



DEPARTMENT OF INFORMATION TECHNOLOGY

FACULTY OF MANAGEMENT STUDIES AND COMMERCE

UNIVERSITY OF SRI JAYEWARDENEPURA

ITC 1370

Information Technology for Business

Chapter 02

Computer Hardware





Learning Objectives

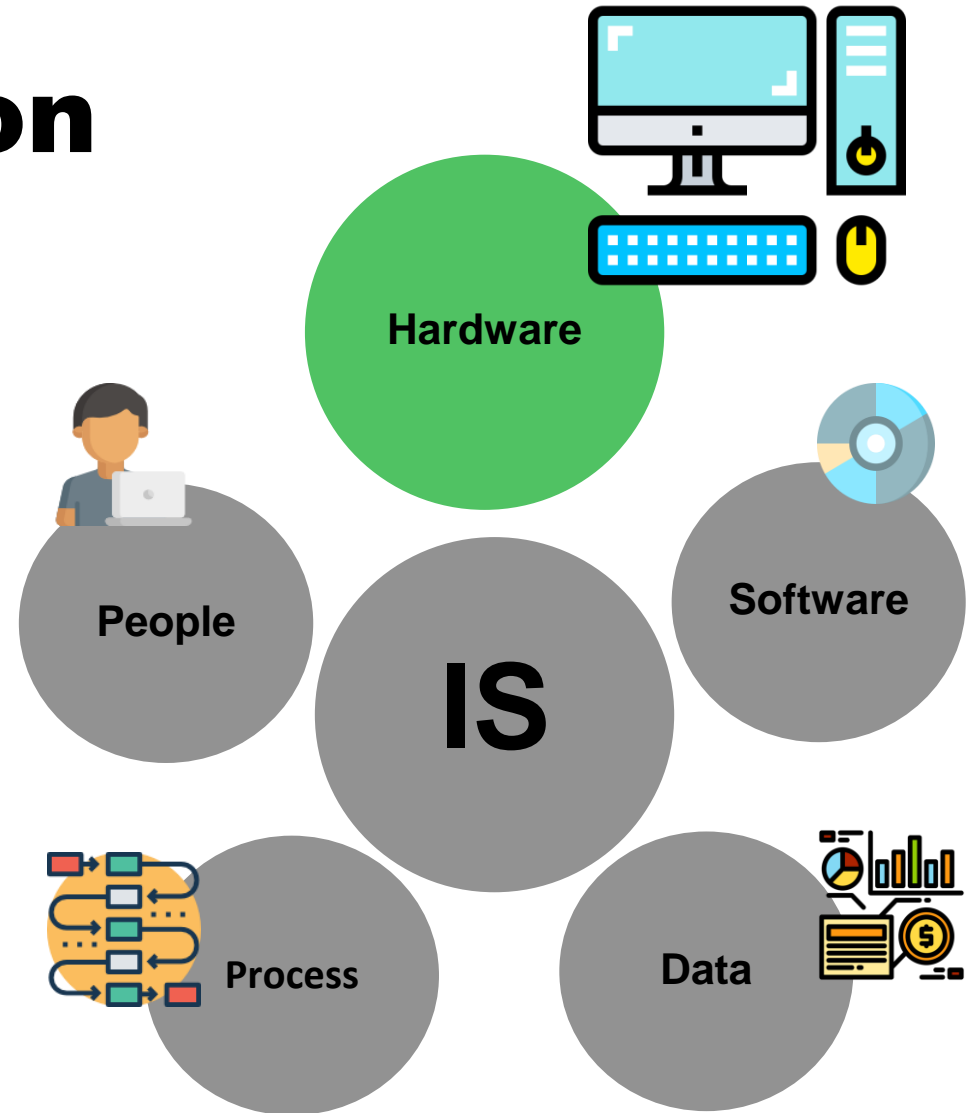
Upon successful completion of this chapter, you will be able to:

1. Identify computer system architecture - System Diagram
Input/Processing/Output/Storage and Networking hardware
2. Discuss trends in hardware
3. Identify how data represent in computer systems
4. Prepare specifications for personal computers

Hardware Introduction

An information system is made up of five components: **hardware, software, data, people, and process.**

The physical parts of computing devices – those that you can touch – are referred to as hardware.





What Is a Computer and What Does It Do?

- Computer

“A programmable, electronic device that accepts data, performs operations on that data, and stores the data or results as needed”

“A computer is a multipurpose multitask multi medium programmable electronic device and it can capture , process , store and share data and users can communicate and collaborate.”

Computers follow instructions, called programs, which determine the tasks the computer will perform

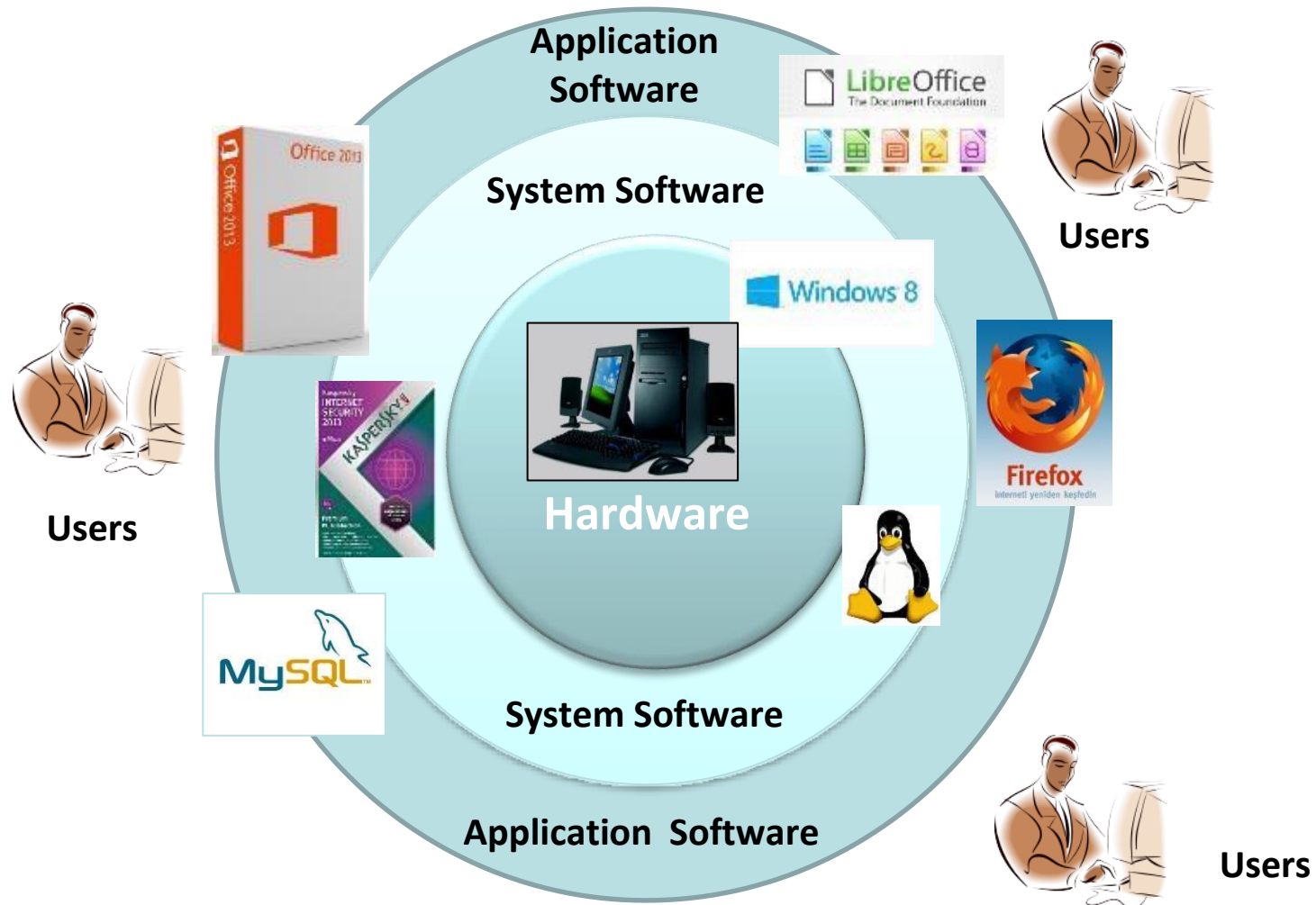
- Basic operations

- Input: Entering data into the computer
- Processing: Performing operations on the data
- Output: Presenting the results
- Storage: Saving data, programs, or output for future use
- Communications: Sending or receiving data

Recommended Video about computer systems:

<https://www.youtube.com/watch?v=Rv73ki6fTuo>

Computer System





Basic operations of a computer system

- Input: Entering data into the computer
- Processing: Performing operations on the data
- Output: Presenting the results
- Storage: Saving data, programs, or output for future use
- Communications: Sending or receiving data

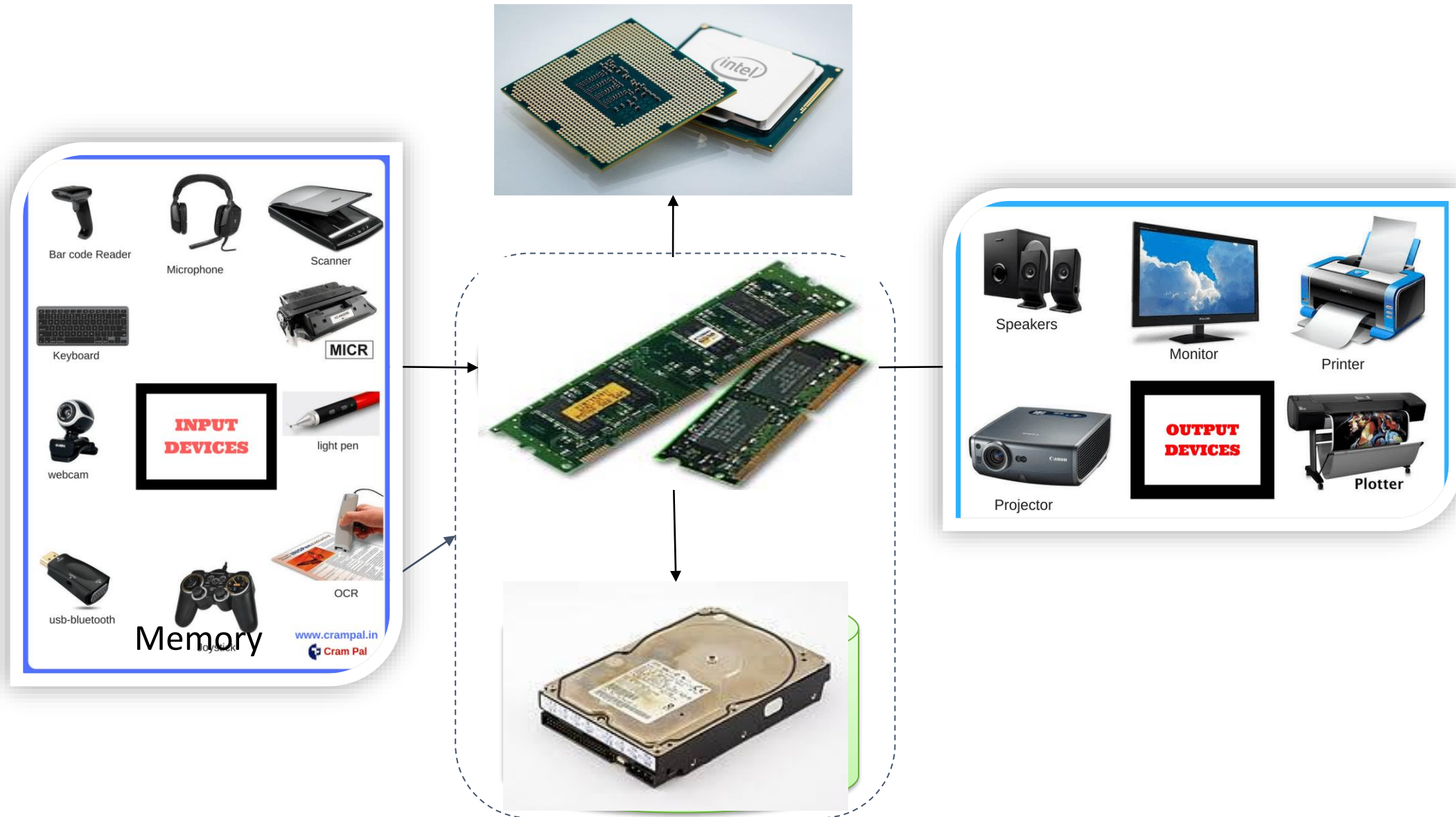
The Computer - Block Diagram



The Computer - Block Diagram



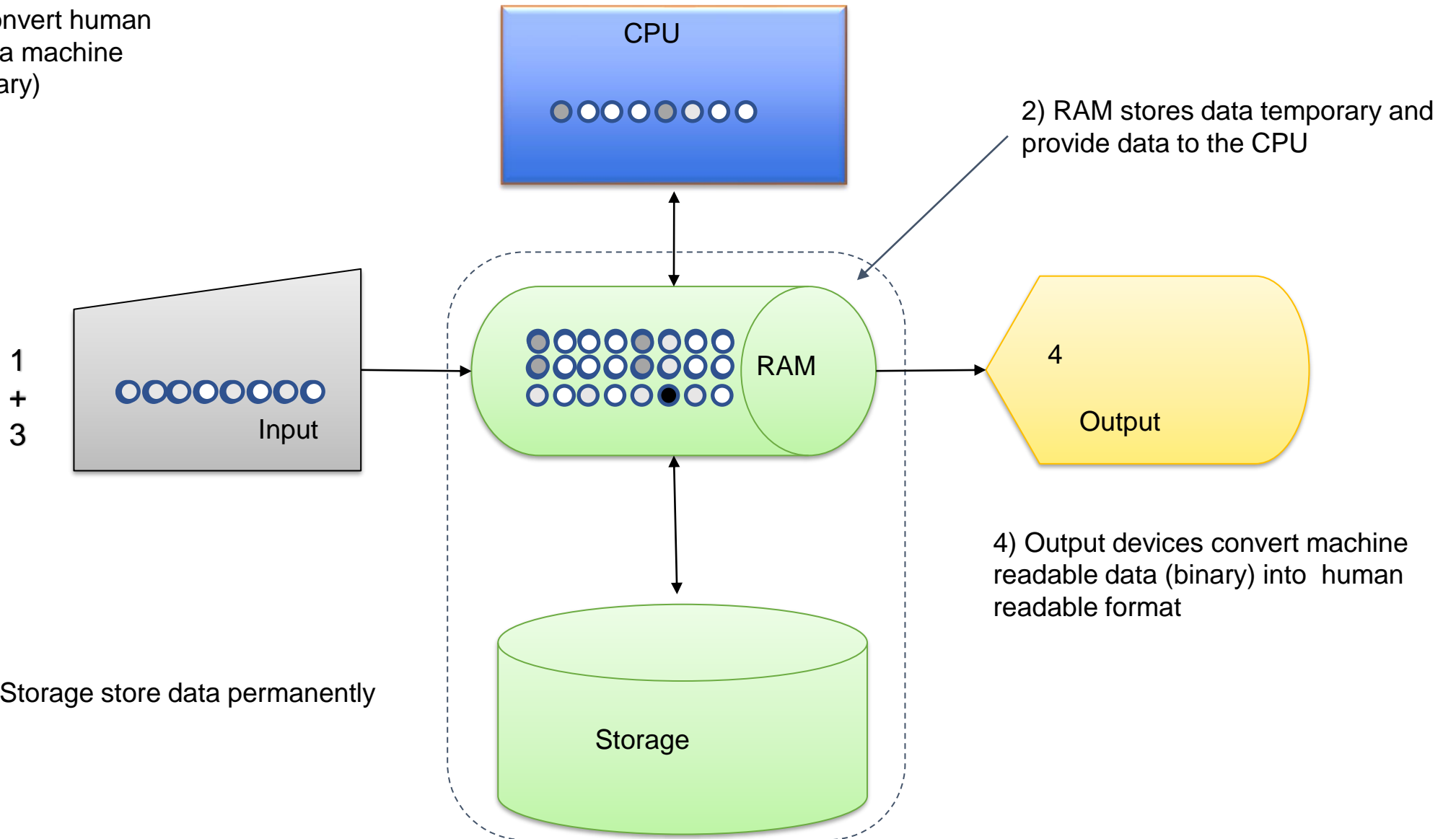
The Computer - Block Diagram



The Computer - Block Diagram

3) CPU process data and issue control commands


1) Input devices convert human readable data into a machine readable form (binary)



How Computer Works: Self study videos

1  **Introducing How Computers Work**
Code.org
https://www.youtube.com/watch?v=OAx_6-wdsIM&list=PLzdnOP11iJNcsRwJhvksEo1tJqjIqWbN-&index=1



2  **How Computers Work: What Makes a Computer, a Computer?**
Code.org
<https://www.youtube.com/watch?v=mCq8-xTH7JA&list=PLzdnOP11iJNcsRwJhvksEo1tJqjIqWbN-&index=2>



4  **How Computers Work: Circuits and Logic**
Code.org
<https://www.youtube.com/watch?v=USCBCmwMCDA&list=PLzdnOP11iJNcsRwJhvksEo1tJqjIqWbN-&index=3>



3  **How Computers Work: Binary & Data**
Code.org
<https://www.youtube.com/watch?v=ZoqMiFKspAA&list=PLzdnOP11iJNcsRwJhvksEo1tJqjIqWbN-&index=4>



5  **How Computers Work: CPU, Memory, Input & Output**
Code.org
<https://www.youtube.com/watch?v=DKGZlaPIVLY&list=PLzdnOP11iJNcsRwJhvksEo1tJqjIqWbN-&index=5>



6  **How Computers Work: Hardware and Software**
Code.org
<https://www.youtube.com/watch?v=xnyFYiK2rSY&list=PLzdnOP11iJNcsRwJhvksEo1tJqjIqWbN-&index=6>

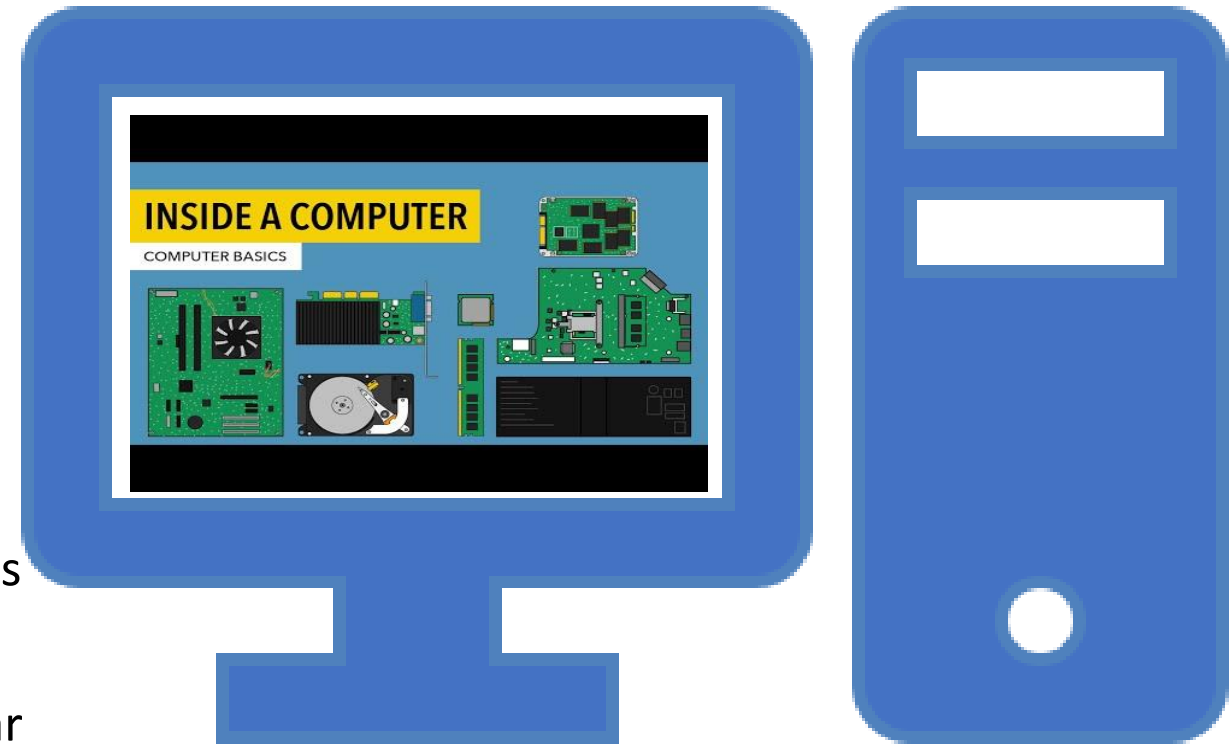
Types of Computers

1. Embedded computers
2. Mobile devices
3. Personal computers
4. Midrange servers
5. Mainframe computers
6. Supercomputers



System Unit

- **System Unit:** The main case of a computer
 - Houses the processing hardware of a computer
 - Also contains memory, the power supply, cooling fans, and interfaces to connect peripheral devices
 - Houses the drive bays in which storage devices (hard drives, DVD drives, etc.) are located
 - With a desktop PC, usually looks like a rectangular box



Recommended Video about inside a computer:

<https://www.youtube.com/watch?v=HB4I2CgkcCo>



The Motherboard

- **Motherboard or system board:** The main circuit board inside the system unit
 - All computer components must connect to the motherboard
 - External devices (monitors, keyboards, mice, printers) typically connect by plugging into a port exposed through the exterior of the system unit
- **Circuit board:** A thin board containing computer chips and other electronic components
- **Computer chip:** Very small pieces of silicon or other semi-conducting material onto which integrated circuits are embedded

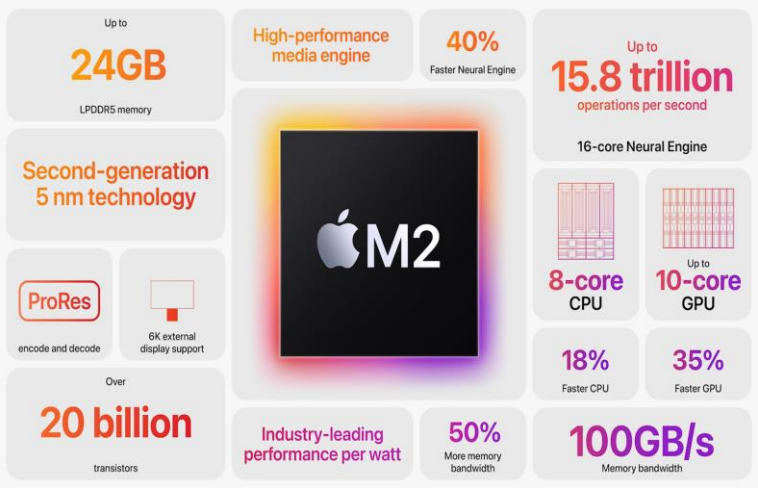
The CPU

- **Central Processing Unit (CPU):** circuitry and components packaged together and attached to the motherboard
 - Does most of the processing of a computer.
 - Also called a processor; called a microprocessor when talking about PCs.
 - Dual-core CPU: Contain the processing components (cores) of two separate processors on a single CPU.
 - Quad-core CPU: Contains 4 cores.
 - Different CPUs are typically designed for desktop PCs, portable PCs, or servers.
 - CPUs of Personal Computers are often made by Intel or AMD.



The CPU

Intel	AMD Ryzen (Advanced Micro Devices)
Very expensive	Cheaper than intel
Slower than AMD Ryzen	Very faster
The microprocessor with poor gaming performance.	The microprocessor with higher Gaming CPU
Versions of intel ➤ Intel i9, i7,i5,i3...etc. <div data-bbox="104 901 718 1219" data-label="Image"> </div>	Versions of AMD Ryzen ➤ AMD Ryzen 9,7,5... etc. <div data-bbox="945 875 1363 1292" data-label="Image"> </div>

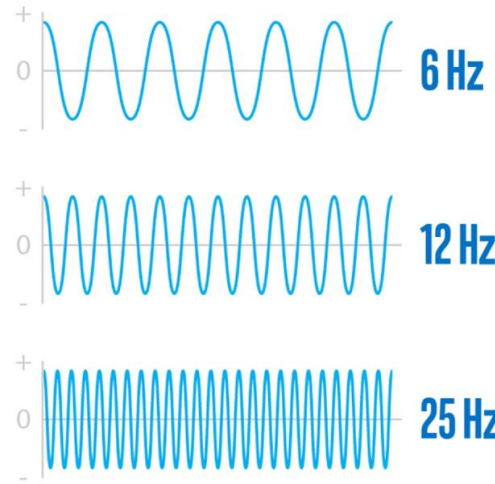


M2 Processor (Apple)



CPU - Factors to be considered

(1) Clock speed (Frequency)



Your CPU processes many instructions (low-level calculations like arithmetic) from different programs every second. The clock speed measures the number of cycles your CPU executes per second, measured in GHz (gigahertz).

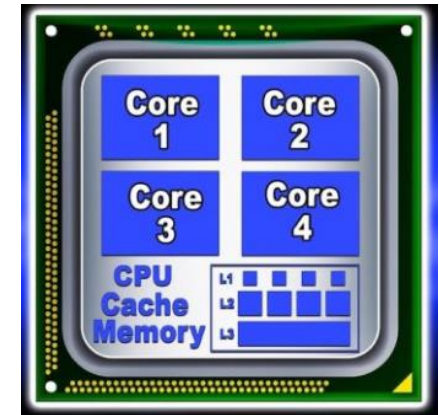
A “cycle” is technically a pulse synchronized by an internal oscillator, but for our purposes, they’re a basic unit that helps understand a CPU’s speed. During each cycle, billions of transistors within the processor open and close.

(2) Number of Cores

A multi-core processor is a computer processor on a single integrated circuit with two or more separate processing units, called cores, each of which reads and executes program instructions.

(3) Cache memory

The CPU internal memory and store copies of data and instructions from RAM. So basically what the CPU cache does, is that it holds common data that it thinks the CPU is going to access over and over again



Recommended Video about Processing Speed:

<https://www.youtube.com/watch?v=eS1rEJZKr4U>

The GPU

- **Graphics Processing Unit (GPU)** : The chip that does the processing needed to display images on the screen.
- can be located on the motherboard, inside the CPU, or on a video graphics board.
- In some cases, both the CPU and GPU are integrated into one CPU package
 - Ex : **APU** – *Accelerated Processing Units* is the integrated processor of AMD
- **System-on-a-chip (SoC)** : SoC is a processor that contains all the necessary capabilities for a single device.



FIGURE 2-10
A GPU.

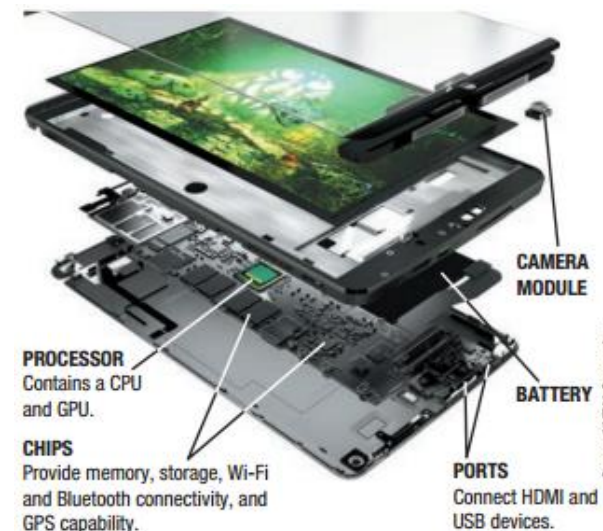


FIGURE 2-8
Inside a tablet system unit.

Buses

Bus: An electronic path within a computer over which data travels

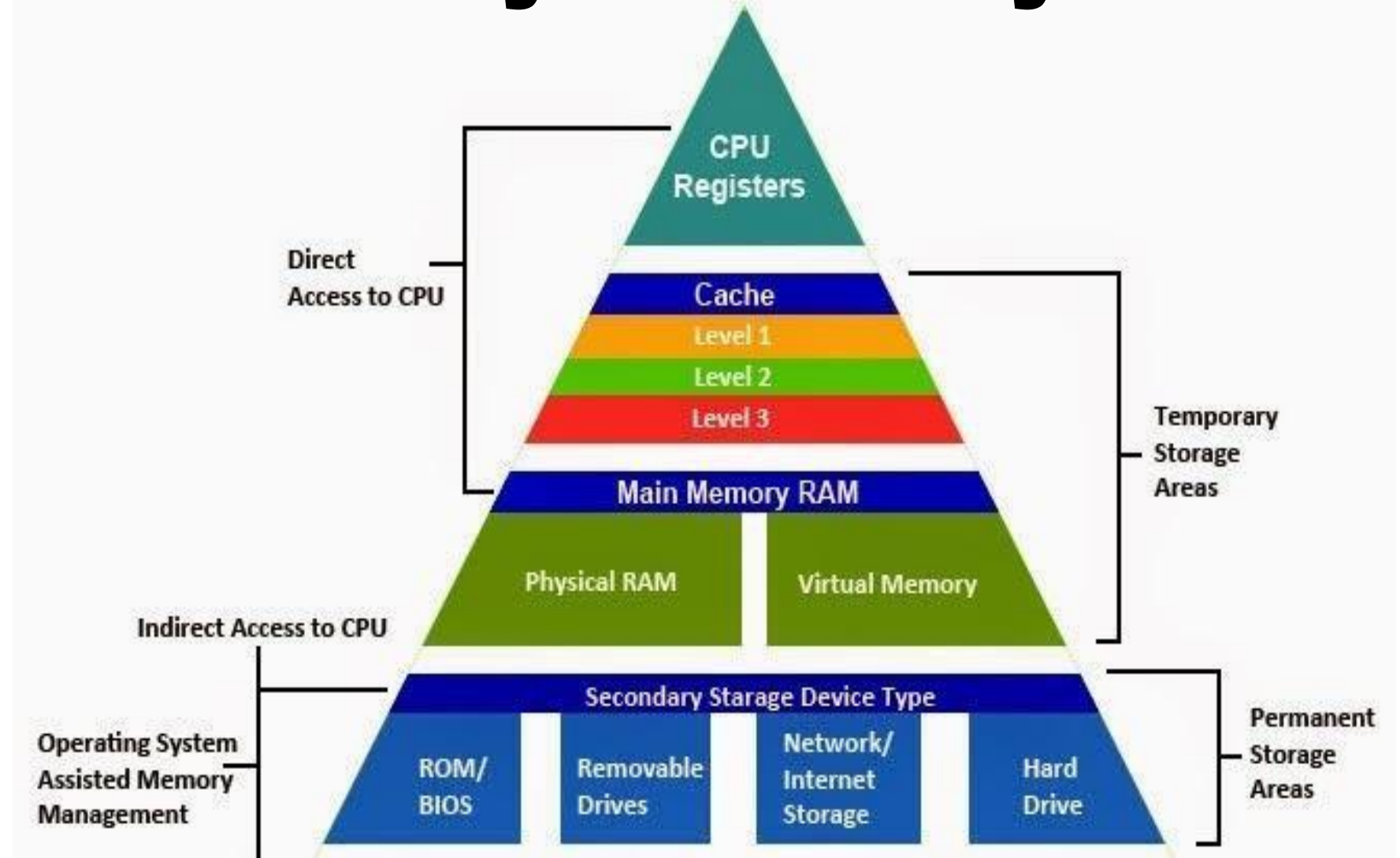
- **Bus width:** The number of wires in the bus over which data can travel
- Bus width and speed determine the throughput of the bus





Computer Memory

Computer memory hierarchy



Recommended Video about
Computer Memory Hierarchy:
<https://youtu.be/NQo7G34hzVQ>



Computer memory

- **RAM (random access memory):** Temporary memory that the computer uses
 - Consists of chips connected to a memory module which is connected to the motherboard
 - Holds data and program instructions while they are needed.
 - Adequate RAM is needed to run programs
 - Volatile: Contents of RAM is lost when the computer is shut off
 - Some forms of nonvolatile RAM are also available
 - **DDR4 (Double Data Rate Fourth Generation Random Access Memory) is the latest version of RAM**
 - DDR4 provides the lower operating voltage (1.2V) and higher transfer rate.



Computer memory

- **Registers:** High-speed memory built into the CPU; used by the CPU
- **Cache memory:** Special group of very fast memory chips located on or close to the CPU
 - More cache memory typically means faster processing
 - Usually, internal cache today
- **ROM (read-only memory):** Read-only chips located on the motherboard into which data or programs have been permanently stored
 - Retrieved by the computer when needed
 - Being replaced with flash memory
- **Flash memory:** Type of nonvolatile memory that can be erased and reprogrammed
 - Some flash memory chips are used by the PC
 - Flash memory chips are also used in flash memory storage₂₆ media (sticks, cards, and drives)

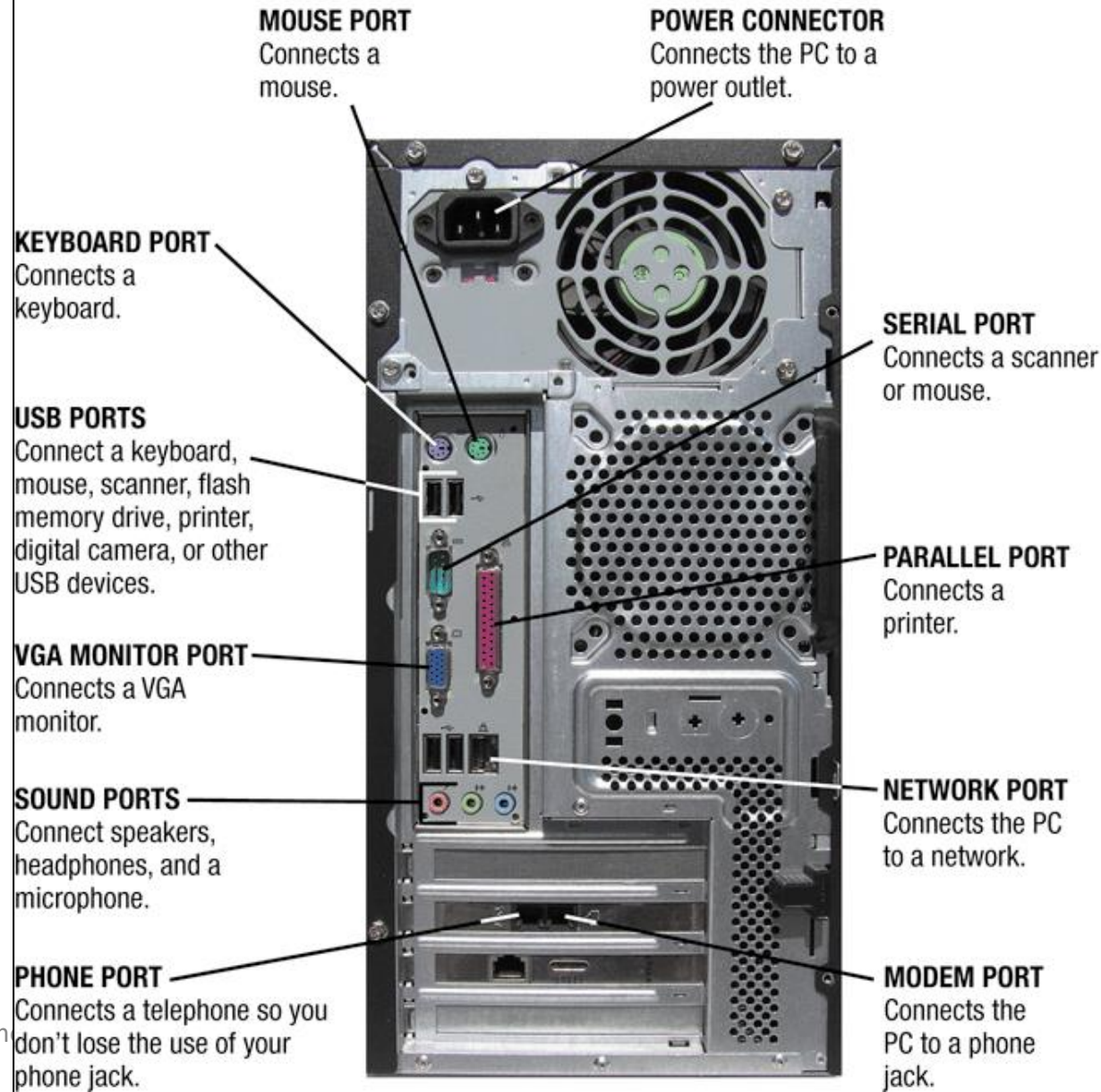


Ports and Connectors

Port: A connector on the exterior of a PC's system unit to which a device may be attached

- Serial
- Parallel
- **RJ45 (Network)**
- **Video Out (DP, HDMI, DVI VGA)**
- RJ11 Modem/Phone
- **USB (2.0, 3.x Type C)**
- eSATA
- **Audio (Mic in, Speaker Out etc and Audio Combo)**

Ports and Connectors



CONNECTORS



USB



FireWire



PS/2 (for mouse or keyboard)



Serial (DB-9)



Monitor (VGA)



Parallel



Telephone (for modem and telephone)



Network (RJ-45)

Ports and Connectors

- Notebook computers have ports similar to desktop PCs, but often not as many



FIGURE 2-20
✓ **Typical notebook ports.** The headphone, microphone, and modem ports are not shown here.



Storage/ Secondary Storage / Permanent Memory

Secondary Storage

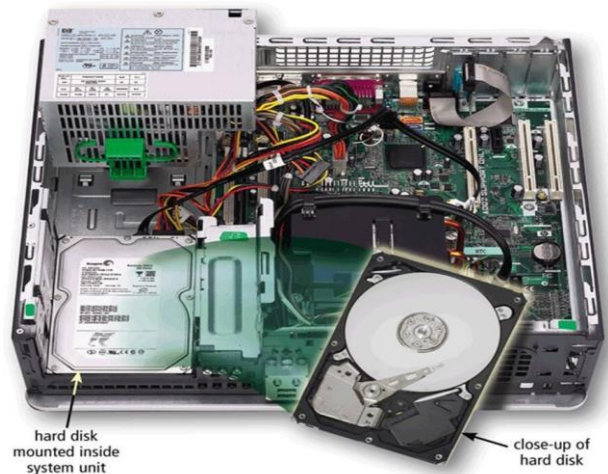


Storage System

- There are two parts of storage system: the **storage medium** and the **storage device**.
 - A **storage medium** is *the hardware where data is actually stored* (for example, a DVD or a flash memory card).
 - The *device that saves data onto the storage medium, or reads data from it*, is known as the **storage device**.
 - A storage medium is inserted into its corresponding storage device (such as a DVD drive or a flash memory card reader) in order to be read from or written to.

Can be

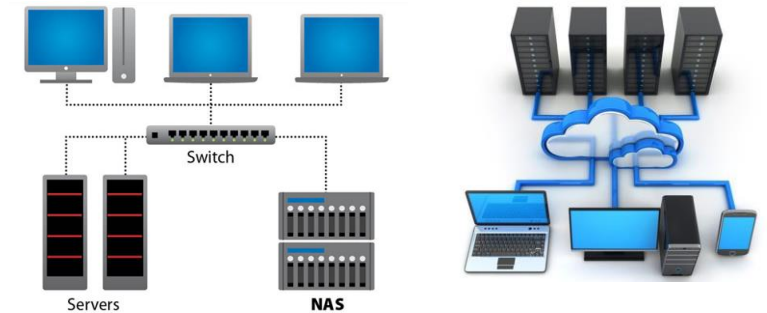
Internal



External



Remote





Internal Storage



Magnetic Hard Disk Drives (HDDs)

- Storage system consisting of one or more metal magnetic discs permanently sealed with an access mechanism inside its drive
 - Can be internal or external
 - Found in most computers
 - Also used in many consumer devices, such as DVRs, gaming consoles, etc.
- Read/write head doesn't touch the surface of the disc
 - Head crashes can occur
 - Backing up is important

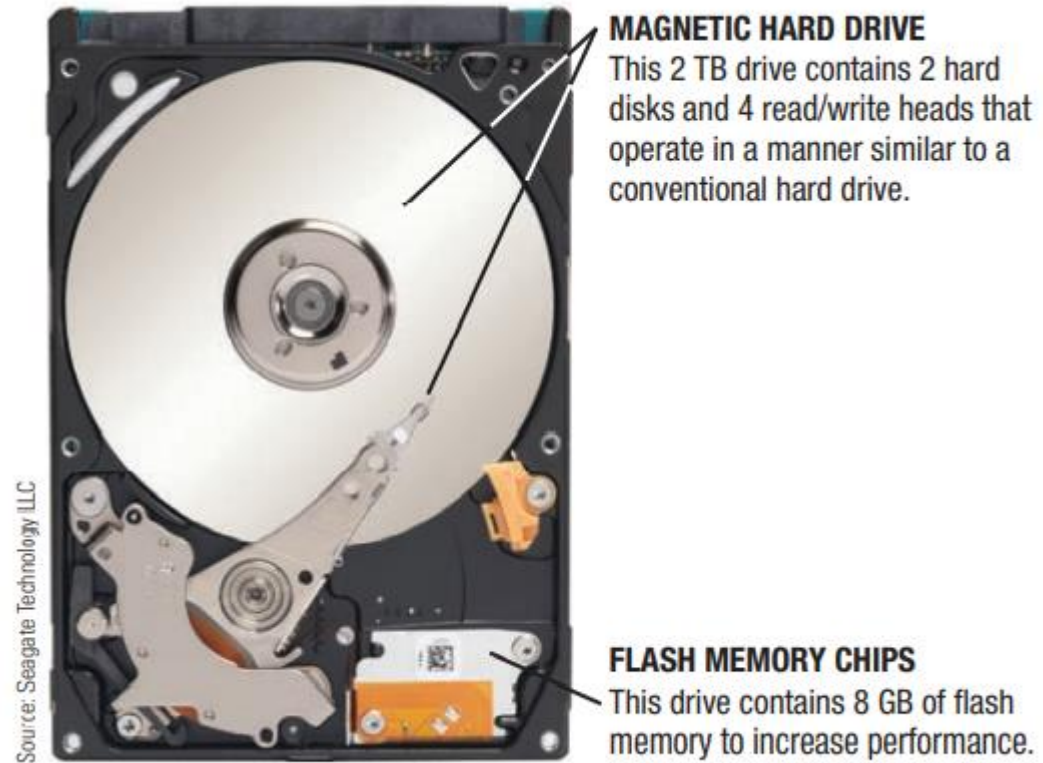
Solid State Drive

- Use flash memory technology
- Use less power and have no moving parts
- Particularly appropriate for portable computers and mobile devices



Solid-State Hybrid Drives (SSHDs)

- also called hybrid drives,
- contain both flash memory chips and magnetic hard drives





External Storage Devices

USB Flash Drives

Consist of flash memory media and a reader in a single self-contained unit

- Typically, portable drives that connect via a USB port
- Also called USB flash memory drives, thumb drives
- Come in a variety of appearances

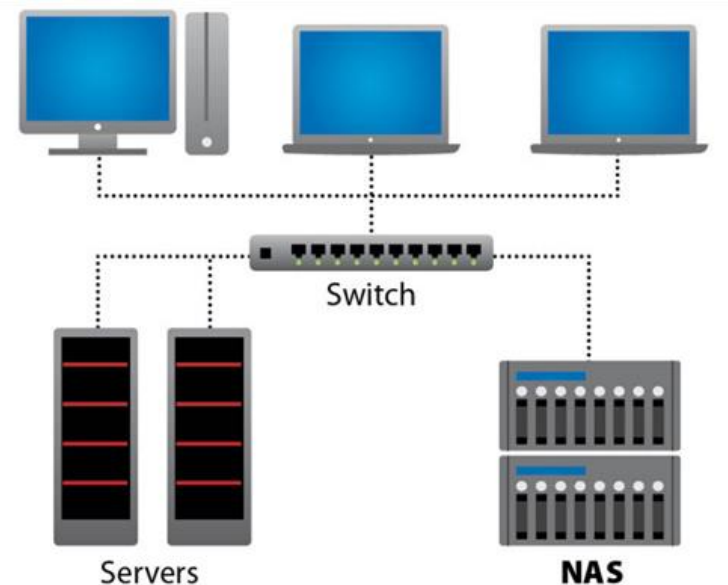




Remote Storage

Network Storage

- Network storage refers to using a storage device that is not connected directly to the user's computer; instead, the device is accessed through a local network or through the Internet
- Using a remote storage device via a local network is referred to as network storage Example: ITRC file server



Cloud Storage

- Remote storage devices accessed via the Internet are often referred to as online storage or cloud storage (Eg. Onedrive, Google Drive, Drop Box, icloud etc...)
- Growing in importance because more and more applications are web-based
- Increasingly being used for backup purposes



Advantages and disadvantages of network storage and cloud storage

Network storage	Cloud Storage
We don't need to pay a monthly fee	Need to pay a rental
We need to maintain hardware/software	We are free from maintaining hardware/software
We need network specialists	No need of specialists
Don't need internet	Need Internet
We are not dependents	We depend on others
Need initial investment	Scalability



Input devices



Data capture methods vs Data entry

In general data capture is fast and accurate, but may be expensive or may not be feasible in some applications. If feasible, Data capture methods is the best.

Source data automation

- The process of collecting data at their point of origin in digital form. It eliminates much of this duplicated effort, delay extra handling, and potential for error by initially collecting data in digital form.
- Source Data Automation is the use of automated methods of data entry that attempt to reduce or eliminate many of the activities, people and data media required by traditional data entry methods. It is basically the process of collecting data at the point of origin in digital form.



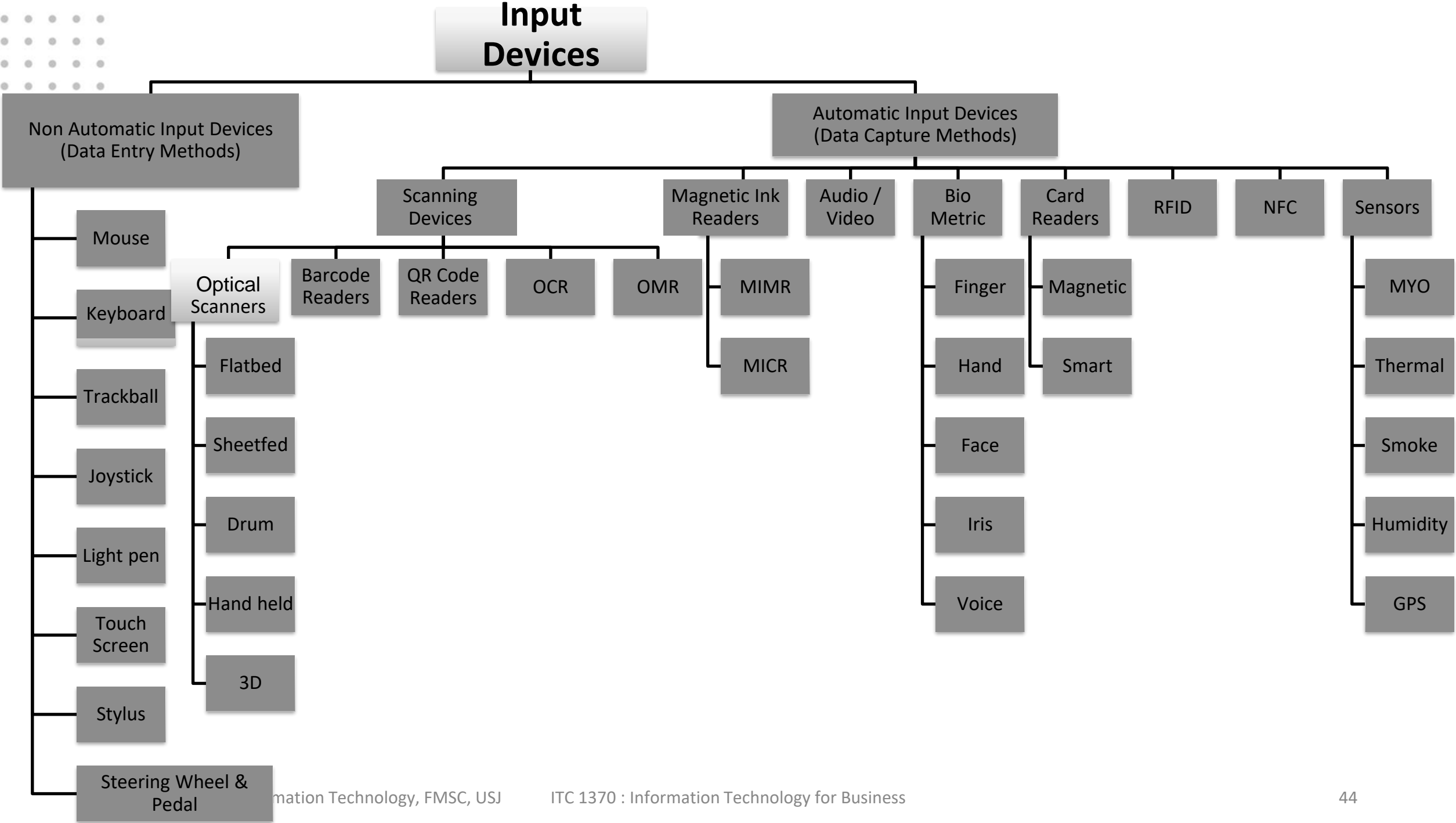
Order processing **without** EDI



Order processing **with** EDI

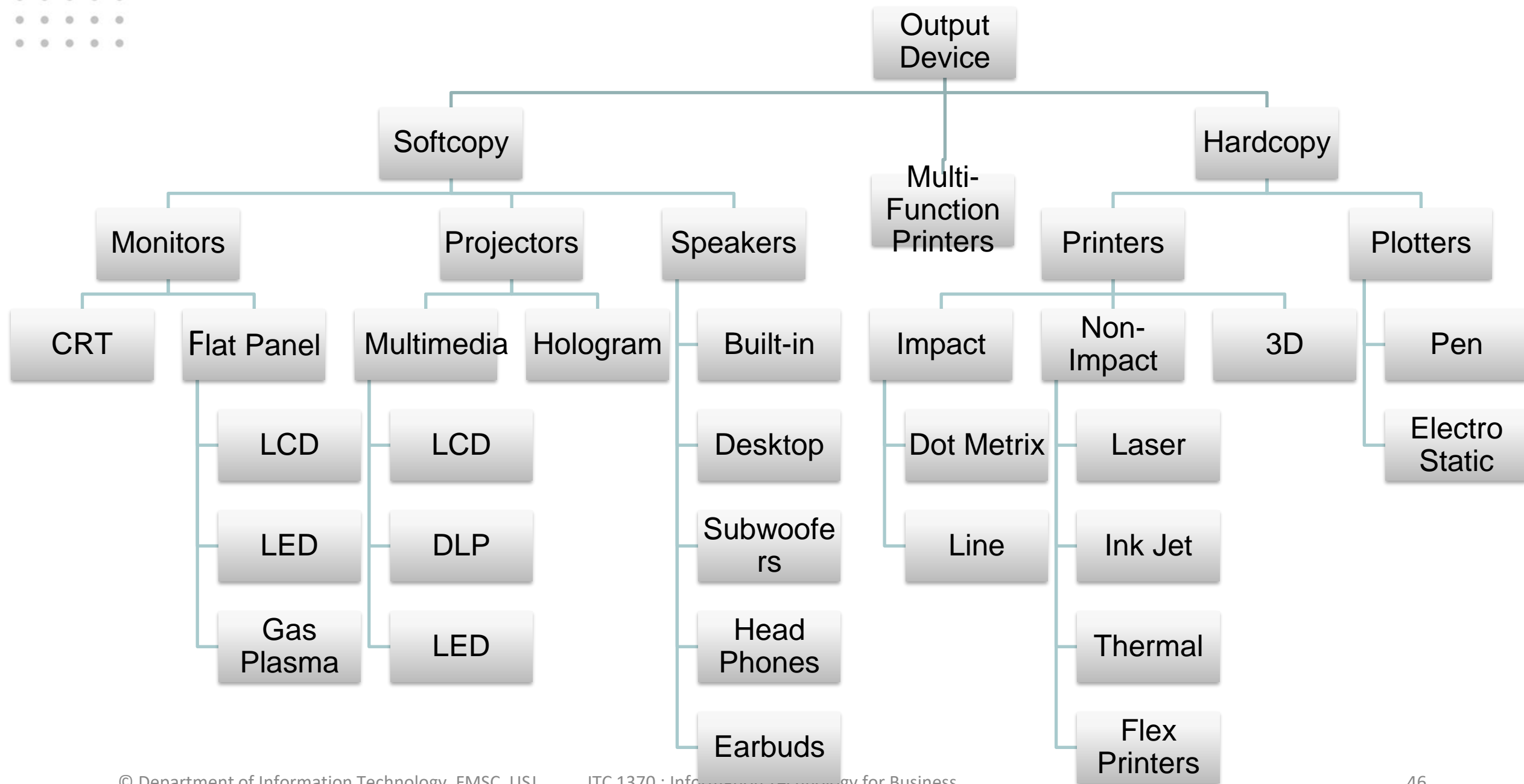


Source: <https://www.pacificcommerce.com.au/page/edi-electronic-data-interchange>





Output devices

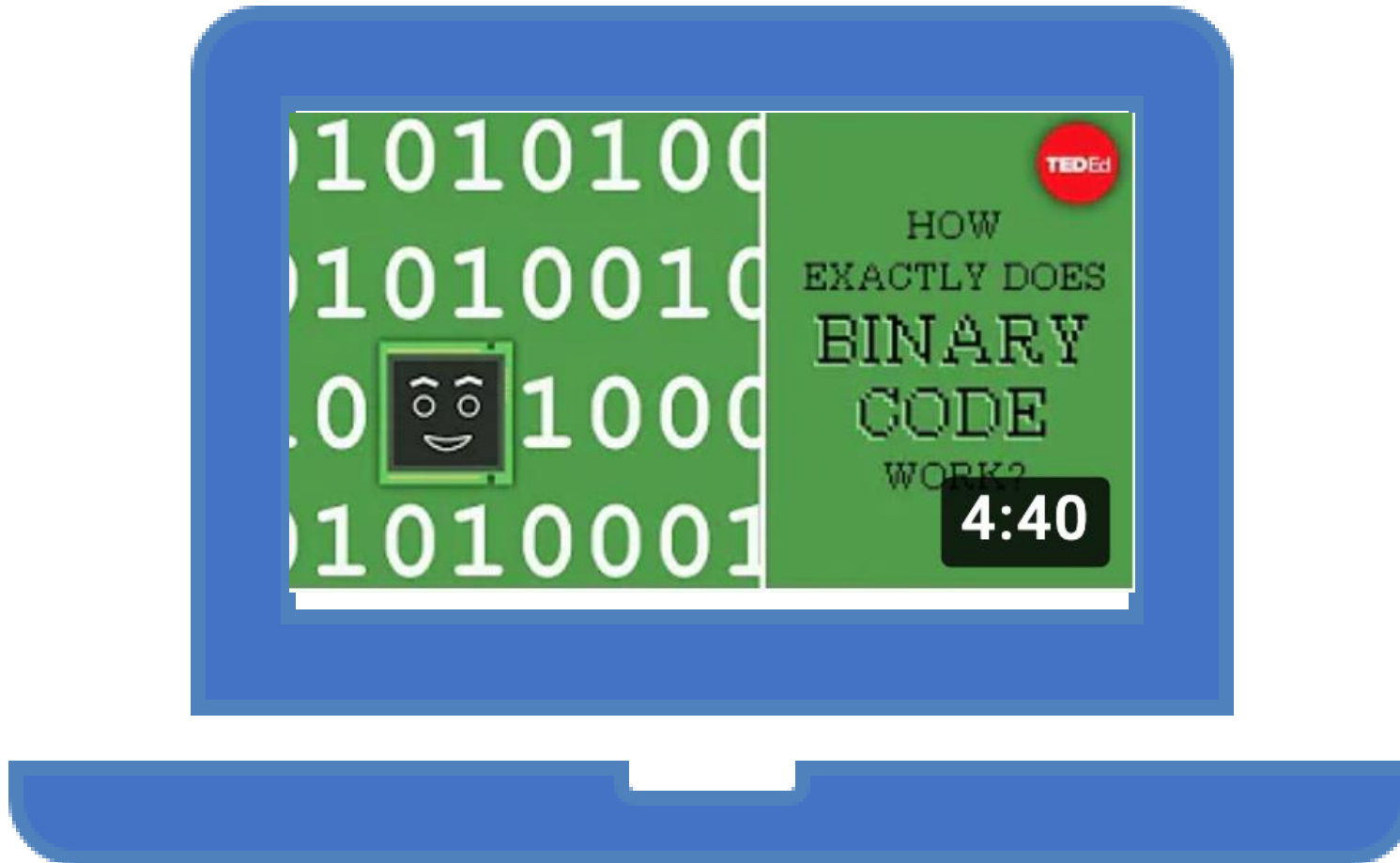


Advantages and disadvantages of Soft copy vs Hard copy

Soft copy	Hard Copy
No per copy cost	Per copy cost
Temporary	Permanent
Flexible (Zoom / change colour etc)	Not flexible
Environmentally friendly	

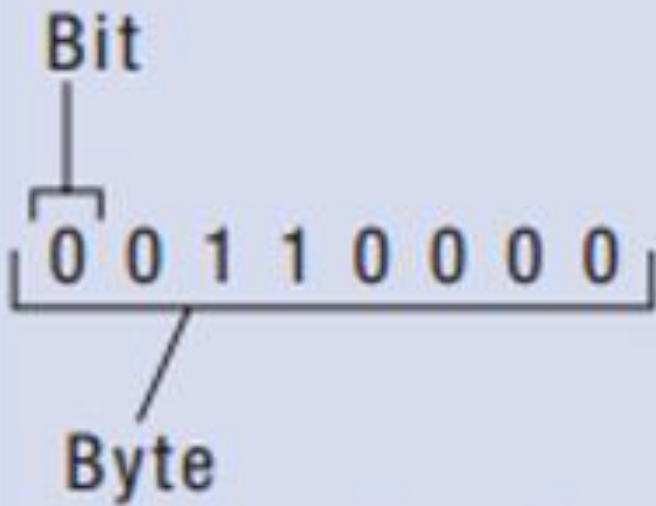


How Data represent in Computer



- Watch the Following from the YouTube

<https://www.youtube.com/watch?v=wgbV6DLVezo>



Abbreviation	Approximate Size
KB	1 thousand bytes
MB	1 million bytes
GB	1 billion bytes
TB	1 trillion bytes
PB	1,000 terabytes
EB	1,000 petabytes
ZB	1,000 exabytes
YB	1,000 zettabytes

Digital Data Representation

- Bit: The smallest unit of data that a binary computer can recognize (a single 1 or 0)
- Byte = 8 bits
- Byte terminology used to express the size of documents and other files, programs, etc.
- Prefixes are often used to express larger quantities of bytes: kilobyte (KB), megabyte (MB), gigabyte (GB), etc.



Digital Data Representation

- 1 Bit = Binary Digit
- 8 Bits = 1 Byte
- 1024 Bytes = 1 Kilobyte
- 1024 Kilobytes = 1 Megabyte
- 1024 Megabytes = 1 Gigabyte
- 1024 Gigabytes = 1 Terabyte
- 1024 Terabytes = 1 Petabyte
- 1024 Petabytes = 1 Exabyte
- 1024 Exabytes = 1 Zettabyte
- 1024 Zettabytes = 1 Yottabyte
- 1024 Yottabytes = 1 Brontobyte
- 1024 Brontobytes = 1 Geopbyte

Digital Data Representation cont.

Coding Systems for Text-Based Data

CHARACTER	ASCII	EBCDIC
0	00110000	11110000
1	00110001	11110001
2	00110010	11110010
3	00110011	11110011
4	00110100	11110100
5	00110101	11110101
A	01000001	11000001
B	01000010	11000010
C	01000011	11000011
D	01000100	11000100
E	01000101	11000101
F	01000110	11000110
+	00101011	01001110
!	00100001	01011010
#	00100011	01111011

FIGURE 2-5
Unicode. Many characters, such as these, can be represented by Unicode but not by ASCII or EBCDIC.

銅

CHINESE

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GREEK

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HEBREW

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AMHARIC

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TIBETAN

Ж

RUSSIAN

Digital Data Representation cont.

Coding Systems for other types of Data

- Audio data: Must be in digital form in order to be stored on or processed by a PC
 - Often compressed when sent over the Internet
 - MP3 files
- Video data: Displayed using a collection of frames, each frame containing a single graphical image
 - Amount of data can be substantial, but can be compressed
 - MPEG-1 - Video CD
 - MPEG-2 - Over-the-air digital television
 - MPEG-3 - Redundant and was merged with MPEG-2
 - MPEG-4 - HD DVD and Blu ray Discs

Self Study Videos:

How Computers Work, Compilation Video of Basics Explained



Recommend to watch this video, it explains fundamental concepts using illustrations.

<https://www.youtube.com/watch?v=Rv73ki6fTuo&t=2588s>

Thank You