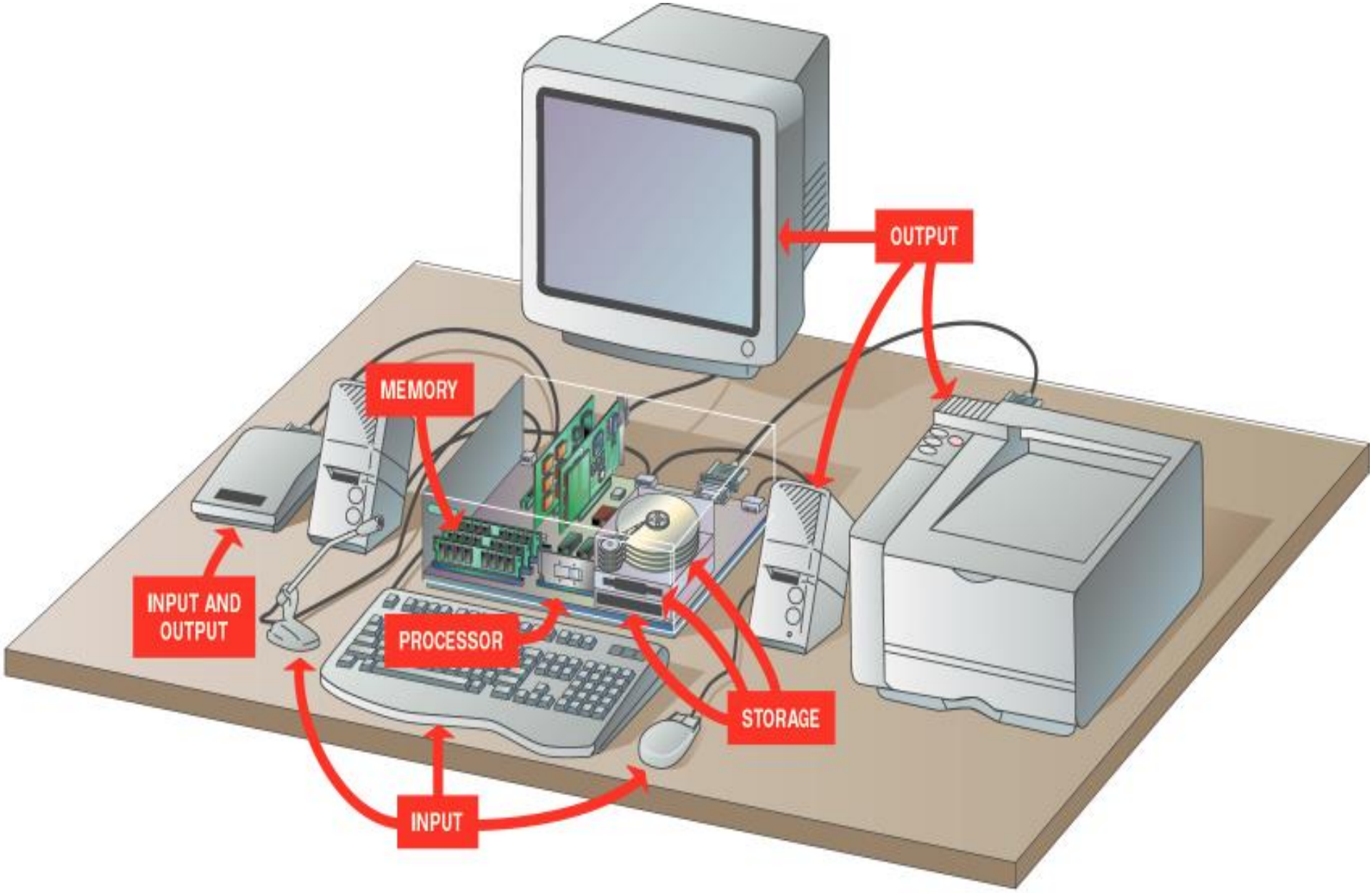
Computer Hardware

(Input and Output Devices)

ESSENTAIL COMPONENTS FOR COMPUTERS

- At the highest level, **two things** are required for **computing**:
  - **Hardware** (is a part which you can touch)
  - **Software** (is a set of instruction through which you use hardware)

- All computers have following essential **hardware components/subsystems**:
  - **Input** (through which you give instruction to computer)
  - **Processor** (is the main engine, it's the area of computer which process that input)
  - **Memory** (during calculations processor keep some files in memory)
  - **Storage**
  - **Output** (through which computer communicate with us)
  - **The Bus** (through bus in any computer all others components communicate with each other)


OUTPUT
MEMORY
INPUT AND OUTPUT
PROCESSOR
STORAGE
INPUT

Components of a Computer

What are common computer hardware components?

p. 1.5 Fig. 1-3

Nadeem Akhtar CS & IT Dept.
UOL, Lahore.

INPUT UNIT

INPUT UNIT

- **Data and Instructions** must enter the computer system, this task is performed by the **input unit**.

- In short, following functions are performed by an input unit:
  - It **accepts (or reads)** the instructions and data from the outside world.
  - It **converts** these instruction & data in computer acceptable form.

INPUT DEVICES

- The following input devices are used.
  - Keyboard
  - Mouse
  - Digital Cameras
  - Microphone
  - Scanner
  - Joystick
  - Pens
  - Touch Screens
  - Bar Code Readers

THE KEYBOARD

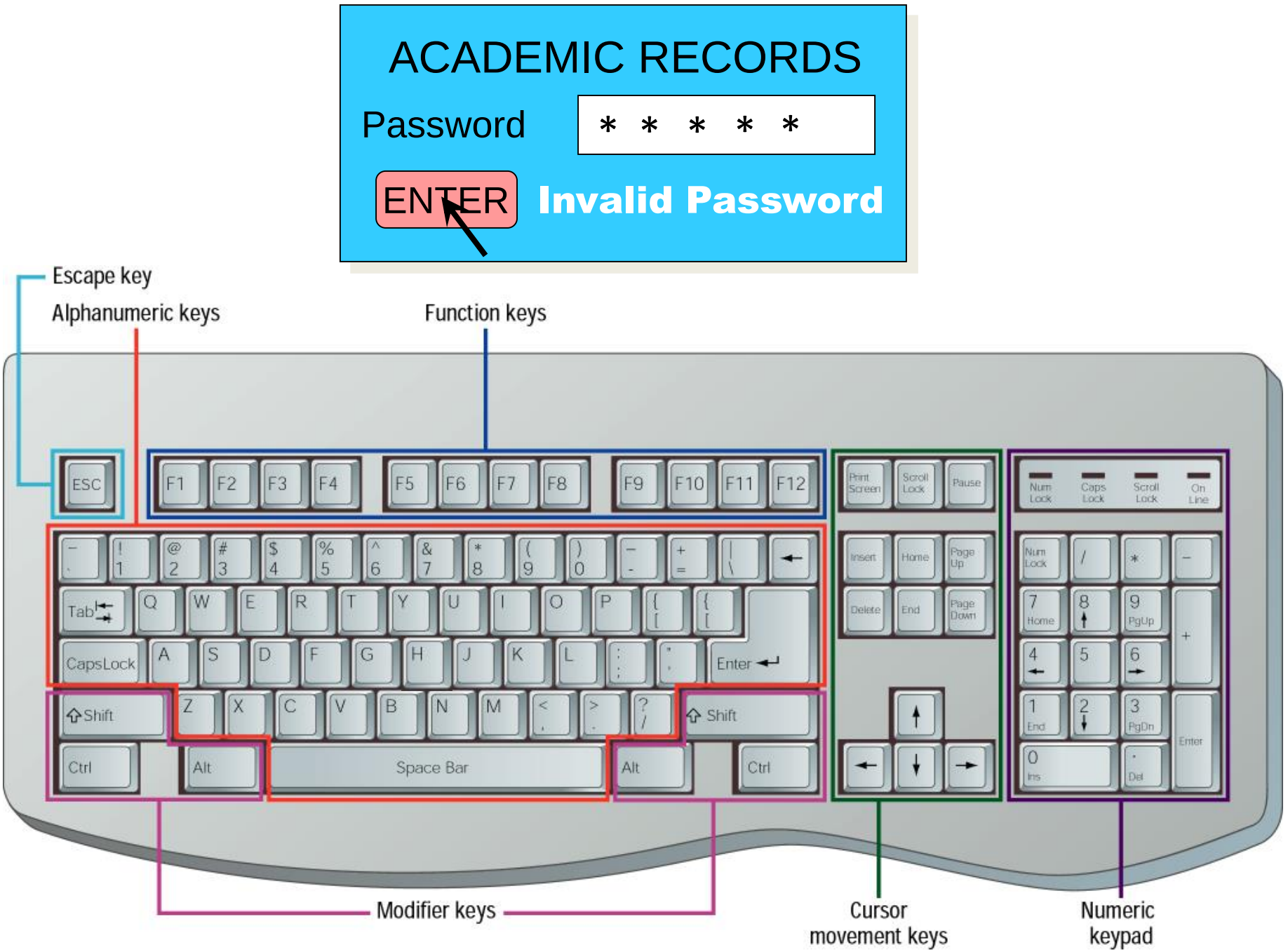
- The **keyboard** was one of the first peripherals to be used with computers, and it is still the primary input device for entering text and numbers.

  - **Alphanumeric Keys** (QWERTY)
  - **Modifier Keys** (SHIFT, ALT and CONTROL)
  - **Numeric Keypad**
  - **Function Keys** (F1, F2 and so on…)
  - **Special Purpose Keys**(DELETE, INSERT, END etc)
  - **Cursor Movement Keys**

KEYBOARD
(Standard Keyboard Layout)

- A standard computer **keyboard** has about 100 keys.

- Most keyboards use the **QWERTY layout**, named for the first six keys in the top row of letters.

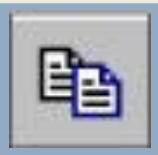

ACADEMIC RECORDS
Password
* * * * *
ENTER
Invalid Password
Escape key
Alphanumeric keys
Function keys
ESC
F1 F2 F3 F4 F5 F6 F7 F8 F9 F10 F11 F12
Print Screen
Scroll Lock
Pause
Num Lock
Caps Lock
Scroll Lock
On Line
Insert
Home
Page Up
Delete
End
Page Down
Tab
CapsLock
Enter
Shift
Shift
Ctrl
Alt
Space Bar
Alt
Ctrl
Modifier keys
Cursor movement keys
Numeric keypad

- An **ergonomic keyboard** has a design that reduces the chance of wrist and hand injuries.

- Ergonomics incorporates **comfort**, **efficiency**, and **safety** into the design of workplace.

- What are alternative forms for command?

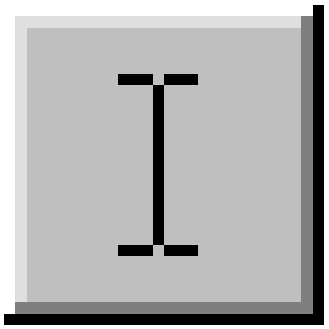
- Many programs allow you to use a button, a menu or a function key to obtain some result.

Command	Button	Menu	Function Key(s)
Copy		File|Copy	CTRL+C
Open		File|Open	CTRL+F12
Print		File|Print	CTRL+SHIFT+F12

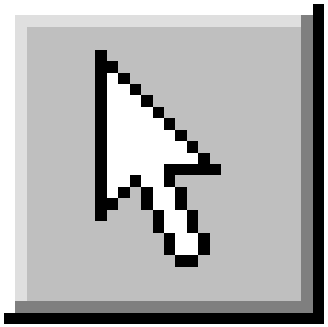
Pointing Devices

What is a pointing device?

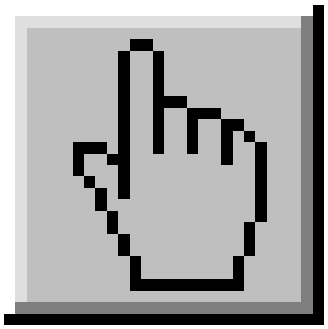
- An input device that allows you to control a pointer on the screen
- A pointer is a small symbol on the screen
- The pointer takes several shapes



I-beam



block arrow



pointing hand

Mouse Techniques

Using the mouse involves **five techniques**:

1. **Pointing**; Move the mouse to move the on-screen pointer.

2. **Clicking**; Press and release the left mouse button once.

3. **Double-clicking**; Press and release the left mouse button twice.

4. **Dragging**; Hold down the left mouse button as you move the pointer.

5. **Right-clicking**; Press and release the right mouse button.

VARIANTS OF THE MOUSE

- Trackballs
- Touchpads
- Integrated Pointed Stick

Trackballs

- A **trackball** is like a mouse turned upside-down.
- Use your **thumb to move the exposed ball** and your fingers to press the buttons.

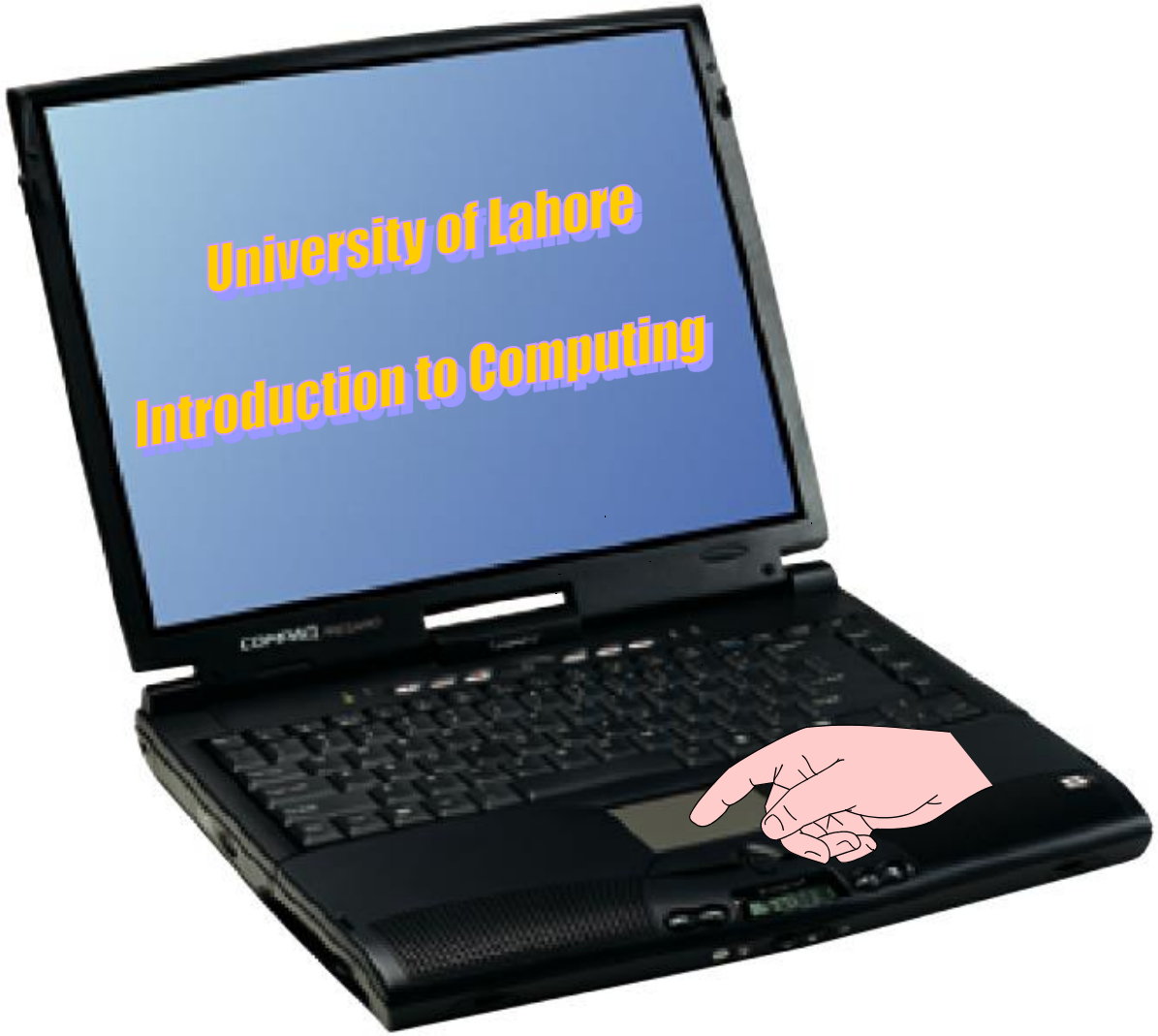
Many styles of trackball are available.

Touchpads

- A **touchpad** is a **touch-sensitive** pad that provides the same functionality as a mouse.

- To use a **touchpad**, you glide your finger across its surface.

- Touchpad provide a set of **buttons** that function like mouse buttons.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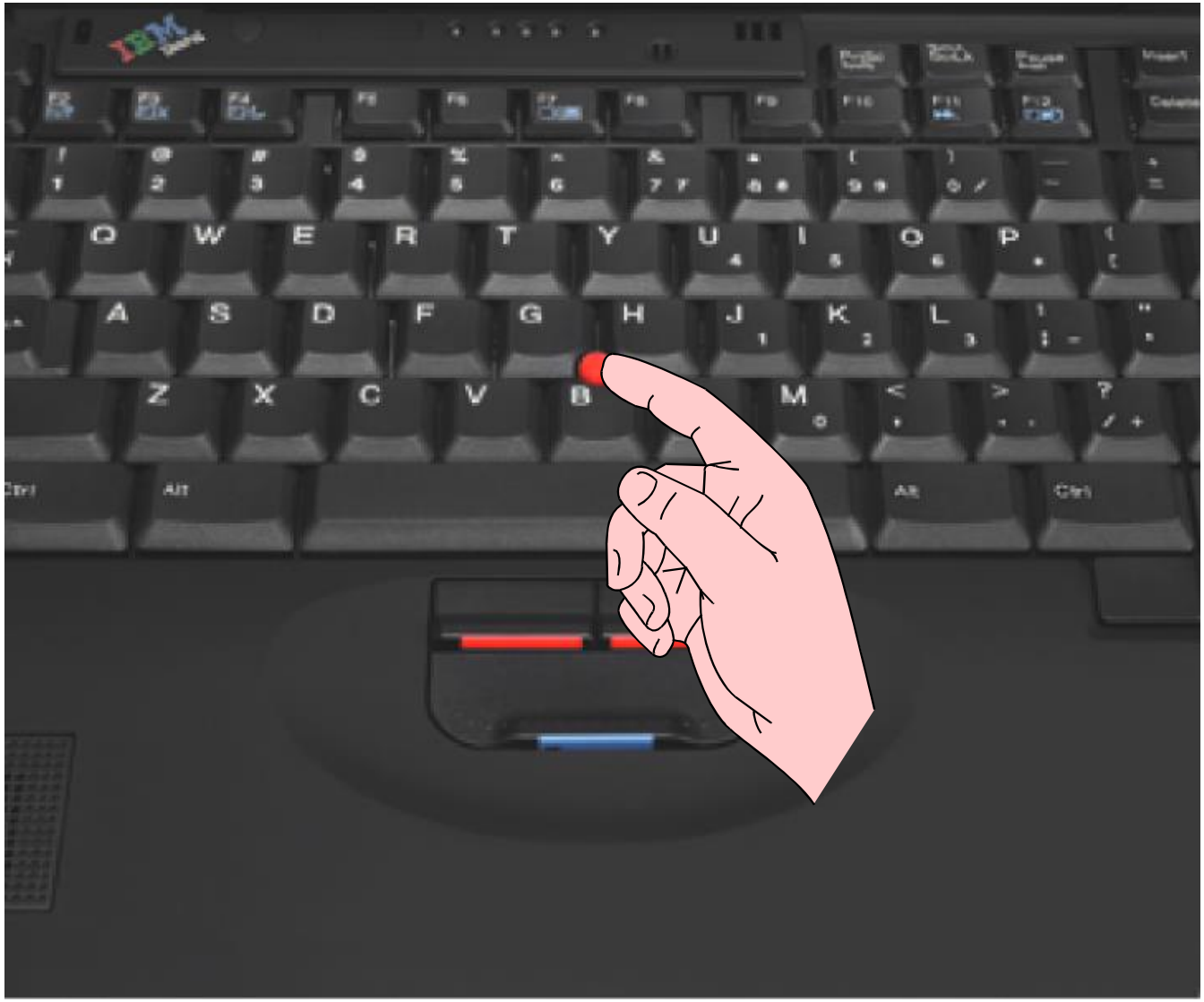
Introduction to Computing

Mouse-Integrated Pointing Stick

- An **integrated pointing stick** is a small joystick built into the keyboard.
- To use an integrated pointing device, you move the **joystick**.
- These devices provide a set of buttons that **function** like mouse buttons.

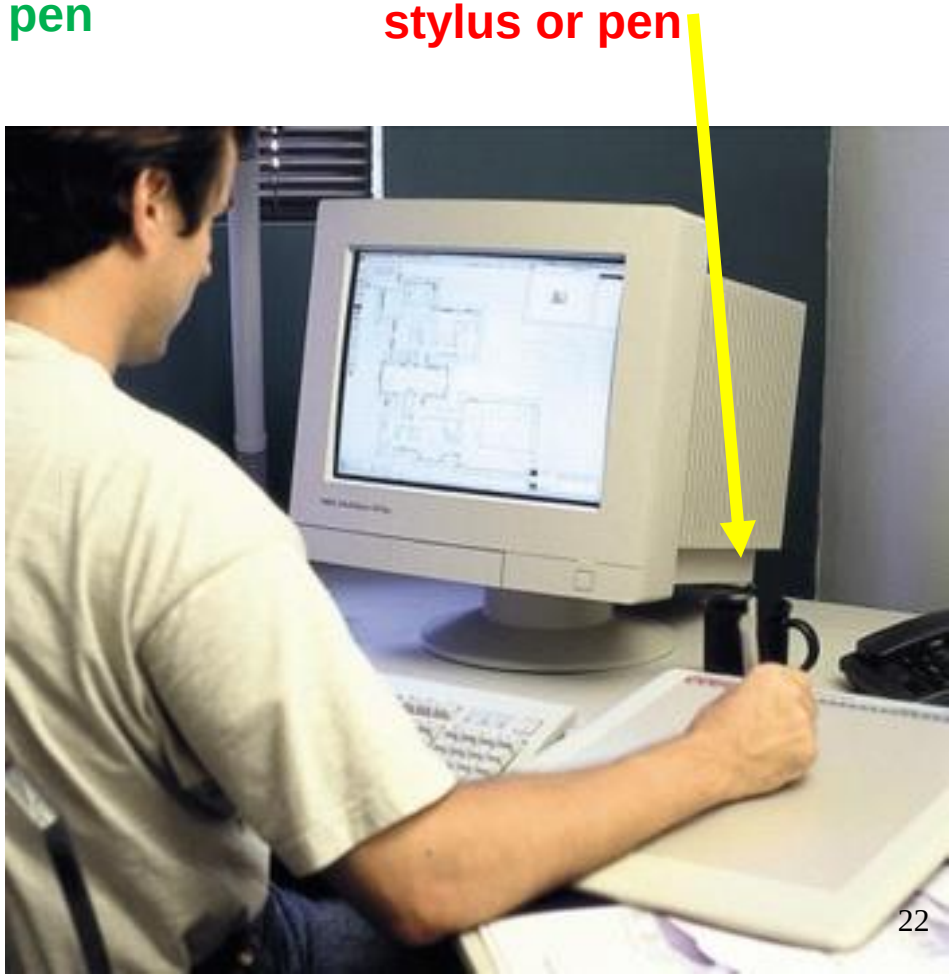

Q W E R T Y U I O P
A S D F G H J K L
Z X C V B M
Alt
Alt
Ctrl

Other Pointing Devices

What is a stylus?

- **Looks like a ballpoint pen, but uses pressure to write text and draw lines**
- **Originally called a pen or electronic pen**

- Used in professional graphical applications
- A graphics tablet, also called a digitizer or digitizing tablet, is a flat rectangular, electronic plastic board used with a stylus



The user can point, tap, draw and write on the computer's screen with a pen.

Touch Screens

- **Touch-screen systems** accept input directly through the **monitor**.

- Touch screens use **sensors** to detect the touch of a finger. They are useful where environmental conditions prohibit the use of a keyboard or mouse.

- Touch-screen systems are **useful** for selecting options from menus.


touch screen on desktop computer
touch screen on smart phone
Why wait?
CHECK IN
Touch screen

Game Controllers

- **Video games and computer games** use a game controller as the input device.

- The primary types of **game controllers** are **joysticks**.

- Other popular types of game controllers are:
  - Gamepads
  - Light guns
  - Dance pads
  - Motion-sensing controllers

JOYSTICK

joystick

wheel

pedal

Other Game Controllers

BAR CODE READERS (Optical Input Devices)

- **Bar code readers** can read bar codes—patterns of printed bars.

- The **reader emit light**, which reflects off the bar code and into a detector in the reader. The detector translates the code into numbers.

- **Flatbed bar code readers** are commonly found in supermarkets.

Bar code readers commonly track sales in retail stores

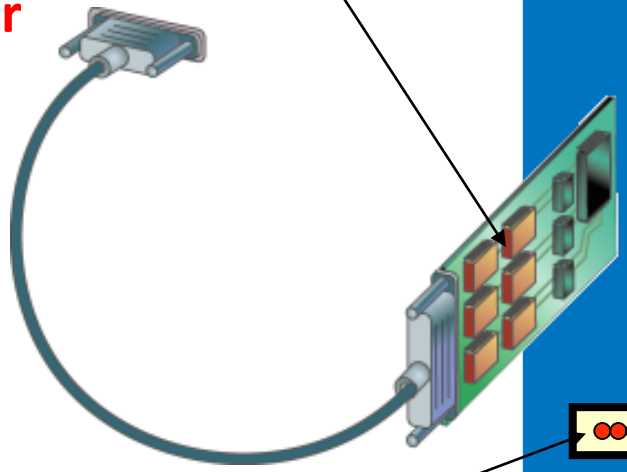
Image Scanners

- **Image scanners** digitize printed images for storage and manipulation in a computer.
- A scanner **shines light** onto the image and interprets the reflection.
- **Optical character recognition (OCR)** software translates scanned text into editable electronic documents.

Document being scanned

Converts diode signals to numbers

To computer



Light source, lens and diode array

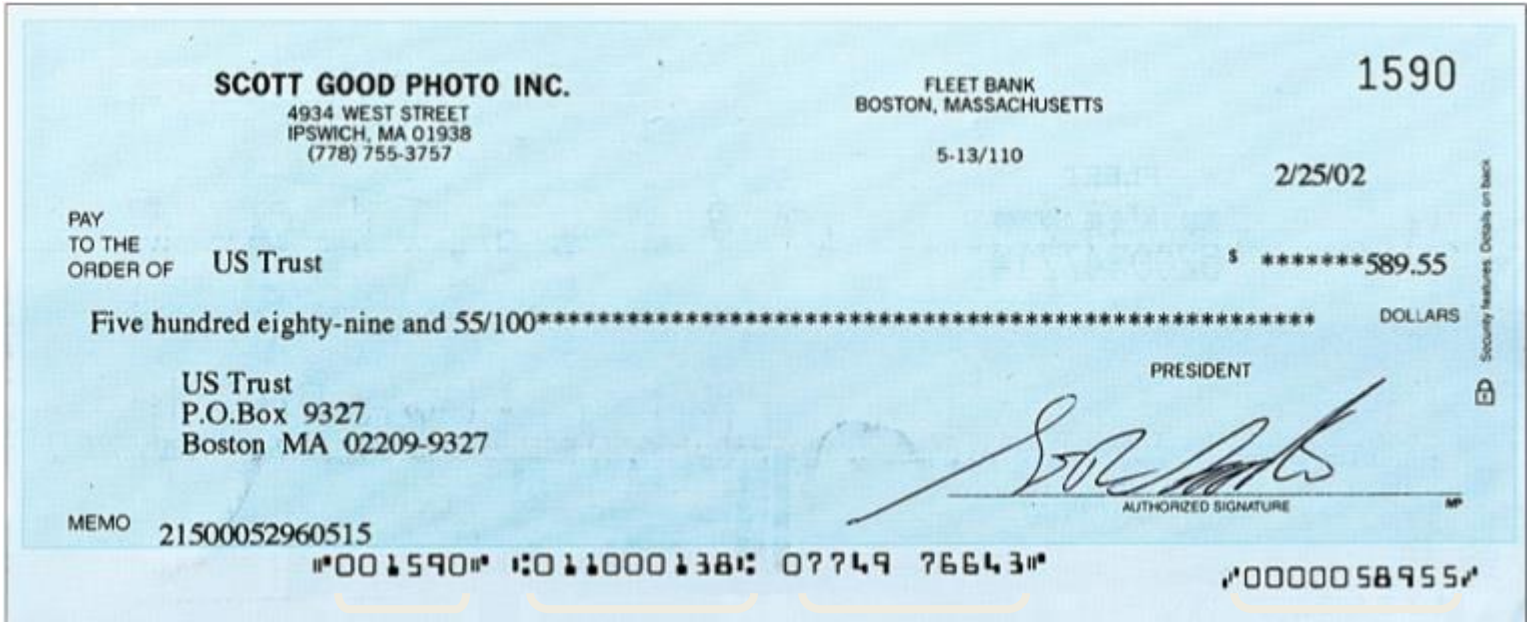
Scanners and Reading Devices

- What are various types of scanners?

Scanners and Reading Devices

What is **a magnetic Ink character recognition reader** (MICR)?

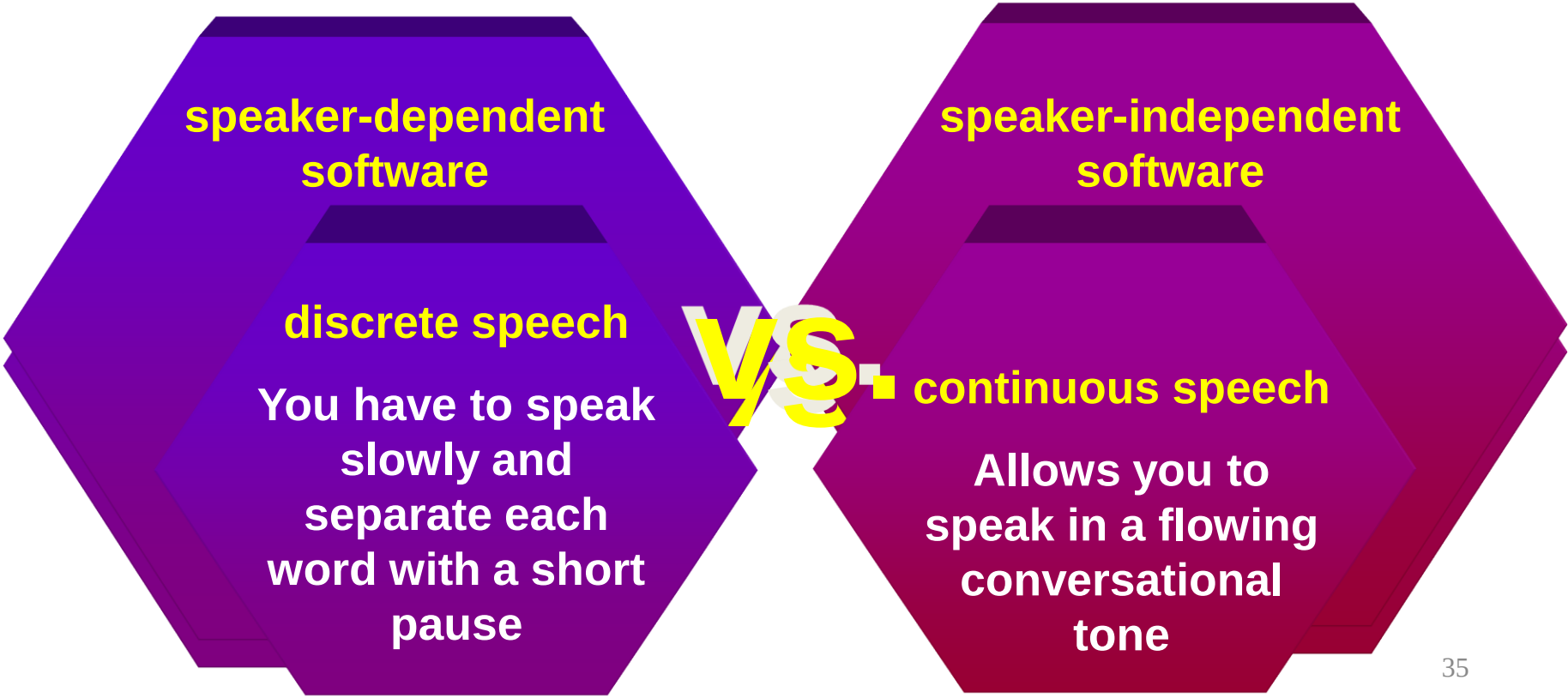
- Can read text printed with magnetized ink
- The banking industry almost exclusively uses MICR for check processing



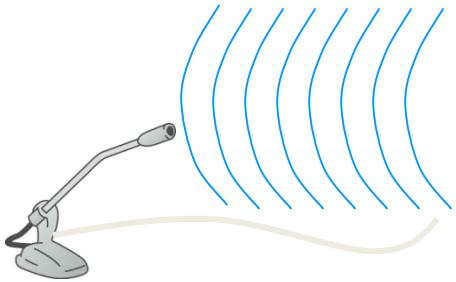
Voice Input

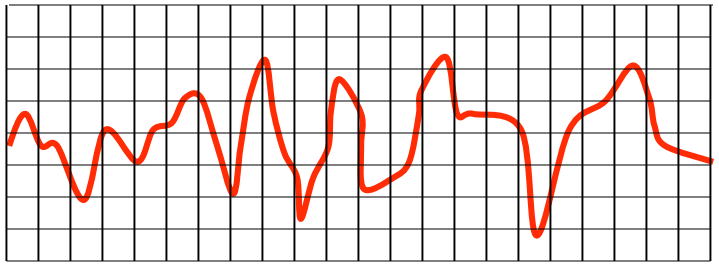
What is voice input?

- The process of entering data by speaking into a microphone that is attached to the sound card on the computer
- Voice recognition, also called speech recognition, is the computer's capability of distinguishing spoken words



Analog Sound Signals





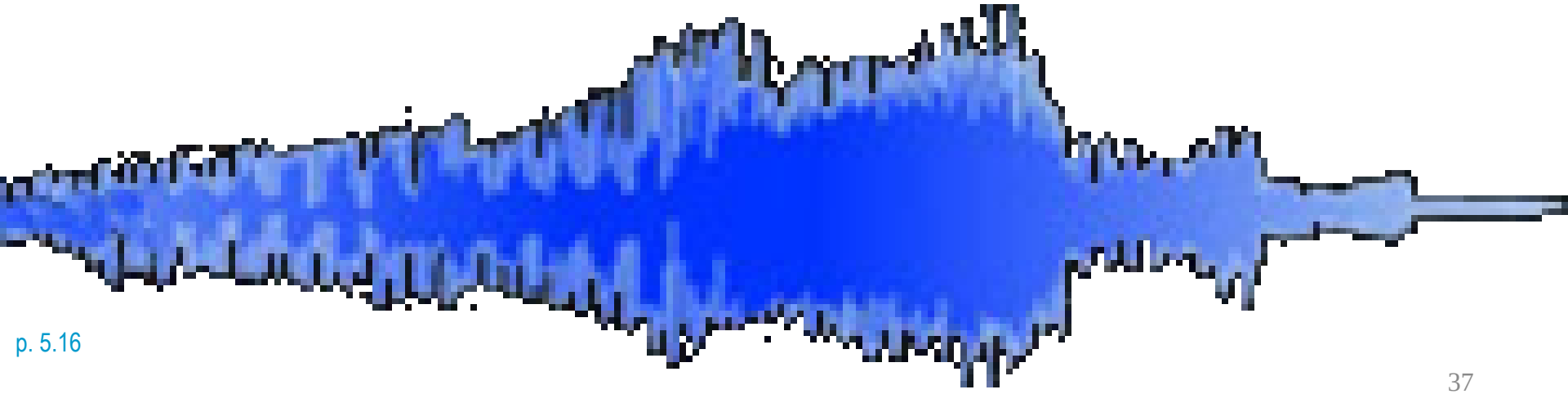
Digital Audio Output [electrical signals] (ex. 11100011) to computer

Analog Signals are Digitized

Voice Input

What is audio input?

- The process of entering any sound into the computer such a s speech, music, and sound effects
- Requires a sound card
- Input sound via a device such as a microphone, each of which plugs into a port on sound card.
- Windows stores audio files as waveforms
  - Called WAV files with a .wav extension



p. 5.16

Microphones & Speech Recognition

- **Microphones** can accept auditory input. A microphone requires a **sound card** in the PC.

- A sound card can **digitize analog sound signals**, and convert digital sound signals to analog form.

- With **speech recognition software**, you can use your microphone to dictate text, navigate programs, and choose commands.

Video Input

What is video input?

- The process of entering a full-motion recoding into a computer and storing it on a storage medium

Video Input

What is a PC video camera?

- A camera that allows the home user to record, edit, and capture video and still images and to make video telephone calls on the Internet
- Also called a PC camera

Video Input

What is a Web cam?

- A video camera whose output displays on a Web page.


video camera
connected to
computer's USB
or FireWire port
My Birthday
SONY
video is displayed on
computer screen

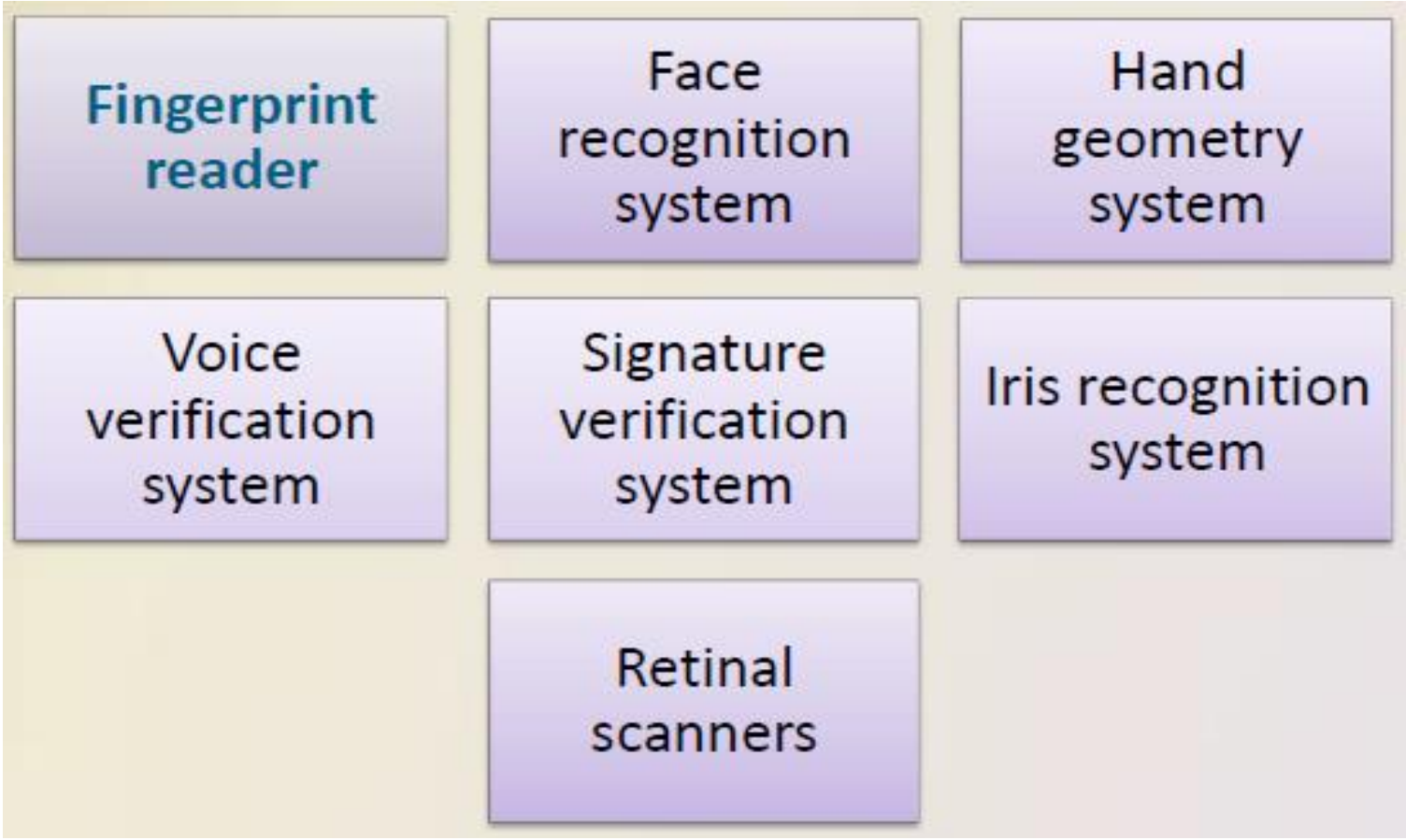
Video Input

What is videoconferencing?

- A meeting between two or more geographically separated people who use a network on the Internet to transmit audio an video data

Biometric Input

- A **biometrics** **authenticate** a **person's identity** by verifying a personal characteristics.



fingerprint reader

hand geometry system

iris recognition system

Click to view Web Link, click Chapter 5, Click Web Link from left navigation, then click Biometric Input below Chapter 5

OUTPUT UNIT

What is Output?

- Any ***hardware component*** used to show results after processing to any user. Output can be text, Audio, Video & graphics.

- **Examples**

✓ Display device
  - Monitor
  - Printer
  - Plotter
- Projectors
- Speakers
- Headphone etc

Display Devices

A display device is simply an output device that visually conveys text, graphics & video information.

Information on a display device, sometimes
called soft copy exists for a temporary period only.

Display devices include:

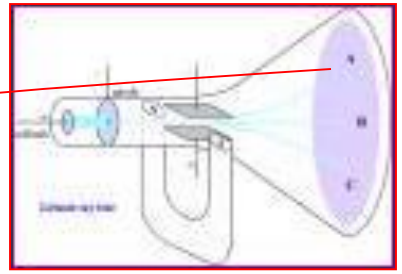
- ✓ CRT Monitors
- ✓ LCD Monitors
- ✓ Gas Plasma Monitors
- ✓ Televisions

Monitors

CRT Monitors

- ✓ Similar to standard Television because it contains the CRT (Cathode Ray Tube)

- ✓ CRT is a large, sealed, glass tube
- ✓ The front of the tube is screen
- ✓ Tiny dots of phosphorus material coat the screen
- ✓ Each dot consists of red, green & blue phosphorus.
- ✓ Inside CRT, an electronic beam moves back & forth across the back site of the screen which causes the dots on the front of the screen to glow Three dots combine to make up one pixel



- ✓ The size of CRT monitors can be 14, 15, 17, 19, 21 and 22 plus more inches which is measured diagonally.

- ✓ The actual viewable area is however, less than the diagonal size. For example, a 21 inches monitor will have 19.8 inches viewable area

LCD Monitors

- ✓ LCD Monitors use Liquid Crystal
- ✓ LCD contains liquid crystals between two sheets of material
- ✓ When an electric current passes through the crystals, they twist which causes the image to be displayed on the screen
- ✓ LCD Monitors are the type of the **flat-panel displays**

- ✓ Flat Panel displays have less weight, compact screen & consume less than one third the power consumed by CRT monitors
- ✓ The size ranges from 15, 17, 18, 20 and 21 plus more inches
- ✓ LCD Monitors typically are more expensive than CRT Monitors
- ✓ Desktop, Notebook & Handheld computers often use LCD displays

LCD or TFT:

Active Matrix or Thin Film Transistor (TFT) Display: Higher refresh rate & contrast

Gas Plasma Monitors

- ✓ Gas Plasma Monitors are Flat-Panel screens instead only they use gas plasma technology, which substitutes a layer of gas for the liquid crystal material in an LCD monitor
- ✓ When voltage is applied, the gas released UV light.
- ✓ The UV light causes the pixels on the screen to glow
- ✓ The Gas Plasma Monitors can be more than 42” wide.

- ✓ **Refresh Rate:** Phosphorus on the CRT Monitors must be refreshed 50 to 100 times after every second (Hz).
- ✓ Faster refresh rate causes fewer flicker on screen
- ✓ **Monitor Resolution:** Depends upon the number of bits to be used to display each pixel:
  - ❑ **2^8 bits = 256 colors**
  - ❑ **2^{16} bits = 65536 colors**
  - ❑ **2^{24} to 2^{32} bits = 16 million to 4 billion colors**

Printers

A printer is an output device that produces text and graphics on a physical medium such as paper or transparency film.

Printed information is called hard copy. And is more permanent than a soft copy.

There are two types of printers:

1. Impact Printers
2. Non-Impact Printers

Impact Printers

- An impact printer forms characters and graphics on a piece of paper by striking a mechanism against an inked ribbon that physically contacts the paper.
- Impact printers are noisy because of this striking activity.
- Impact printers normally do not provide Letter Quality (LQ) printing. They are ideal to print multipart forms because they easily can print through many layers of papers.

Printers

Two commonly used types of impact printers are:

a. Dot Matrix Printers
b. Line Printers

Dot Matrix Printers

Dot Matrix Printer produces the printed images when tiny wire pins on a print Head mechanism strike an inked ribbon.

When ribbon passes against the paper, it creates dots that form characters and graphics.

The speed of dot matrix is measured in characters per second (cps).
The print head can contain 9 to 24 pins. A high number of pins means the printer prints more dots per character, which results in higher print quality.

Printers (Dot Matrix Printers)

Most dot matrix printers use continuous-form paper, in which each sheet of paper is connected together. The pages have holes along the sides to help feed the paper.

The speed is measured by number of characters per second (CPS). It ranges from 300 to 1100 CPS

Factories & retail counters use impact printers because these printers can withstand dusty environment, vibrations & extreme temperatures.

9-pin dot matrix printer in action

Printers (Line Printers)

Line Printers

• A line printer is a high speed impact printer that prints an entire line a time.

• The speed is measured by number of lines it can print. (LPM). These printers are capable to print 3000 LPM.

•A line printer is often connected with a midrange mainframe, server or network.

•Line printers are bigger in size & are more expensive than dot matrix printers.

2-Non-impact Printer

•A non-impact printer forms characters & graphics on a piece of paper without actually striking the paper.

• Some spray ink, while others use heat & pressure to create images.

Because, these printers do not strike the paper, they are much quieter than impact printers.

The commonly used types of the non-impact printers are:

- ✓ Ink-jet printers
- ✓ Laser Printers

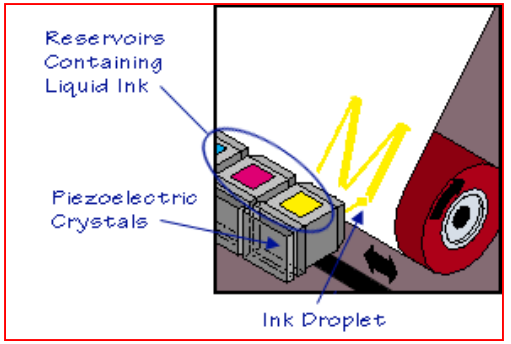
Ink-Jet Printers

Ink Jet Printers create characters & graphics by spraying tiny drops of liquid ink onto a piece of paper.

•Ink Jet Printers usually use individual sheets of paper stored in removable or stationary tray.

• These printers can print both black & white & color prints on a variety of paper types. e.g., plain papers, photo paper, glossy paper and banner paper.

• Most Ink Jet Printers have the resolution ranges from 300 to 2400 dpi & speed 3 to 20 p p m.



Higher the dpi, better the quality of the image

Ink Jet Printers have become most popular type of the color printers especially in homes because of their lower cost & better quality printing

Laser Printers

Laser Printers use a laser to mark the parts of the page where the text & image is to formed. The paper is passed through a toner solution where the mark areas pick up the toner & the text becomes visible.

Laser Printers usually use individual sheets of paper stored in removable or stationary tray. Some laser printers have trays that can accommodate different sizes of papers.

These Printers can print both black, white & gray and color prints. However, color laser printers are expensive.

Most Laser Printers have the resolution ranges from 600 to 2400 dpi & speed 6 to 40 ppm.

Their print quality is higher.

HP Laser Jet 2100

HP Color Laser Jet 4550

Plotters

- Plotters are used to produce **high-quality drawings**.

Display Devices

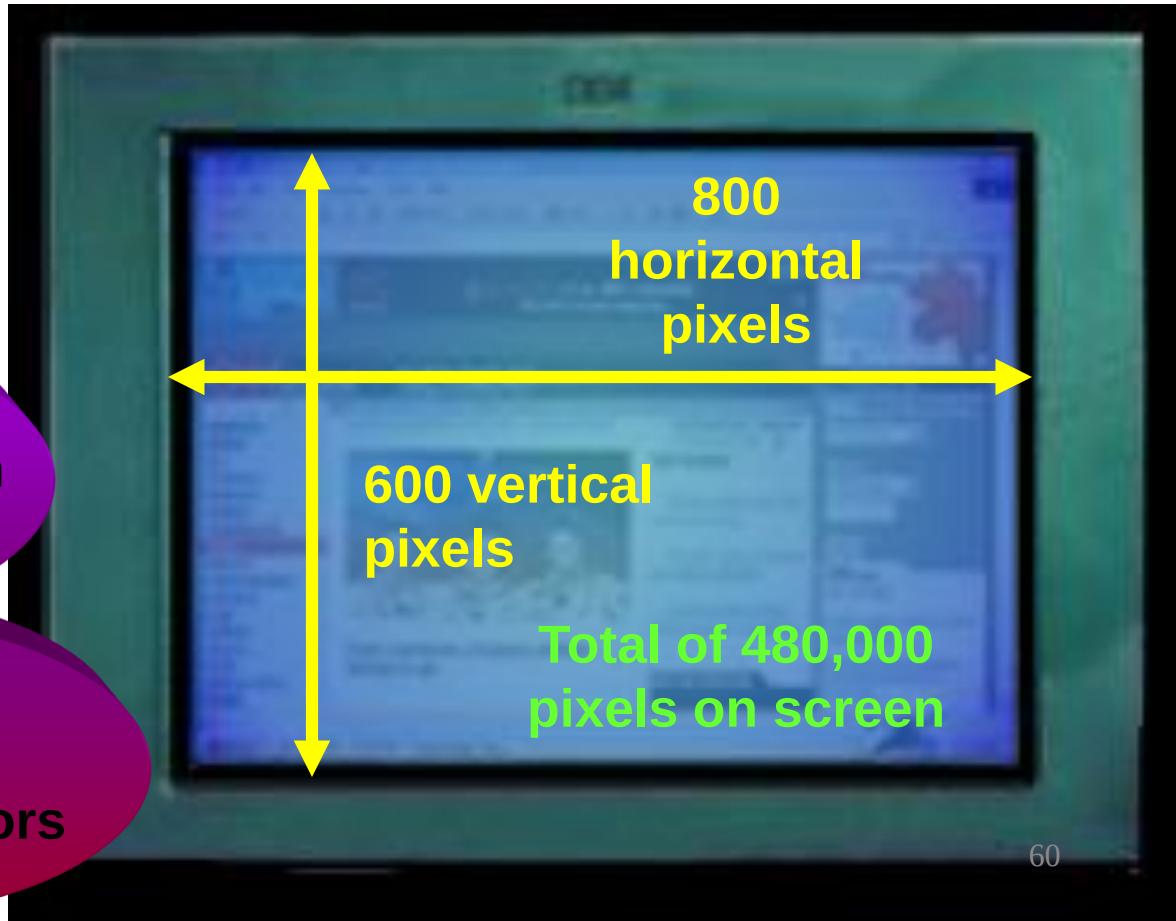
What is display resolution?

- Describes the sharpness and clearness of an image
- Resolution of a display device stated as dots, or pixels

800 x 600 typically the standard

1280 x 1024 maximum resolution of most monitors

2048 x 1536 maximum for high-end monitors



Other Output Devices

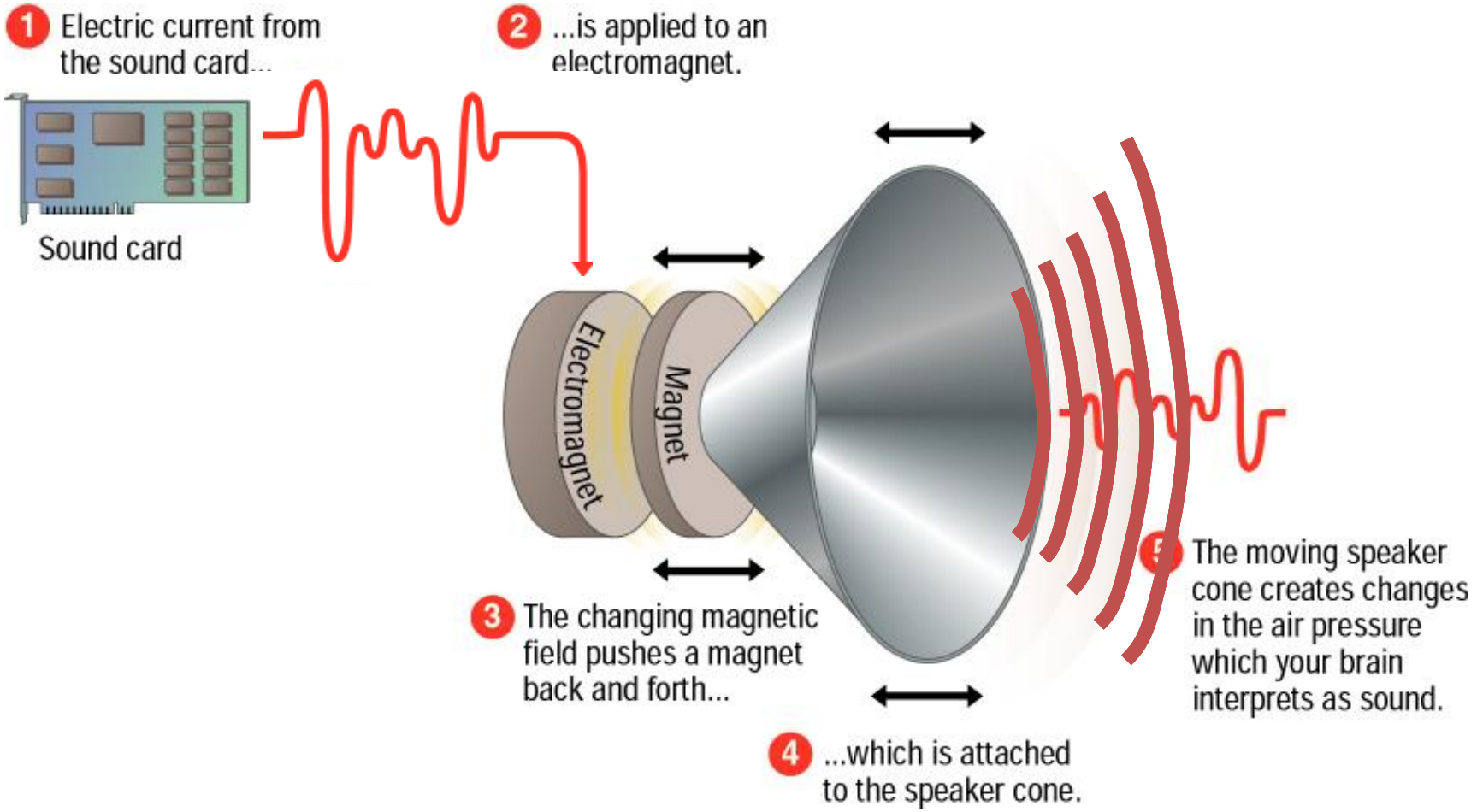
What is a data projector?

- A device that takes the image from a computer screen and projects it onto a larger screen so an audience of people can see the image clearly.

SOUND SYSTEMS

- **Multimedia PCs** come with a sound card, **speakers**, and a CD-ROM or DVD drive.

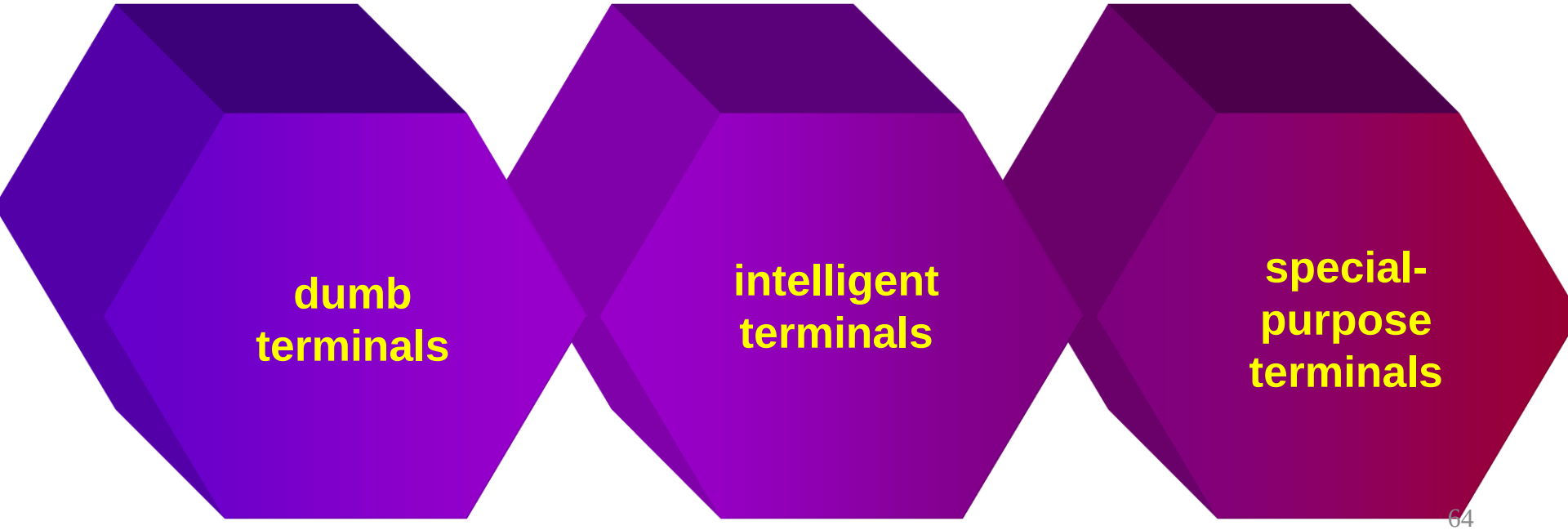
- A **sound card** translates digital signals into analog ones that drive the speakers.


1 Electric current from the sound card...
Sound card
2 ...is applied to an electromagnet.
Electromagnet
Magnet
3 The changing magnetic field pushes a magnet back and forth...
4 ...which is attached to the speaker cone.
5 The moving speaker cone creates changes in the air pressure which your brain interprets as sound.

Terminals

What is a terminal?

- A device that performs both input and output because it consists of a monitor (output), a keyboard (input), and a video card
- Three basic categories



Terminals

What is a dumb terminal?

- Has no processing power so it cannot function as an independent device.

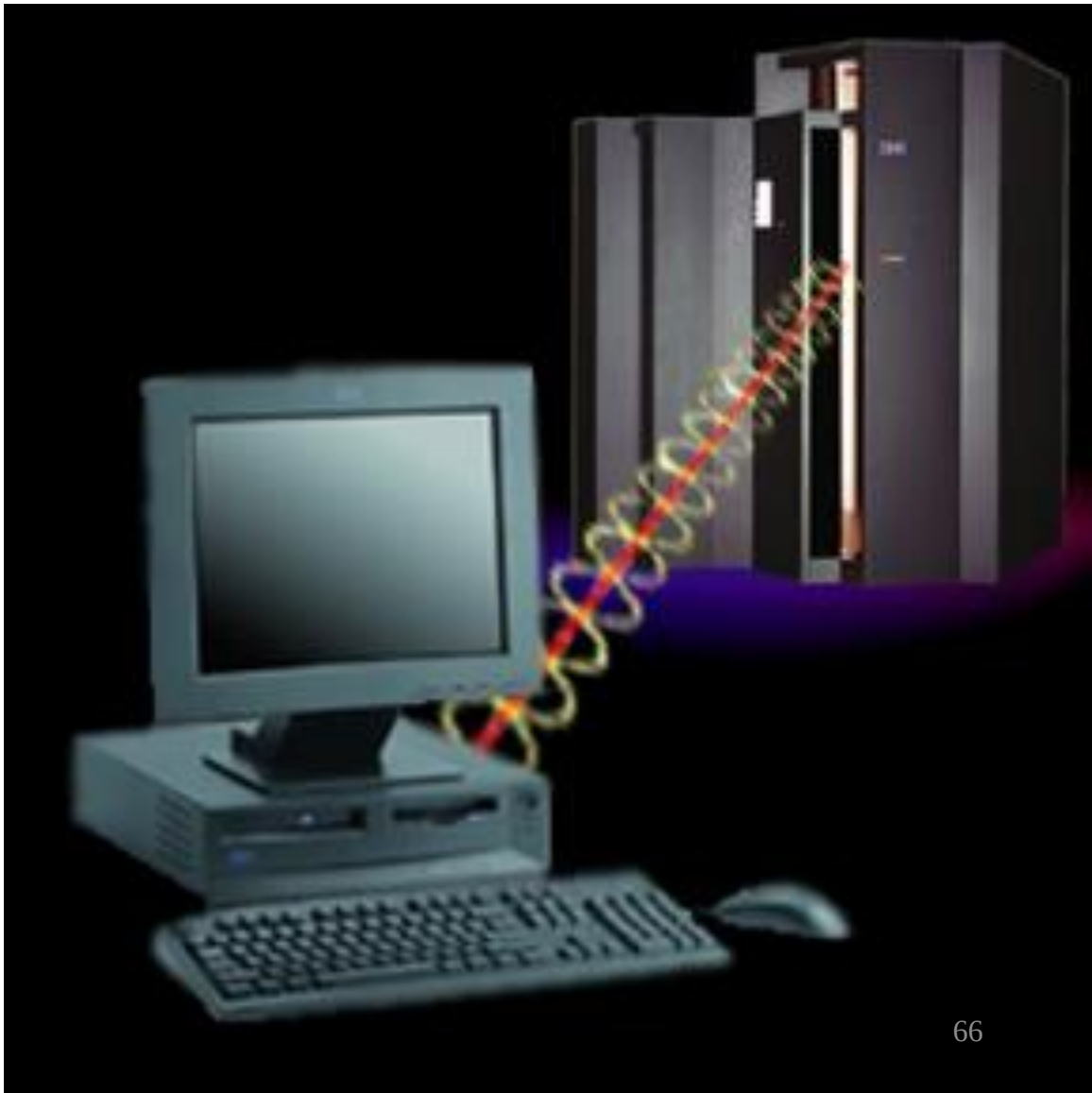
- **Can enter and transmit data to, or receive and display information from, a computer to which it is connected**

- **Connect to a host computer that performs the processing and then sends the output back to the dumb terminal**

Terminals

What is an intelligent terminal?

- Has memory and a processor that has the capability of performing some functions independent of the host computer
- Sometimes called programmable terminals because they can be programmed by the software developer to perform basic tasks



Terminals

What is a point-of-sale (POS) terminal?

- Records purchases at the point where the consumer purchases a product or a service

- Output from POS terminals serve as input to other computers to maintain sales records, update inventory, verify credit, and perform other activities associated with the sales transactions that are critical to running the business

Terminals

What is an automated teller machine (ATM)?

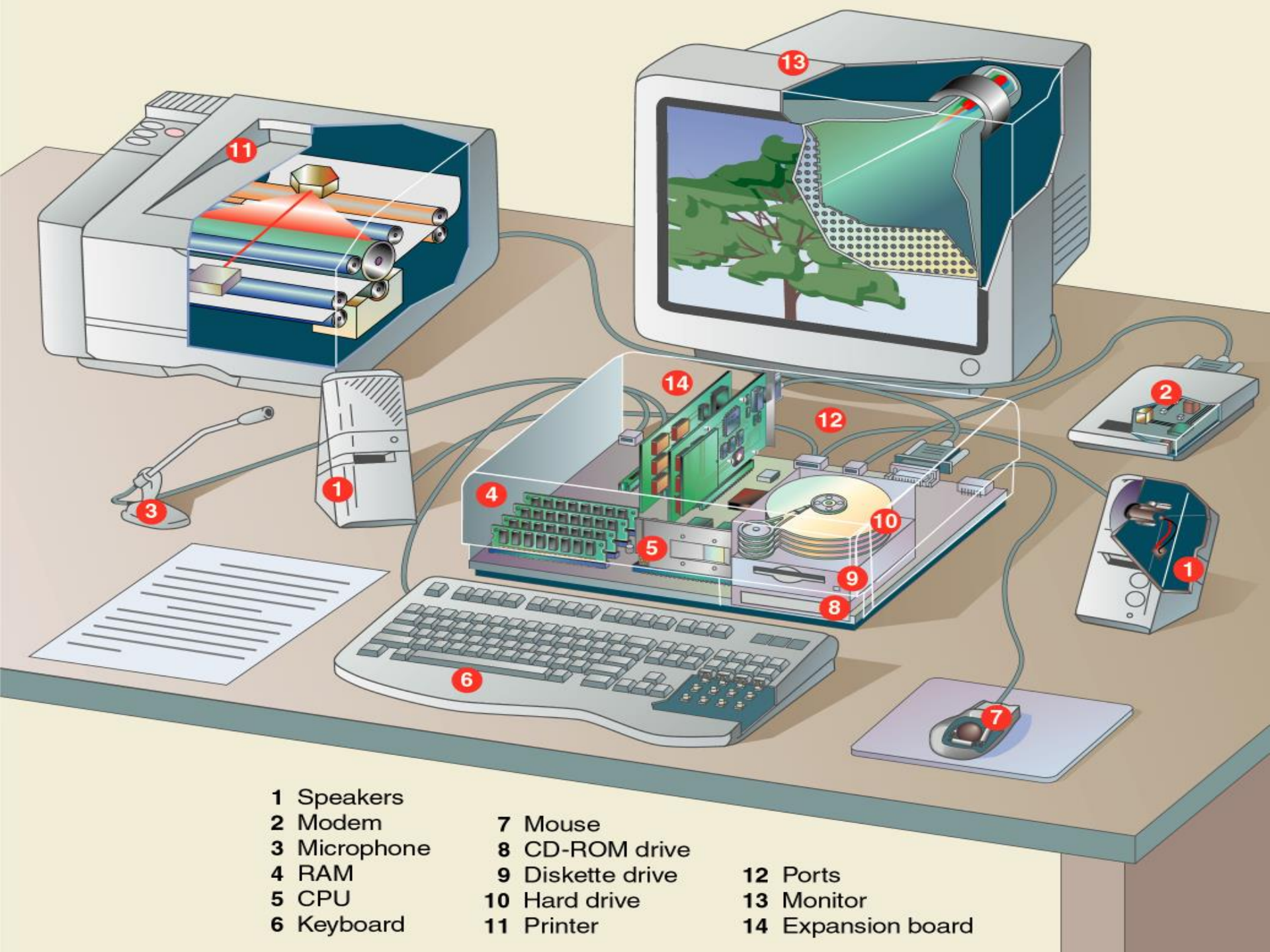
- A self-service banking machine that connects to a host computer through a network
- Insert a plastic bankcard with a magnetic strip into the ATM
- Enter your password, called a personal identification number (PIN), to access your bank account

MODEM

- The word **modem** is made by combining two words **Modulator** and **Demodulator**.
- **Mo** is first two letters of **Modulator** while **dem** is first three letters of **Demodulator**.
- **Microphone** is like a modulator, speaker is demodulator both found in **telephones**.
- **Modem** is used for both the purposes of input and output. Modulator and Demodulator both were found in **one package** called modem.

- **Network Interface Card** (they do both function of input and output)

- **Touch screen** (work for both input and output)


1 Speakers
2 Modem
3 Microphone
4 RAM
5 CPU
6 Keyboard
7 Mouse
8 CD-ROM drive
9 Diskette drive
10 Hard drive
11 Printer
12 Ports
13 Monitor
14 Expansion board