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FACULTY OF INFORMATION TECHNOLOGY
SOFTWARE ENGINEERING DEPARTMENT

CHAPTER 2

BASIC CONCEPTS OF INFORMATION TECHNOLOGY



CONTENTS

1. Data and Information

2. Computer System

3. Hardware

4. Software

5. Computer Network

6. The Internet and Web

7. Management of Data

1. Data and Information

- The Data Pyramid is a concept that visualizes the Data-Information-Knowledge-Wisdom hierarchy.

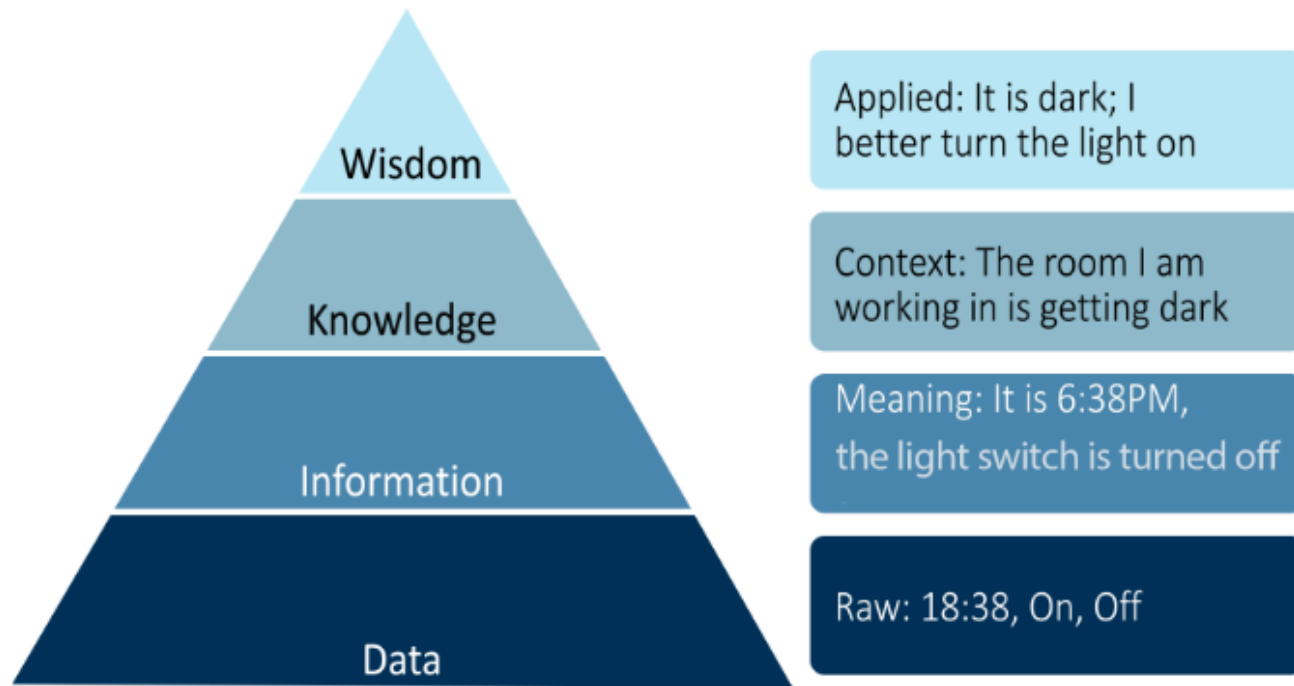


Figure. The Data Pyramid



Data and Information

- **Data** is the raw, unprocessed facts, including text, numbers, images, and sounds
- **Information** is a collection of processed data from a variety of sources to be used in context and have meaning
 - Data is continually aggregating and is not useful until it has been processed and is presented in a usable form.



Data and Information

- Match each component to the correct category:

DATA

INFORMATION

- 15% humidity
- The time is 3:05am.
- 18:23
- 45 mph
- The customer's name is Mike.
- It's hot outside.
- Phoenix
- The price of the item is \$4.25.



Data and Information

- **Unstructured Data**

- Most of the data stored today are unstructured and include things such as text, blogs, clickstreams, tweets, audio, video format, comments on a web page, text messages,...

- **Structured Data**

- Structured data is coded in a way that makes it easy to convert into a form usable for analysis.
- **Example:** contact information such as first name, last name, email address, and phone number. In addition, quantitative fields like date of birth, date of transaction, and the amount received or amount due,...



Data and Information

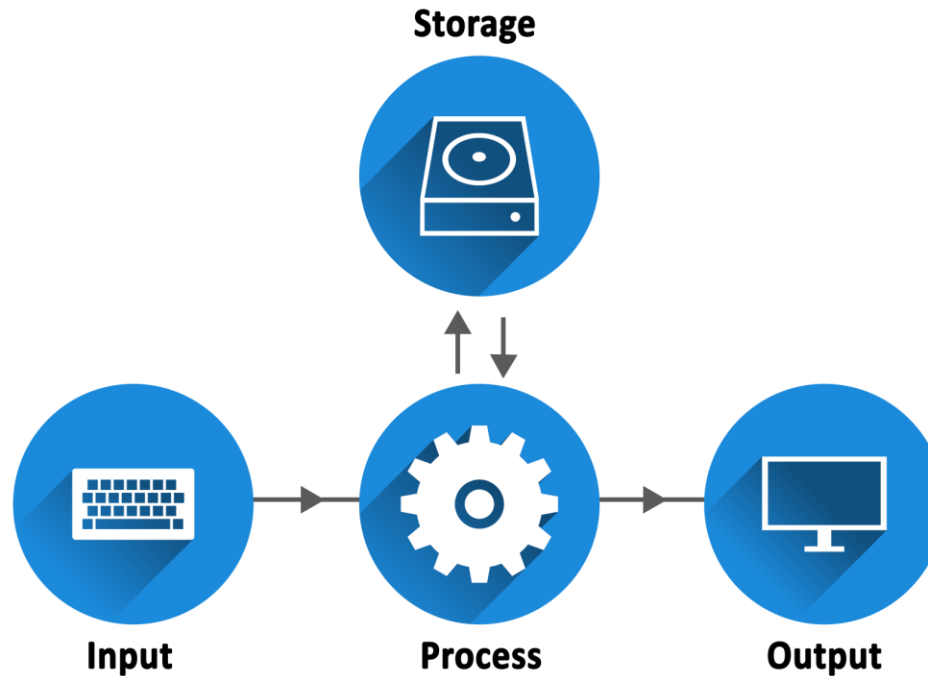
- **Big Data**

- Big data is a large collection of data that is incapable of being processed by previous generations of analytical tools.
- Big data is rapidly changing the way businesses make decisions and understand customer behavior.
- Big companies like Amazon and Netflix use data science to analyze customer experience, model customers, and align its product offering to a specific customer's characteristics.



2. Computer System

- **A computer** is an electronic device, operating under the control of instructions stored in its own memory
- **The Functions of a Computer System:**



Information Processing Cycle



Information Processing Cycle

DATA

2 Medium Sodas	\$1.49 each
1 Small Turkey Sub	\$3.49 each
1 Caesar Salad	\$4.49 each
1 Bag of Chips	\$0.99 each
3 Cookies	\$0.39 each
Amount Received	\$20.00

PROCESSES

- Computes each item's total price by multiplying the quantity ordered by the item price (i.e., $2 * 1.49 = 2.98$).
- Organizes data.
- Sums all item total prices to determine order total due from customer (13.12).
- Calculates change due to customer by subtracting the order total from amount received ($20.00 - 13.12 = 6.88$).

INFORMATION

Arrow Deli
10 Park Street
Maple River, DE 20393
(734) 555-2939

QTY	ITEM	TOTAL
2	Medium Sodas	2.98
1	Small Turkey Sub	3.49
1	Caesar Salad	4.49
1	Bag of Chips	0.99
3	Cookies	1.17
Total Due		13.12
Amount Received		20.00
Change		6.88

Thank You!



Computer System

- **Components of a Computer System**

- **Hardware:** electronic and mechanical parts
- **Software:** include the data and the computer programs
- **Middleware (may be or not):**
 - The components that share software and data between elements of a computer system
 - Allows the hardware and software to communicate with each other, enabling data to move between computer system components
- **Network**



Characteristics of Computers

Speed

Versatile

Memory

Accuracy

Automation

Diligence

No IQ

Economical



The History of the Computer

First Generation (1946-1959):

Vacuum Tubes

- UNIVAC và ENIAC
- Consumed a lot of electricity, Bulky in size, Low Reliability

Second Generation (1959-1965): Transistors

- Faster, cheaper, smaller, and more reliable
- Could be programmed using assembly and high-level languages
ngon ngu bac thap

Third Generation (1965-1971):

Integrated Circuits

- Could perform one million transactions per second
- Larger primary memory and secondary storage

Fourth Generation (1971-1989): Microprocessors

vi xu ly, con chip

- GUIs Giao dien do hoa
- Use of computers in offices and at homes
- Networks allowed sharing of resources

Fifth Generation (Present and Beyond): Artificial Intelligence, Quantum Computing

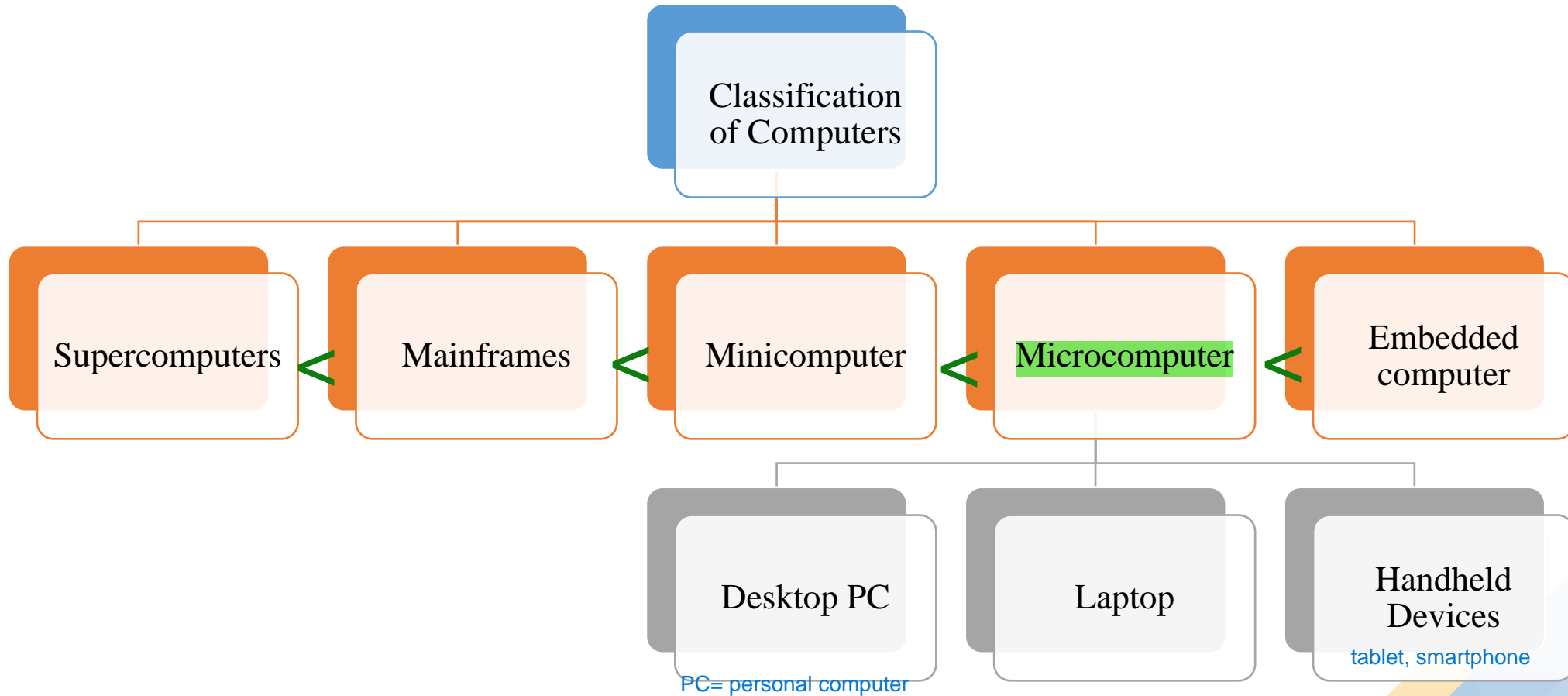
may tinh luong tu

- Gaming, Expert systems, Natural languages, Neural networks, Robotics
nhân diện
ngon ngu tu
nhien



Classification of Computers

phan loi





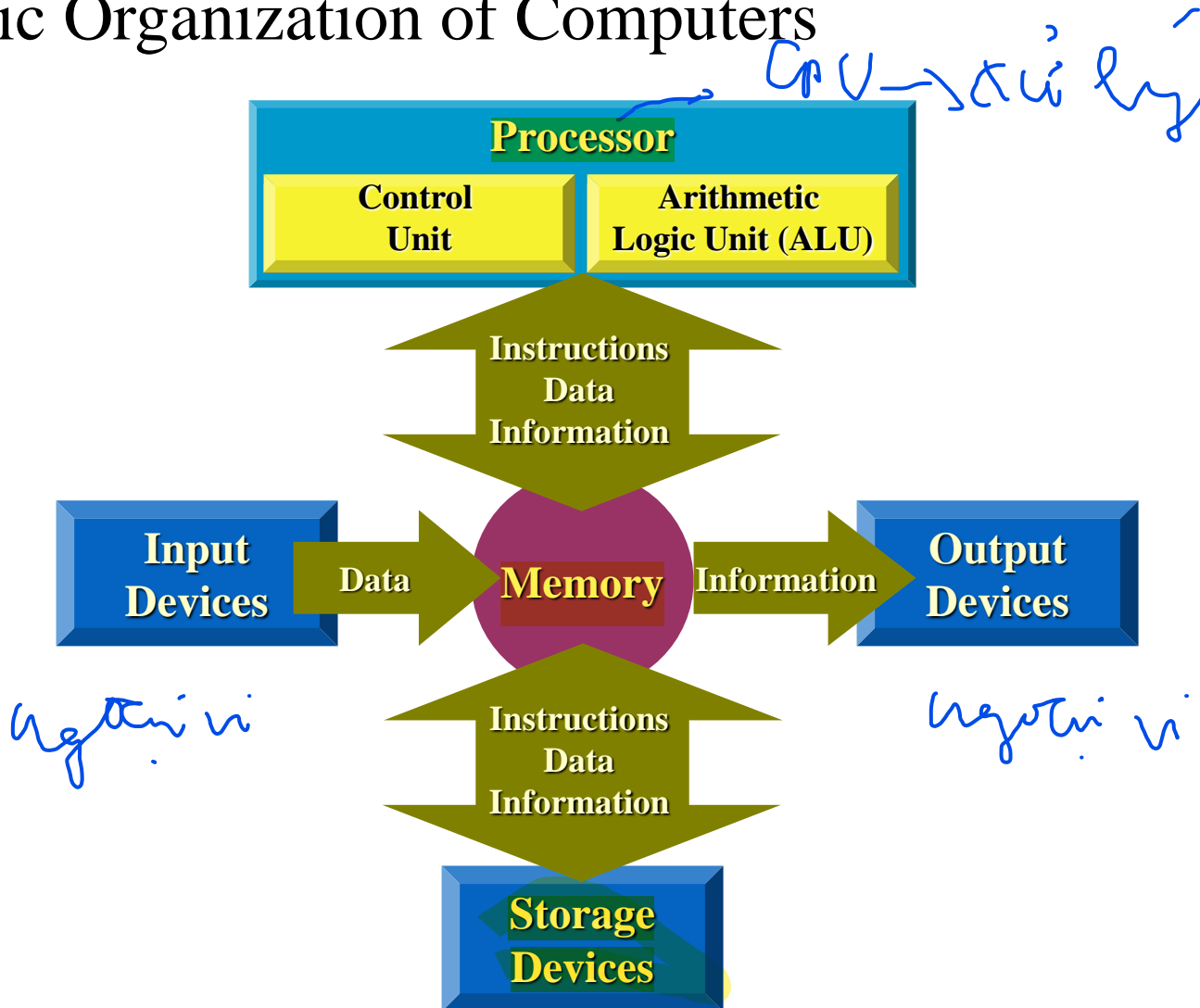
Classification of Computers





3. Computer Hardware

- Basic Organization of Computers





Computer Hardware

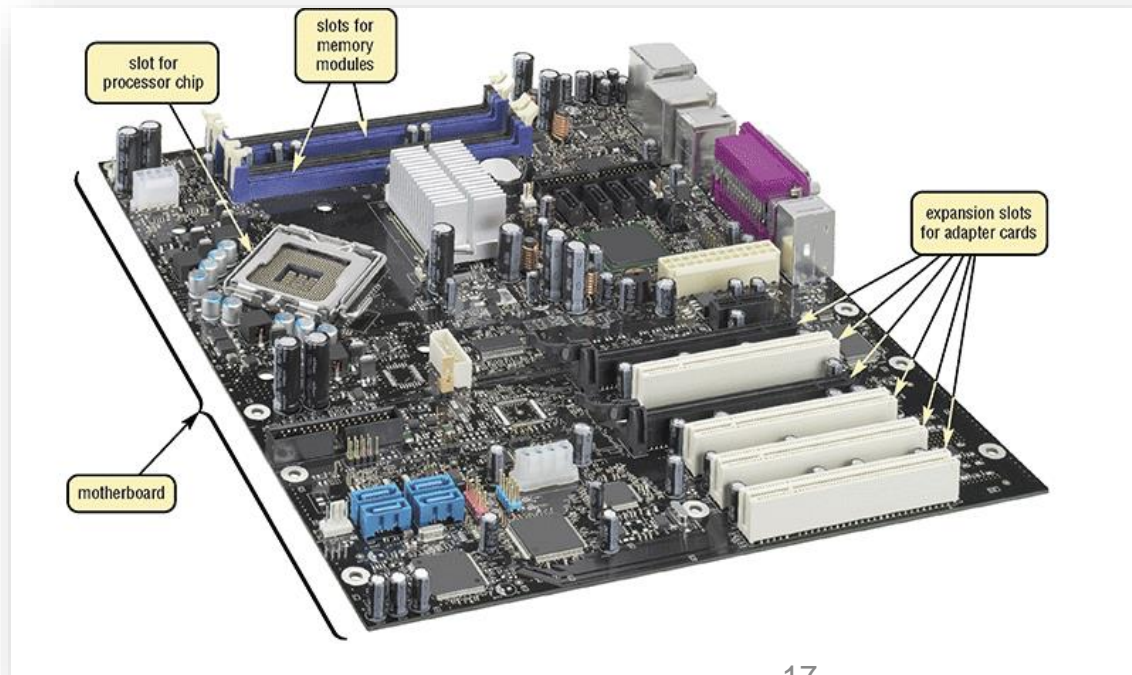
- **System Unit**
 - Motherboard, CPU, RAM, power supply, and any other internally installed components.
- **Peripheral Devices**
 - Units support the input and output functions



Computer Hardware

- **Motherboard**

- Main circuit board in system unit
- Contains expansion slots, processor chips, and memory slots
- Sometimes called a system board





Computer Hardware

- **Central processing unit (CPU)**

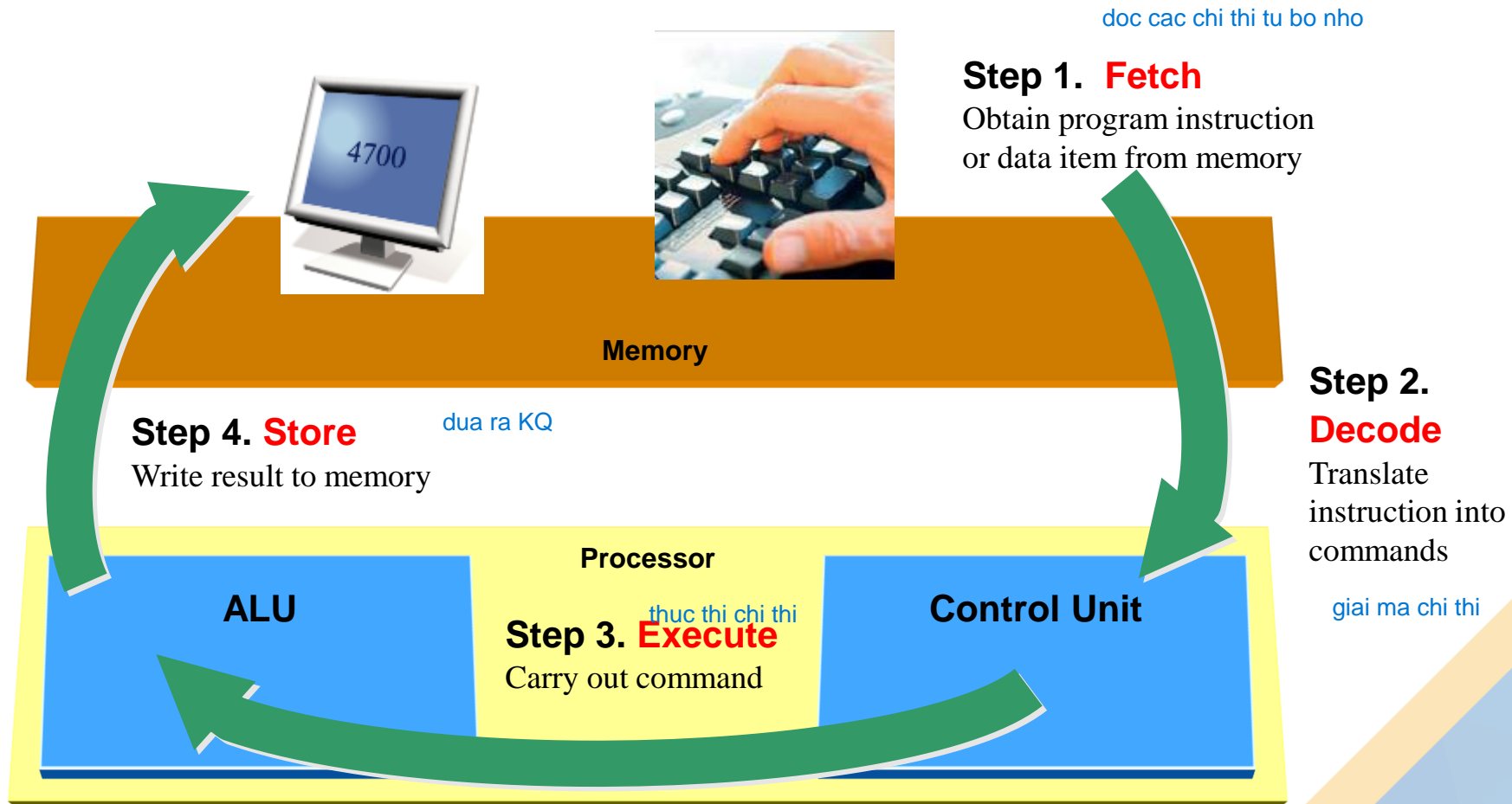
- Interprets and carries out basic instructions that operate a computer
- Also called the processor
- What are **multi-core processors**?
 - A dual-core processor is a single chip that contains two separate processors
 - A quad-core processor is a single chip that contains four separate processors
 - A multi-core processor is a chip with two or more separate processors
 - Each processor on a multi-core chip generally runs at a slower clock speed, but increase overall performance
- CPU consists of three parts: the arithmetic/logic unit (ALU), control unit (CU), register





Computer Hardware

- Central processing unit (CPU)





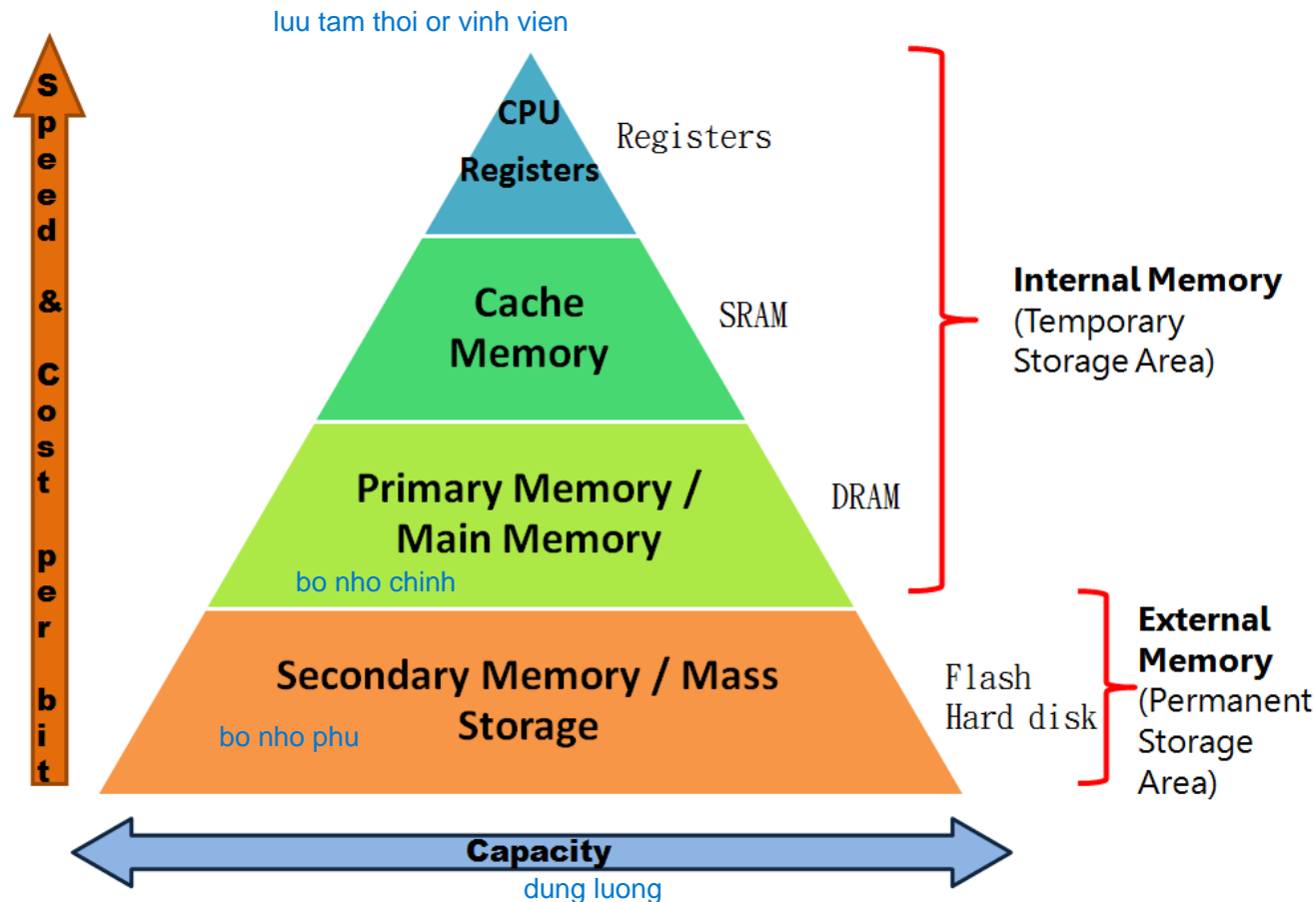
Computer Hardware

• Memory

- Memory is an internal storage area in the computer, which is used to store data and programs either temporarily or permanently.

• Types of memory

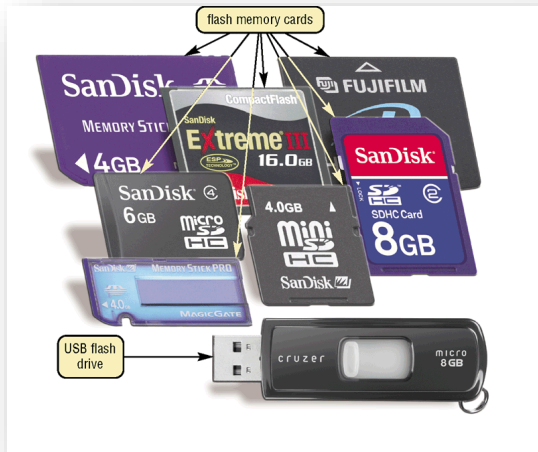
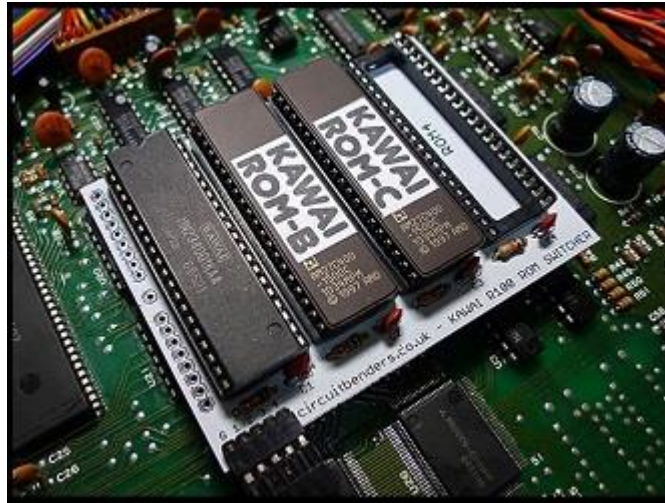
- Registers
- Cache memory
- Main memory
 - RAM
 - ROM
- Secondary memory
 - Hard Disk
 - CD/DVD
 - USB
 - Flash Card,...





Computer Hardware

- **Memory**





Basic Units of Measurement

- Memory capacity is measured in **bits** (binary digits).
- A bit is the smallest unit of storage that is set to 0 or to 1.
- Bits need to be combined to create a useful representation of data or information;
 - 1 byte = 8 bits
- A **byte** contains enough information to store a single character

He nhi phan

Don vi do co ban nhât

chũ số nhị phân

xu ly nhanh hơn, giảm độ phức tạp

0: trạng thái dòng
1: trạng thái mô
của transistors



Basic Units of Measurement

Basic Units of Measurement

Kilobyte (KB) $1 \text{ KB} = 1,024 \text{ B} = 2^{10} \text{ B}$

Megabyte (MB) $1 \text{ MB} = 1,024 \text{ KB}$

Gigabyte (GB) $1 \text{ GB} = 1,024 \text{ MB}$

Terabyte (TB) $1 \text{ TB} = 1,024 \text{ GB}$

Petabyte (PB) $1 \text{ PB} = 1,024 \text{ TB}$

Exabyte (EB) $1 \text{ EB} = 1,024 \text{ PB}$

Zettabyte (ZB) $1 \text{ ZB} = 1,024 \text{ EB}$

Yottabyte (YB) $1 \text{ YB} = 1,024 \text{ ZB}$



Basic Units of Measurement

Exercise:

1. Supposedly, your internet connection speed is 20Mbps (Megabits per second). How long will it take to download the file size is 2GB.



Computer Hardware

- **Peripheral Devices** Hello \Leftrightarrow 1010101
 - **Input devices** translate data into a form that the **computer** can understand
 - **Output devices** translate information into a form that **humans** can understand.



Computer Hardware

- Input devices

Scanner





Computer Hardware

- **Output devices**



printer

Projector



Monitor



Plotter: may ve



Computer Hardware

- **Input/Output devices**



Man hình cảm ứng



Máy fax



modem

Computer Hardware

- **Buses/Bus lines**

cáp

- Buses or bus lines are the wires that serve as electrical roadways, transmitting information between the CPU and other components.
- The three types of bus lines:
 - Address Bus
 - Data Bus
 - Control Bus

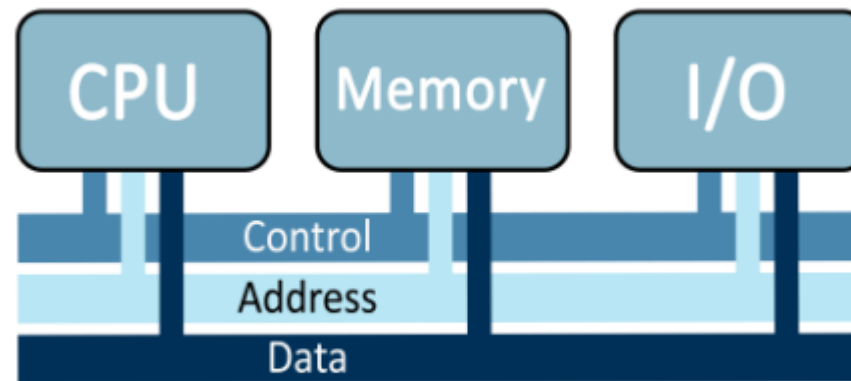


Figure. Buses as data paths of a computer system.



Computer Hardware

- **Power Supply**

- The power supply converts alternating current (AC) into low-voltage direct current (DC) for the computer.
- When the computer is turned on, the power supply allows converted electricity to travel to the hardware elements within the system unit.





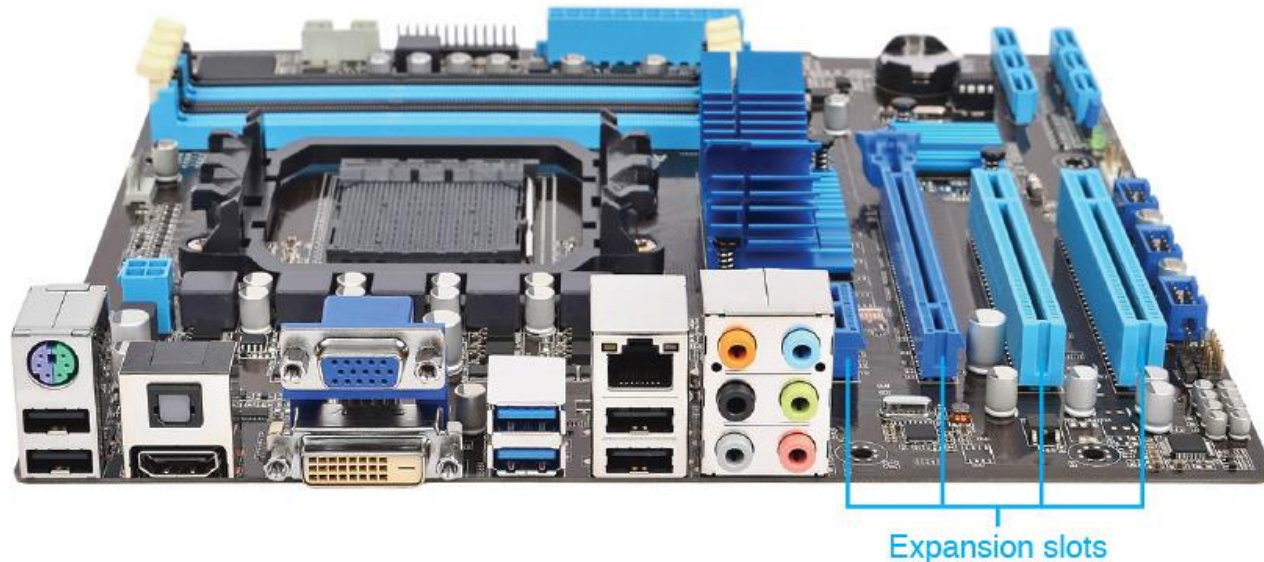
Computer Hardware

- **The System Clock**

- The system clock sends out a pulse of electricity at regular intervals. xung nhiet
 - The electronic components of the computer need these electric pulses in order to operate.
 - The more pulses sent out by the system clock, the faster the computer.
- The system speed commonly is measured in two primary measurements: Don vi do toc do xu ly may tinh
 - **megahertz (MHz)**, which converts to millions of pulses per second;
 - **gigahertz (GHz)**, which converts to billions of pulses per second.

Computer Hardware

- **Expansion Slots** Khe cắm (card mạng, đồ họa, âm thanh....)
 - Expansion slots are sockets on the motherboard where expansion cards can be installed.
 - Common types of expansion cards include graphics, sound, and network cards.





Computer Hardware

• Ports and connectors

Cong

Type	Picture	Type	Picture	Type	Picture
Audio in		HDMI port		Serial	
Cable TV		Headphones		Side surround sound	
Center surround sound/subwoofer		Keyboard		S/PDIF in	
Composite video in		Microphone		S/PDIF out	
Digital Video Interface (DVI)		Monitor		Speaker	
eSATA port		Mouse		S-video	
FireWire		Network		Telephone line in	
FM reception		Rear surround sound		USB	



4. Software

- **Software** is general term that is used to describe any single program or group of programs. tap hop cac chi thi
- A **computer program** is a **collection of instructions** that performs a specific task when executed by a computer.
- There are two major kinds of software:
 - **System software** phan mem he thong
 - **Application software** phan mem ung dung

System software

- Consists of the programs that control or maintain the operations of the computer and its devices. quan ly
- Serves as the interface between the user, the application software, and the computer's hardware
- System software is **“background”** software that helps the computer manage its own internal resources

- **Types of system software**

- Operating systems OS: he dieu hanh
- Utilities chuong trinh tien ich
- Device **drivers**
- **Compilers**

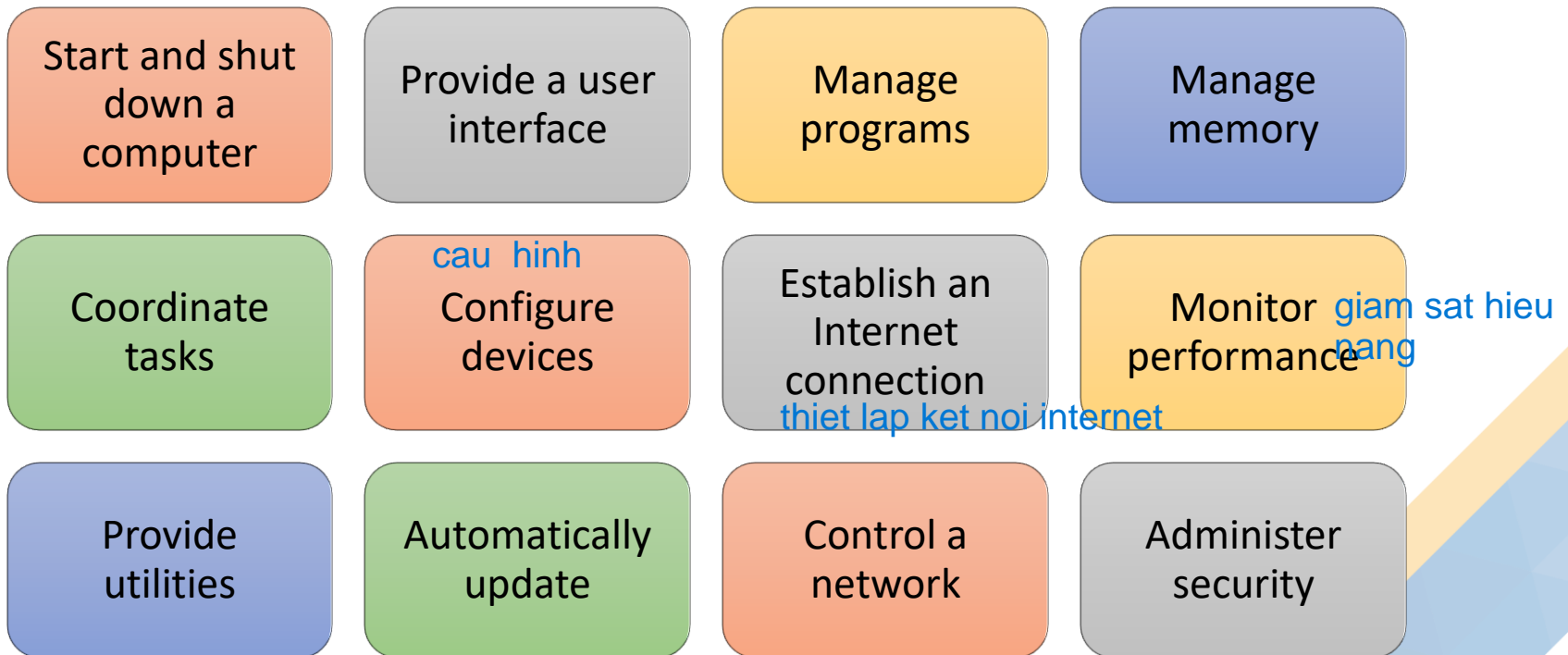
Trinh bien dich: chuyen
doi nn bac cao -> ma~
may





Operating Systems

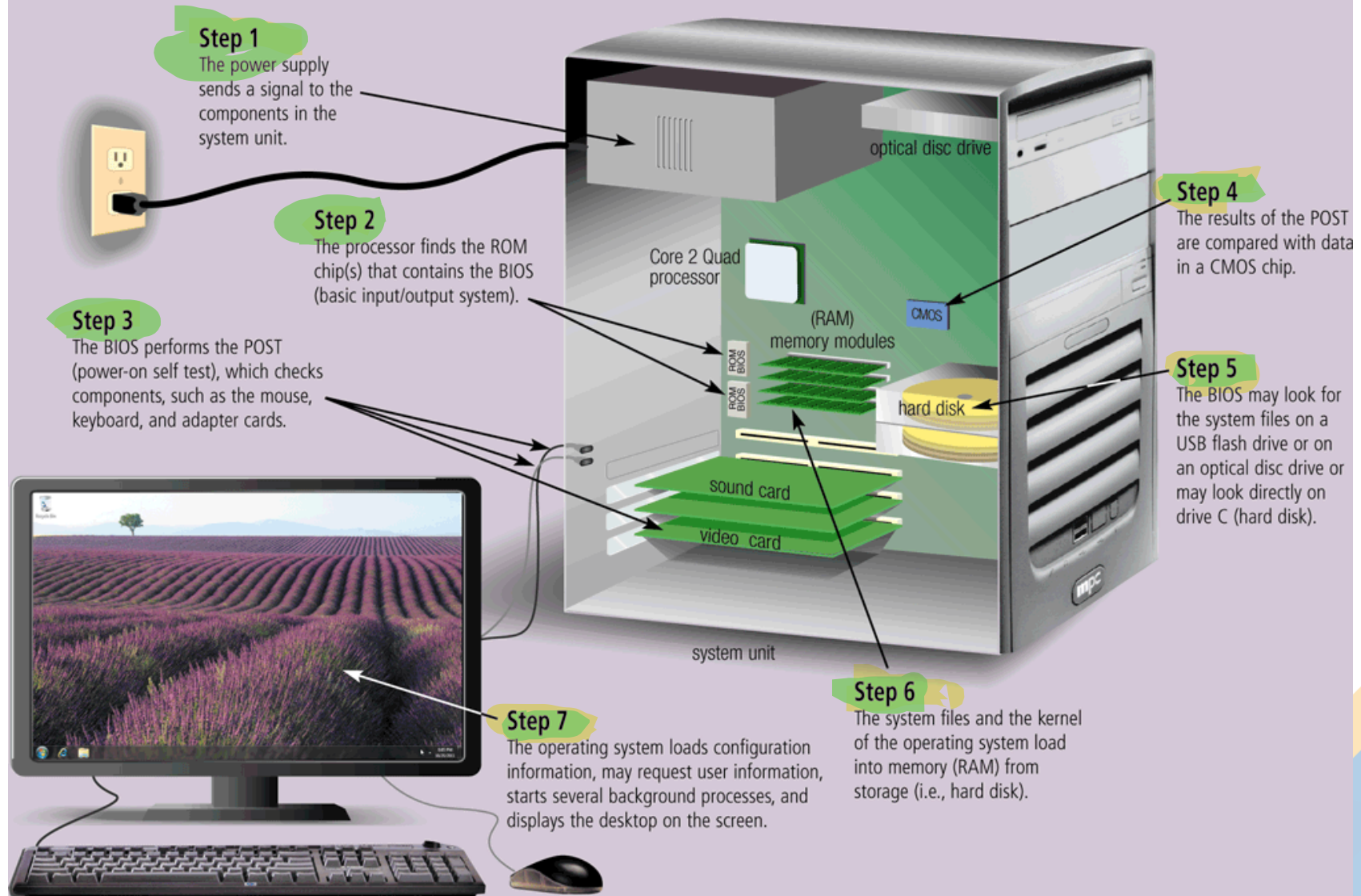
- An **operating system (OS)** is a set of programs containing instructions that work together to coordinate all the activities among computer hardware resources. *dieu phoi*
- The operating system is often referred to as the software environment or **software platform**



Booting

How a PC Boots

qua trình khởi động máy tính





User Interface

- UI controls how you enter data and instructions and how information is displayed on the screen
- **Types of UI:**
 - Command-line interface giao dien dong lenh
 - Graphical user interface (GUI) giao dien do hoa

```
bash-2.05b$ ping -q -c1 en.wikipedia.org
PING rr.chtpa.wikimedia.org (207.142.131.247) 56(84) bytes of data.

--- rr.chtpa.wikimedia.org ping statistics ---
1 packets transmitted, 1 received, 0% packet loss, time 0ms
rtt min/avg/max/mdev = 112.076/112.076/112.076/0.000 ms
bash-2.05b$ grep -i /dev/sda /etc/fstab | cut --fields=3
/dev/sda1      /mnt/usbkey
/dev/sda2      /mnt/ipod
bash-2.05b$ date
Wed May 25 11:36:56 PDT
bash-2.05b$ lsmod
Module                Size  Used by
joydev                 8256   0
ipw2200               175112  0
ieee80211             44228   1 ipw2200
ieee80211_crypt       4872    2 ipw2200,ieee80211
e1000                 84468   0
bash-2.05b$
```

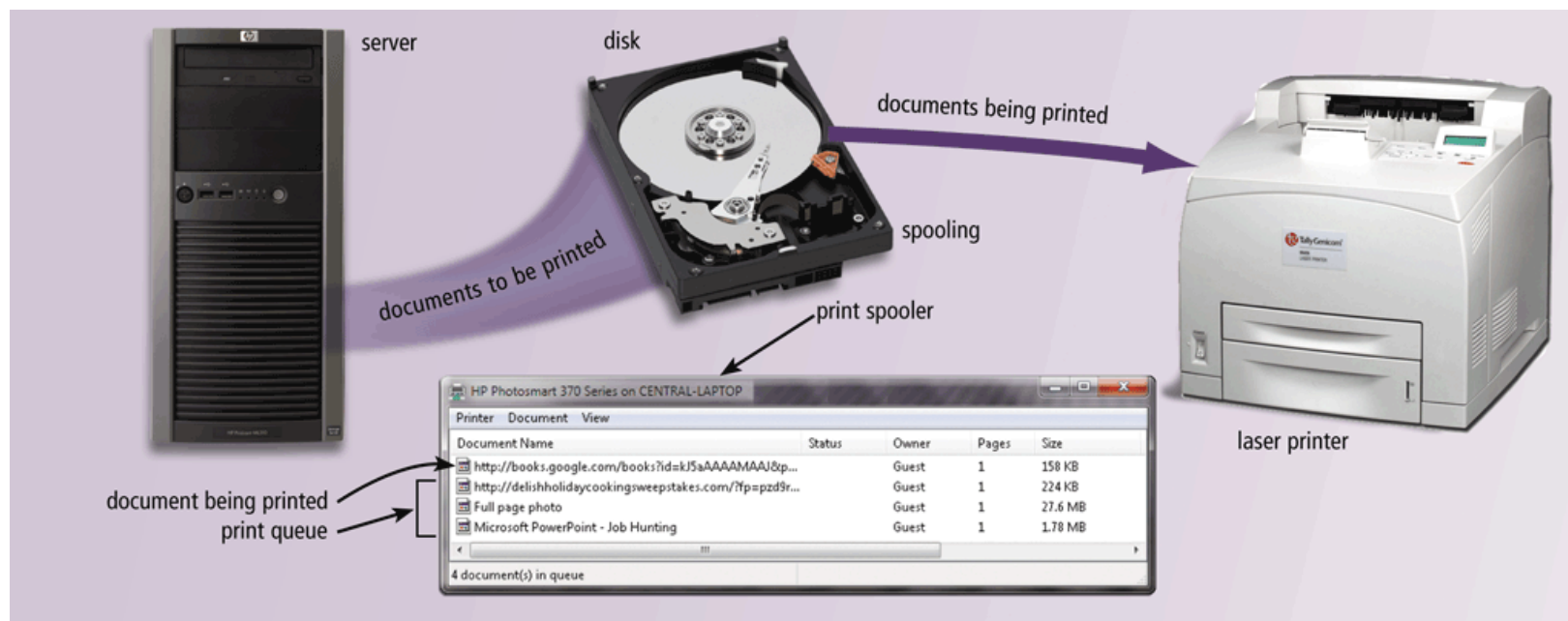
command entered by user

command prompt



Operating System Functions

- Coordinate tasks, determines the order in which tasks are processed
- **Plug and Play** automatically configures new devices as you install them
- **A driver** is a small program that tells the operating system how to communicate with a specific device





Types of Operating Systems

Category	Description
Stand-alone	<ul style="list-style-type: none">• A complete operating system that works on a desktop computer, notebook computer, or mobile computing device• Windows, Mac OS, UNIX, Linux,...
Server/Network	<ul style="list-style-type: none">• Control and coordinate computers that are networked or linked together• Located on server• Linux, Windows Server, UNIX, Solaris, NetWare• ...
Embedded	<ul style="list-style-type: none">• Resides on a ROM chip on a mobile device or consumer electronic device• Windows Phone 7, Palm OS, iOS, BlackBerry, Android



Utilities

- **File manager**
 - Displaying a list of files, organizing files, sorting, copying files, ...
- File compression [Chương trình nén tập tin](#)
- Search utility
- Image viewer, media player
- Disk defragmenter, disk cleanup
- Backup, restore
- Personal firewall, Antivirus programs
- Troubleshooting
- Uninstaller
-



Application software

- Consists of programs designed to make users more productive and/or assist with personal tasks.
 - To make business activities more efficient
 - Microsoft Office: Word, Excel, PowerPoint, Access, One Note, InfoPath, Outlook,...
 - To assist with graphics and multimedia projects
 - AutoCAD, Adobe Photoshop, ...
 - To support home, personal, and educational tasks
 - Google map, Google Classroom, ...
 - To facilitate communications
 - Web browser (IE, Firefox, **Chrome**, Safari, Opera,...), Gmail, Zalo, Messenger, Skype ...



Application software

- Target users of application software fall into one of the following three categories:
 - **Bespoke:** custom-made, specifically designed and developed for an organization
hang duoc dat rieng
 - **Off-the-shelf:** provides a general set of features that are useful to a broad range of users
office, zalo
 - **Hybrid:** off-the-shelf software, customized to an organization's needs.
hon hop dieu chinh cho phu hop
- **Software Packaging:** Software can be packaged in various ways:
 - Shareware: installed as a trial limited by time and/or functionality
ban dung thu, gioi han chuc nang va thoi gian su dung
 - Freeware: free, but protected by end-user license agreements (EULA) and copyright laws
nguai su dung dau cuoi cam ket
luat ban quyen
 - Public domain: no EULA and no intellectual property protections
khong co bat ky cam ket, ban quyen (dung thoi mai)



Application vs. System Software

- Match each software type to the correct category

APPLICATION SOFTWARE

SYSTEM SOFTWARE

Linux

Microsoft Windows

Web Browser

Spreadsheet *bang tính (Excel)*

Mac OS X

Accounting

DOS



Software Development Life Cycle

Vòng đời phát triển phần mềm

- **Requirements Analysis**

- determine what services the system will provide, identify any conditions (such as time constraints and security), and define how users will interact with the system

- **Design**

structure --> database --> interface

- creates a plan for **constructing** the system
- plans a solution

- **Implementation and Integration**

- **developing programs** and databases and creating data files.

- **System Maintenance**

- **sửa lỗi (tính toán...)** **bảo trì hệ thống** **không tương thích** troubleshooting application errors and incompatibilities, updating documentation, and providing end-user support

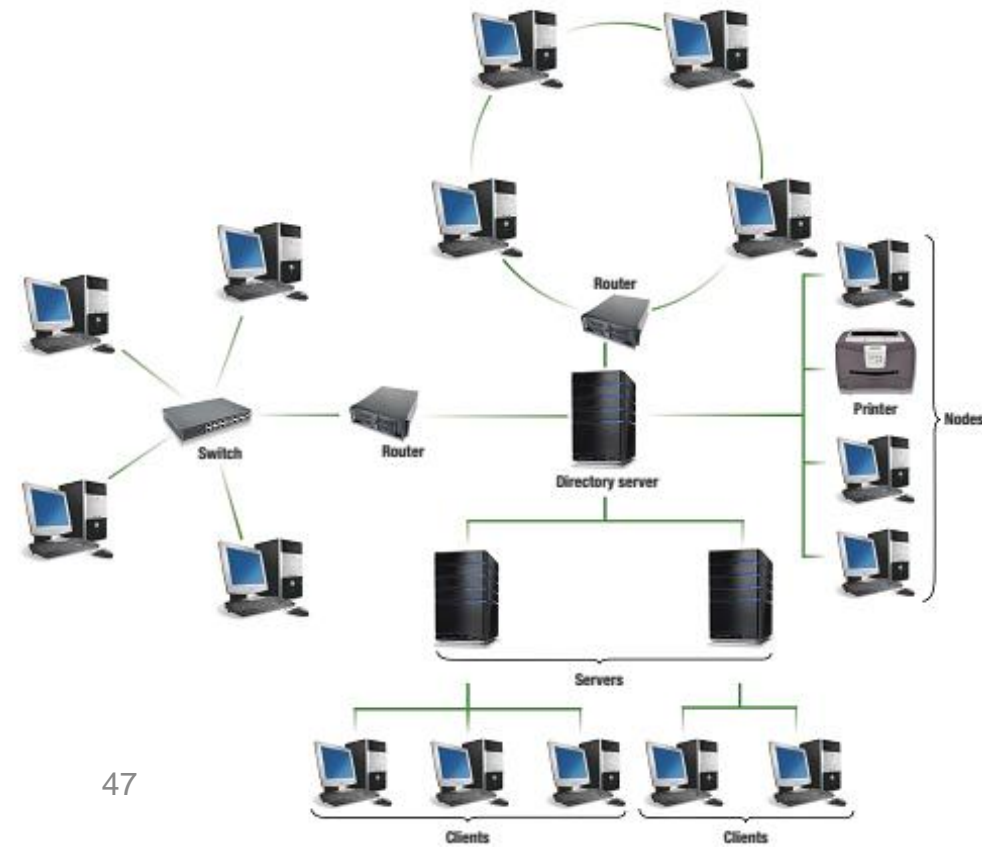


Software Development Life Cycle

- **Quality Assurance** dam bao chat luong - QA loi chuc nang qua ngan sach
 - As systems have become more **complex**, **malfunctions**, **cost overruns**, and **missed deadlines** are becoming more common
→ need for more effective quality control processes.
- **Tesing**
 - process of checking systems and confirming that the final product was compatible with the system requirement specification
 - one part of quality assurance
- **Documentation**
 - A system is not effective unless people can learn to use it and maintain it properly.
 - Three types of system documentation: user documentation, system documentation, and technical documentation tai lieu HDSD danh cho nguoi dung
tai lieu thiet ke, tai lieu phan tich yeu cau, tai lieu yeu cau phan mem, ban thiet ke, bao cao...

5. Computer Network

- A **computer network** is a collection of computers and devices connected together via **communications devices** and **transmission media**.
phuong tien truyền dẫn (day, switch...)
- Networks allow computers to share resources such as **hardware, software, data, and information**.





Network Terms

- **Node** - ^{nut mang} any device that is connected to a network. It could be **a computer, printer, or data storage device.**
- **Client** - ^{may tram, may nut} a node that requests and uses resources available from other nodes. Typically, a client is a user's personal computer.
- **Server** - a node that shares resources with other nodes. Depending on the specific task, they may be called an application server, database server, file server, printer server, or web server.
- **Host** - any computer system connected to a network that provides access to its resources.



Network Types

- **LAN** - Local area network *mang cuc bo*
 - Networks with nodes that are in close physical proximity such as same **building, colleges, office,...**
- **WLAN** - Wireless LAN *mang cuc bo ket noi khong day*
 - Computers connect to WLAN use Wi-Fi technology.
- **MAN** - Metropolitan area network *pham vi giua cac toa nha trong thanh pho*
 - Networks are frequently used as links between office buildings that are located throughout a city
- **WAN** - Wide area network *pham vi dat nuoc*
 - Countrywide and worldwide networks. **The widest of all WANs is the Internet**, which spans the entire **globe**

Internet: mang dien rong, pham vi toan cau



Network security

- Three technologies commonly used to ensure network security are:
 - **Firewall:** consists of hardware and software that control access to a company's intranet and other internal networks. Most use software or a special computer called a **proxy server**.
 - **Intrusion detection systems (IDS):** use sophisticated statistical techniques to recognize and disable network attacks. [hệ thống tìm kiếm, nhận diện](#)
 - **Virtual private networks (VPN):** create a secure private connection between a remote user and an organization's internal network. [mạng riêng ảo](#)

6. The Internet and Web

- The **Internet** is a worldwide collection of networks that connects millions of businesses, government agencies, educational institutions, and individuals. WAN + LAN +
- The **Web**, short for World Wide Web or WWW, is one of the more popular **services on the Internet**. It provided a multimedia **interface to resources available** on the Internet.
- Internet is infrastructure while the Web is service on top of that infrastructure.





The Internet and Web

- **Browser**

- Is software that provide access to web resources.
- This software connects you to **remote computers**; opens and transfers files; displays text, images, and multimedia.

- **URLs - uniform resource locators** Dia chi web

- Is address of the resources.
- **Protocols** are **rules** for exchanging data between computers, such as http or https
- **Domain name** indicates the specific address where the resource is located



Basic parts of a URL



The Internet and Web

- **IP address - Internet protocol address**
 - Every computer on the Internet has a unique numeric address.
- **Web page**
 - Document contain text, graphics, audio, and video
 - Created from **HTML** (Hypertext Markup Language) ngon ngu danh dau sieu VB
- **HTML**
 - a way of encoding a document. Special symbols called ^{the} tags describe how the document should appear on a display screen,



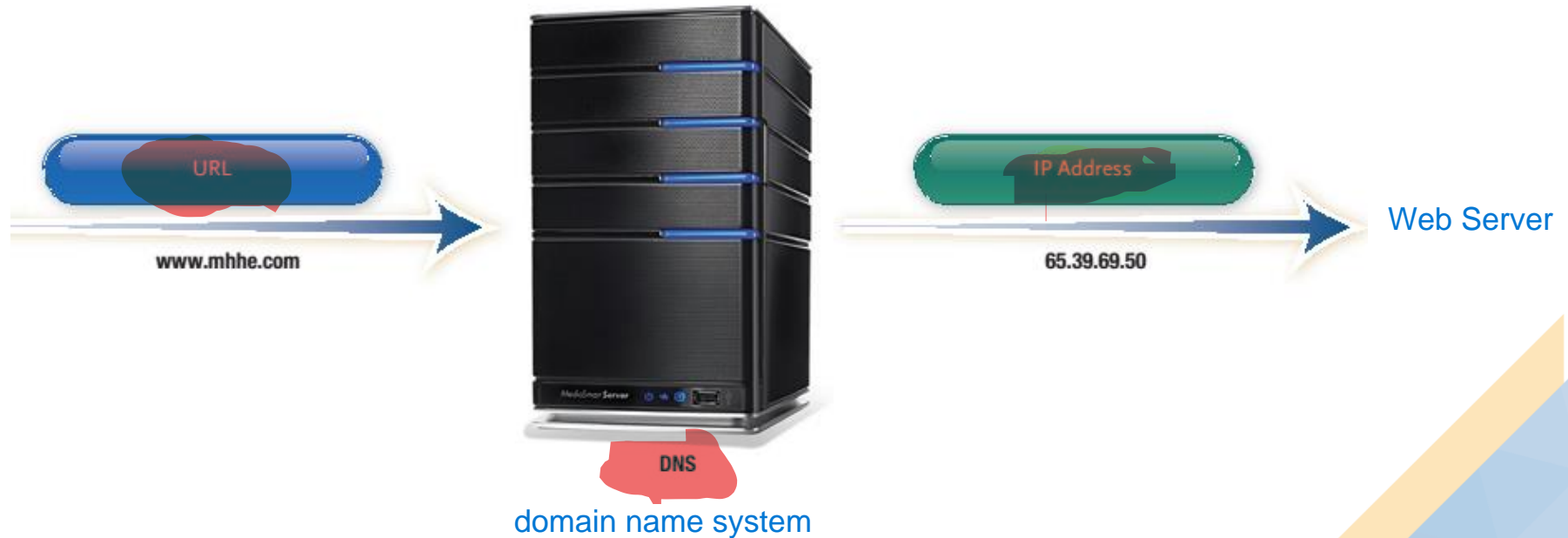
The Internet and Web

vo

trang vo

- **Website:** a collection of related Web pages
- **Web server:** contains website

tap hop cac tap tin



Exercise

- Match each component to the correct category:

Component	Category
Internet Browser	Software (2)
RAM	Hardware (1)
Bus / Ring / Star / Mesh	Network (2)
Hard Disk	Hardware (1)
Text Editing Program	Software (2)
Power Supplies	Hardware (1)
Client-to-server / Peer-to-peer	Network (3)
Motherboard	Hardware (1)
LAN / WAN	Network (3)
Internet	Network (3)
CPU	Hardware (1)
Operating System	Software (2)



7. Management of Data

- **Databases**

- **Databases** are multidimensional, allowing information to be accessed from various views through internal linking between entries.
- **Traditional file systems** are ^{1 chiều}one-dimensional. Traditional files present information from a single point of view and do not interact with other files.
- **Example:**
 - ^{bảng lương}Payroll was processed using the payroll file, the personnel department maintained employee records → **Database systems** integrate the information stored. With such a system, the same employee data could be used to process payroll, calculate vacation days, and manage employee benefits.



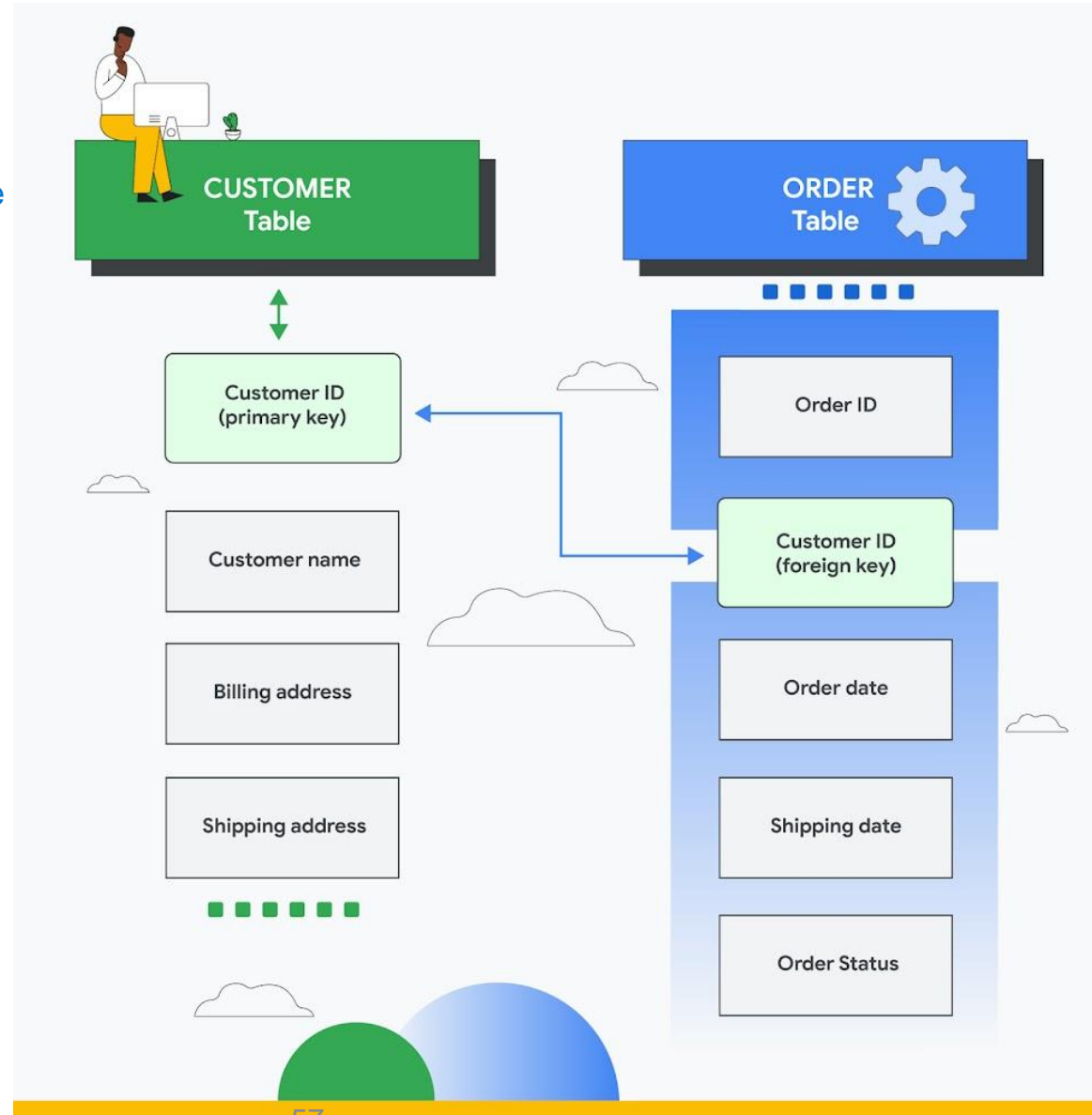
Management of Data

- Type of Database

- Relational Database
- NoSQL Database
- Cloud Databases
- Distributed Databases
- ...

CSDL quan hệ

CSDL phân tán





Management of Data

- **Database Management Systems (DBMS)** he quan tri CSDL
 - A typical database application has two major layers: an *application layer* and a *database management layer*.
 - The application layer communicates with the end user and receives a request
 - The Database Management System (DBMS) as a tool to alter the database after receiving the request through the application layer (add or delete data to or from the system)
 - Examples: **MySQL, SQL Server**, Oracle, PostgreSQL, ...



Q&A