Module 1
Introduction to Information and Communication Technologies

Lesson 2
How do Computers Work?

Rationale

The lesson will introduce you to the computer. Your knowledge about the elements of the computer and how they work will enable you to easily understand the later lessons on hardware, software and networks.

Scope

- What is a computer?
- What are the elements of a computer system?
- What are the different types of computer systems?
- What are the components of a data processing cycle?
- What is the role of a computer in the data processing cycle?
- What are some trends in the development of computers?

Learning Outcomes

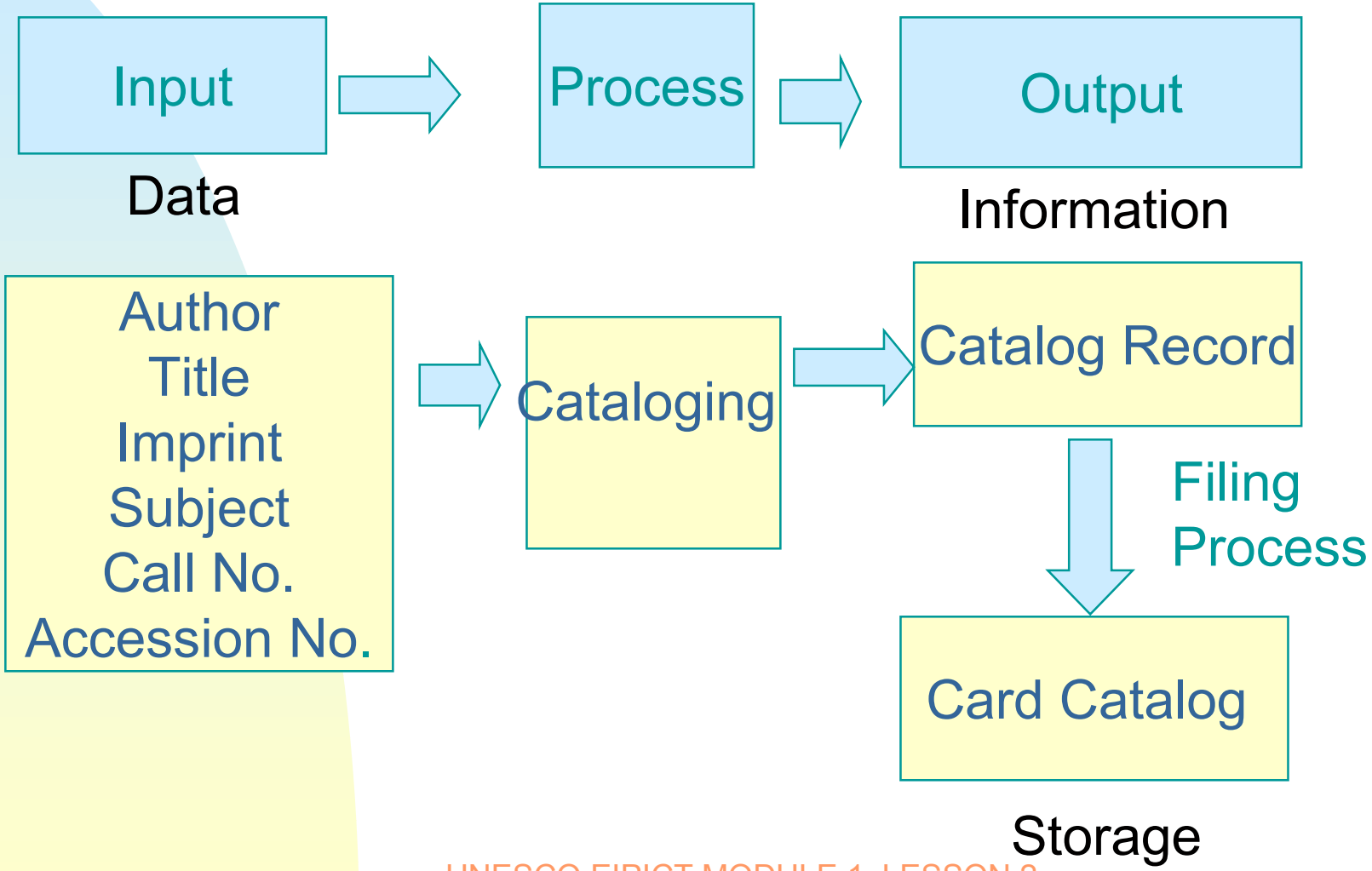
By the end of this lesson, you should be able to:

- Describe how computers process information
- List the elements of a computer system
- Identify the different types of computer systems and their uses
- Explain the data processing cycle
- Define the role of computers in the data processing cycle
- Be aware of development trends in ICTs

What is a Computer?

- A computer is a machine with electronic and electromechanical parts. It is programmable and is capable of performing the following functions:
  - Accepting data (input)
  - Processing data
  - Generating output (information)
  - Storing data/information
  - Retrieving/sending data/information

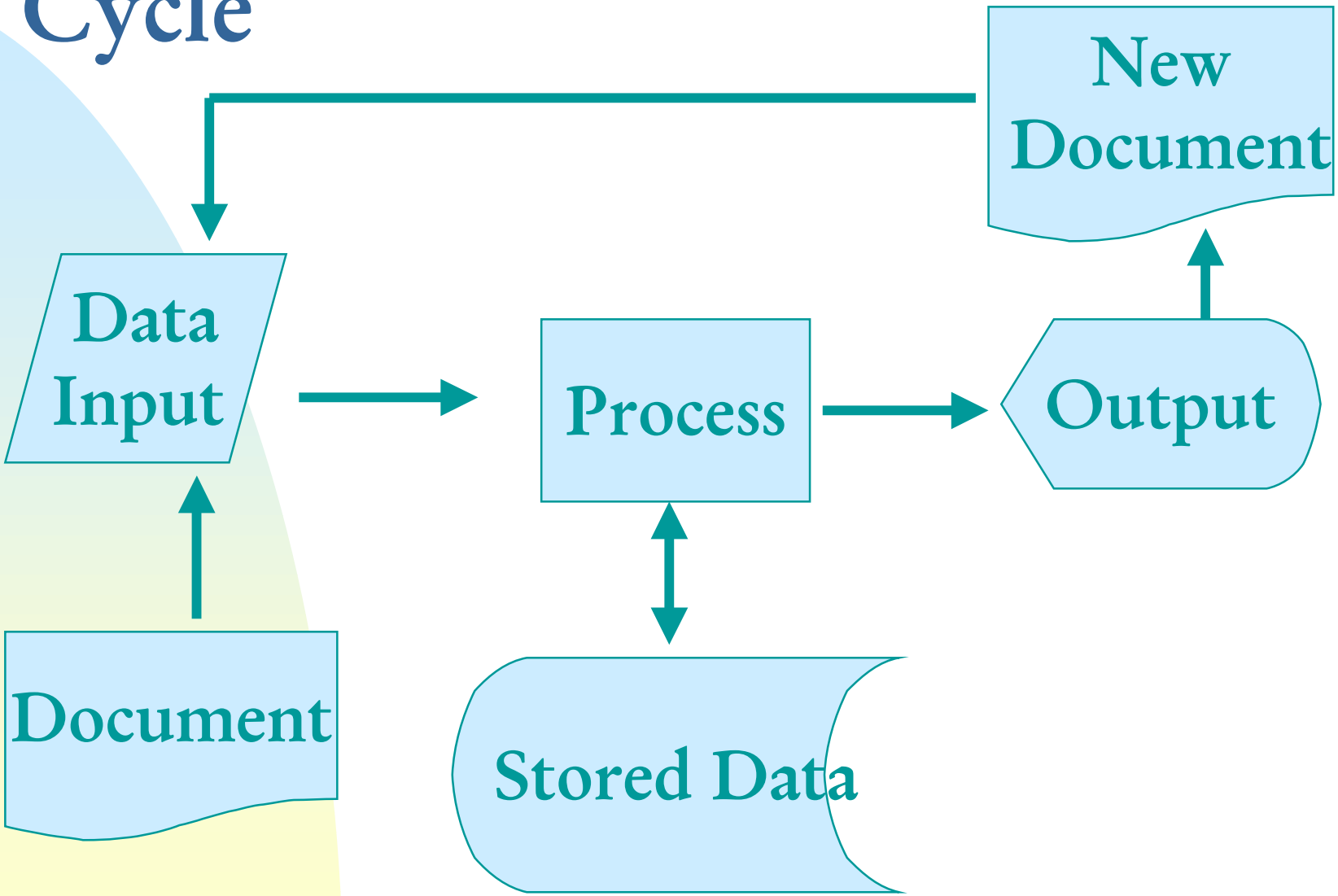
How is Data Processed into Information?



What is the Role of Computers in the Information Cycle?

- Accept data through input devices
- Process data using microprocessors
- Store data for interactive use in the RAM and for longer periods of storage in the ROM and hard disks
- Output data through output devices.

The Information Processing Cycle



Elements of a Computer System(1)

1. People - the most important part and beneficiary of a computer system, generally categorized as either end-users or developers
2. Procedures - are descriptions of how things are done, i.e. manuals, documentation, …
3. Data/Information - raw facts (data) and processed data (information) that are used to produce the desired result

Elements of a Computer System(2)

4. Hardware - the physical elements of a computer system categorized according to the basic operations they perform: input, processing, output, storage and communications.
5. Software - provides the step by step instructions that tell the computer what to do. Generally software is divided into system software and application software.
6. Communications - refers to the electronic transfer of data from one place to another

How is Data Represented in the Computer?

Computers represent data as two-state systems. This means that the computer recognizes only two numbers, 0 and 1. Larger numbers, letters and special characters are formed using combinations of 0 and 1. Each of these two numbers is called a **bit** from the words **b**inary dig**it.** The combination of bits to form meaningful characters or numbers is called a **byte.**

What Coding Schemes are Used to form Meaningful Bytes of Data?

- There are usually 8 bits in a byte. The coding scheme ASCII (As-key) and ASCII-8 or extended ASCII has been adopted as a standard by the US government and by computer manufacturers.
- ASCII can have 128 combinations of 7 bits each, while ASCII-8 can have as many as 1256 combinations

Development of Computers

- The beginning of the commercial computer age began on June 14, 1951 with the delivery of UNIVAC - Universal Automatic Computer - to the US Bureau of Census
- Prior to this, however, Charles Babbage invented the Difference Engine and conceived of another machine called the Analytical Engine. The latter had all the components of the computer: input, output, processing and storage. Babbage is called the father of computers.

What are the Computer Generations? (1)

- First generation, 1951-1958: Vacuum tubes were used as the internal computer components, punched cards and magnetic tapes for storing data, and machine language for programming.
- Second generation, 1959-1964: Transistors replace vacuum tubes, assembly languages and high level languages replaced machine languages, and the removable disk pack replaced punched cards. Transistors enabled manufacturers to produce smaller computers.

What are the Computer Generations? (2)

- Third generation, 1965-1970: Integrated circuits (ICs) developed. ICs led to the production of even smaller computers called mini computers. Software became more sophisticated.
- Fourth generation, 1971-present. The microprocessor or computer on a chip was developed. This led to Personal Computers (PCs)
- Fifth generation, present and beyond. Includes recent and emerging technologies, (voice recognition, artificial intelligence, neural systems, quantum computers, etc.)

What are the Different Types of Computer Systems?

- In general, computers are sorted according to physical size and processing power.
- The different types are: Supercomputer, Mainframe, Minicomputer, Microcomputer (Desktop,Laptop, Notebook, Palmtop), Microcontroller

What are the Advantages of Using Computers for Data Processing?

- Faster data input, processing and retrieval
- Tireless--can work 24 hours a day, 7 days a week
- Less prone to error
- Produce output requirements easily
- Can send and retrieve data from other computers if in a network

What are some Disadvantages of Using Computers?

- Require skilled manpower for design, programming and data encoding
- Require electricity
- Require air conditioning for non-stop work
- Expensive to acquire and maintain
- Require frequent upgrade due to fast developments in hardware and software
- Require regular staff training

What are some General Trends in Computers?

- Moore's Law: Computing power doubles approximately every 18 months
- Faster processors
- Bigger storage capacity
- Bigger memory
- Stand alone>>>Network>>>Distributive computing
- Software bloat
- Lower cost

What are some General Trends in Hardware?

- Downsizing and right sizing: Mainframe >>> PC>>Pocket PC
- Increasing memory: RAM 1MB to at least 256 MB
- Increasing storage: Hard disk now in GB
- Increasing processor speed: PC XT to Pentium 4
- Increasing storage capacity of auxiliary devises. Diskette to high capacity flash disks

What are some General Trends in Software?

- More sophisticated software
- Bigger storage requirement
- Bigger memory requirement
- More user-friendly operating system
  - DOS to Windows
- Use of open-source software
  - Operating system-- Linux
  - Database management system—MRSQL
  - Library Management System—phpMylibrary, WebISIS

Conclusion

Computers are reliable and efficient tools for data processing and information retrieval.There are advantages and disadvantages in using them. The efficiency of these tools is dependent on the specifications of the computer hardware, the software, database design and the user.