IO INTERFACE

COMPUTER ORGANIZATION&ARCHITECTURE

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2020-21

IO INTERFACE

- NEED FOR IO INTERFACE

  - communication b/w CPU &Peripherals

- IO INTERFACE

  -h/w component b/w CPU & Peripherals

- IO BUS & INTERFACE MODULES

  -Synchronization,Decode

- IO COMMAND

  -received by Interface

Introduction

- The input-output subsystem of a computer, referred to as I/O, provides an efficient mode of communication between the central system and the outside environment.

- Programs and data must be entered into computer memory for processing and results obtained from computations must be recorded or displayed for the user.

- A computer serves no useful purpose without the ability to receive information from an outside source and to transmit results in a meaningful form.

NEED FOR I/O INTERFACE

- Input-output interface provides a method for transferring information between internal storage and external I/0 devices.
- Peripherals connected to a computer need special communication links for interfacing them with the CPU to resolve the differences between the central computer and each peripheral
- The major differences are:
  - Peripherals are electromechanical and electromagnetic devices CPU and memory are electronic devices. Therefore, a conversion of signal values may be required.
  - The data transfer rate of peripherals is usually slower than the transfer rate of the CPU, and a synchronization mechanism may be needed.
  - Data codes and formats in peripherals differ from the word format in the CPU and memory.
  - The operating modes of peripherals are different from each other and each must be controlled so as not to disturb the operation of other peripherals connected to the CPU.

I/O INTERFACE

- To resolve the differences between peripherals and cpu ,computer systems include special hardware components between the CPU and peripherals to supervise and synchronize all input and output transfers.
- These components are called interface units because they interface between the processor bus and the peripheral device

The magnetic disk, printer, and terminal are employed in practically any general-purpose computer.

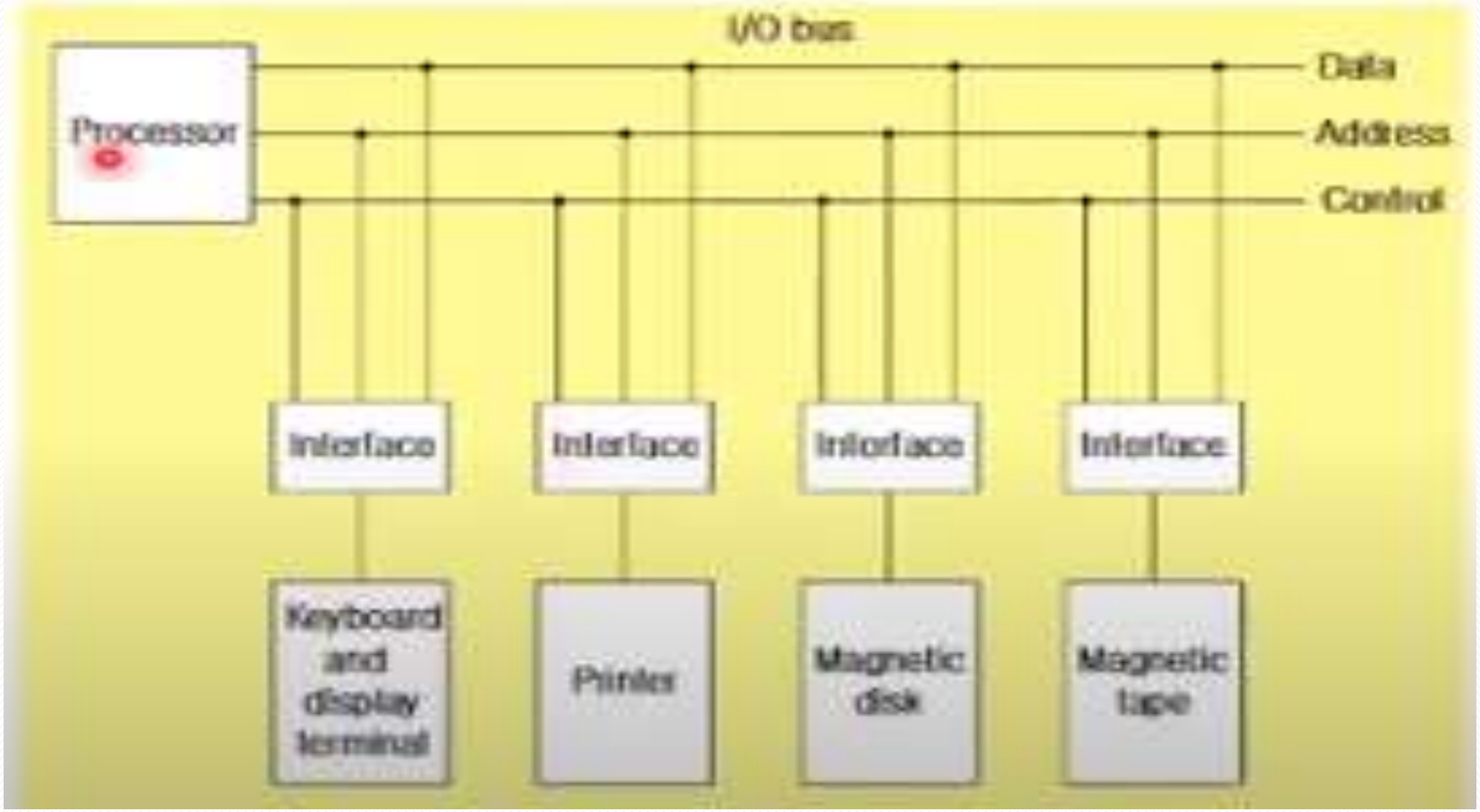
The magnetic tape is used in some computers for backup storage.

Each peripheral device has associated with it an interfaceunit.

Each interface decodes the address and control received from the I/O bus, interprets them for the peripheral, and provides signals for the peripheral controller.

It also synchronizes the data flow and supervises the transfer between peripheral and processor.

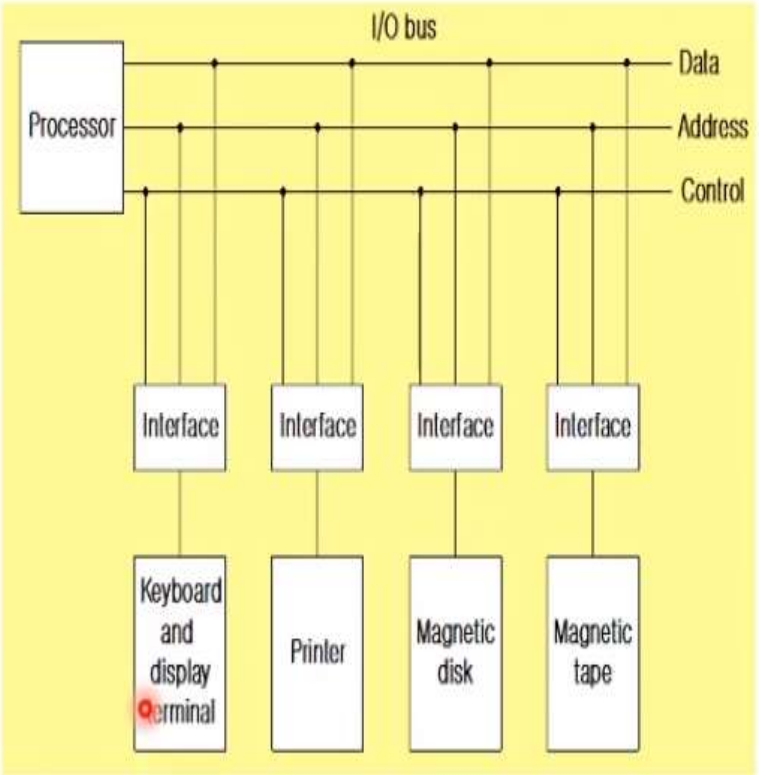
I/O BUS&INTERFACE



- Each peripheral has its own controller that operates the particular electromechanical device.
- For example, the printer controller controls the paper motion, the print timing, and the selection of printing characters.
- A controller may be housed separately or may be physically integrated with the peripheral.

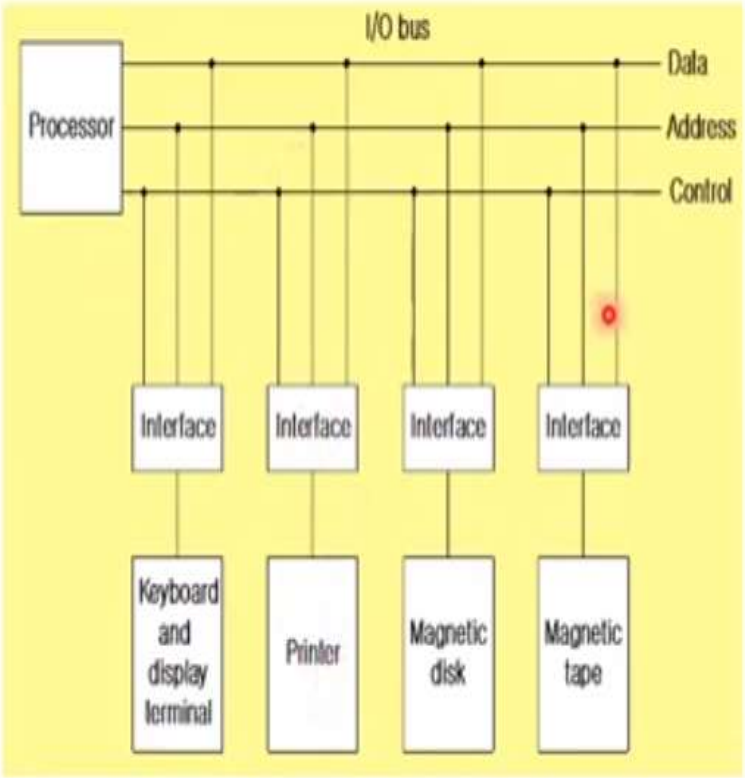
I/O BUS AND INTERFACE MODULES

- The 1/0 bus consists of data lines, address lines, and control lines
- Each peripheral device has associated with it an interface unit.
- Each interface decode the address and control received from the IO bus, interprets them for the peripheral, and provides signals for the peripheral controller.
- It also synchronizes the data flow and supervises the transfer between peripheral and processor.
- Each peripheral has its own controller that operates the particular electromechanical device



I/O BUS AND INTERFACE MODULES

- To communicate with a particular device, the processor places a device address on the address lines.
- Each interface attached to the I/0 bus contains an address decoder that monitors the address lines.
- When the interface detects its own address, it activates the path between the bus lines and the device that it controls.
- All other peripherals are disabled by their interface



- At the same time that the address is made available in the address lines, the processor provides a function code in the control lines.
- The interface selected responds to the function code and proceeds to execute it

I/O COMMAND

- The processor provides a function code in the control lines.
- The function code or **IO command** is an instruction that is executed in the interface and its attached peripheral unit.
- There are four types of commands that an interface may receive
  - **control command** is issued to activate the peripheral and to inform it what to do
  - **status command** is used to test various status conditions in the interface and the peripheral
  - **data output command** causes the interface to respond by transferring data from the bus into one of its registers.
  - **data input command** allows the interface to receive an item of data from the peripheral and places it in its buffer register.

control command

A control command is issued to activate the peripheral and to inform it what to do.

For example, a magnetic tape unit may be instructed to backspace the tape by one record, to rewind the tape, or to start the tape moving in the forward direction.

The particular control command issued depends on the peripheral, and each peripheral receives its own distinguished sequence of control commands, depending on its mode of operation

status command

A status command is used to test various status conditions in the interface and the peripheral.

For example, the computer may wish to check the status of the peripheral before a transfer is initiated.

During the transfer, one or more errors may occur which are detected by the interface.

These errors are designated by setting bits in a status register that the processor can read at certain intervals.

data output command

A data output command causes the interface to respond by transferring data from the bus into one of its registers.

Consider an example with a tape unit.

The computer starts the tape moving by issuing a control command. The processor then monitors the status of the tape by means of a status command. When the tape is in the correct position, the processor issues a dataoutput command.The interface responds to the address and command and transfers the information from the data lines in the bus to its buffer register.The interface then communicates with the tape controller and sends the data to be stored on tape.

data input command

- The data input command is the opposite of the data output. In this case the interface receives an item of data from the peripheral and places it in its buffer register. The processor checks if data are available by means of a status command and then issues a data input command.
- The interface places the data on the data lines, where they are accepted by the processor

I/O VERSUS MEMORY BUS

- In addition to communicating with I/O, the processor must communicate with the memory unit.
- Like the I/O bus, the memory bus contains data, address, and read/write control lines.
- There are three ways that computer buses can be used to communicate with memory and I/O:

- 1. Use two separate buses, one for memory and the other for I/O.
- 2. Use one common bus for both memory and I/O but have separate control lines for each.
- 3. Use one common bus for memory and I/O with common control lines.

- In the first method, the computer has independent sets of data, address, and control buses, one for accessing memory and the other for I/O.

- This is done in computers that provide a separate I/O processor (IOP) in addition to the central processing unit (CPU).

- The memory communicates with both the CPU and the IOP through a memory bus.
- The IOP communicates also with the input and output devices through a separate I/O bus with its own address, data and control lines.
- The purpose of the IOP is to provide an independent pathway for the transfer of information between external devices and internal memory

Conclusion

- Note:

  The computer treats an interface register as being part of the memory system.

  The assigned addresses for interface registers cannot be used for memory words, which reduces the memory address range available.

- The interface may operate with an output device or with an input device, or with a device that requires both input and output.