Lecture 08

Interfacing Fundamentals

Issues

- Definition of interface
- Components of an interface
- Interface types
- Data transfer Schemes

Definitions

Interface

- A shared boundary between system elements defined by:
  - ✓*common physical interconnection characteristics*
  - ✓*signal characteristics and*
  - ✓*meanings of interchanged signals.*

Definitions…*cntd*

Interface Device

- A device that meets the interface specifications on one side of an interface.

- Usually refers to a device through which a system or equipment works to meet the interface specifications.

e.g. data terminal equipment(DTE), such as a modem

Definitions…*cntd*

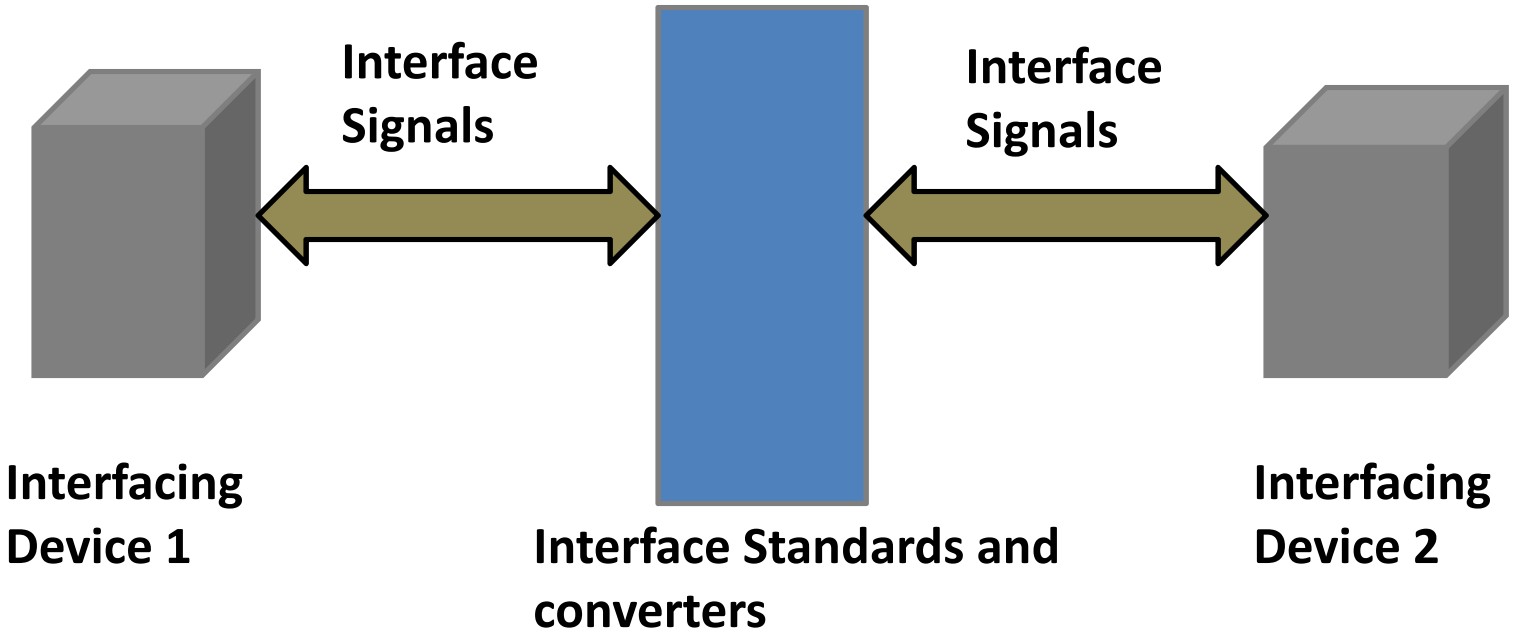
Interface Specification

- Also referred to as Interface standard or protocol

- A set of technical requirements that must be met at an interface.

These standards are usually set by international Associations and institutions.

Components of an interface



Components…*cntd*

Interfacing of two devices require processing the interfacing signals based on the type of devices used.

e.g consider the EIA standard RS-232 interface :

- ✓ *It's usually used if the interfacing devices are computer terminals:*
- ✓ *The RS-232 standard uses a positive voltage (+10V) for logic '1' and a negative voltage (-10V) for logic '0'*

Components…*cntd*

- These signals are called as standard CMOS signals.

✓ But most of the other motherboard signals and interfacing circuit signals use TTL signals.

- A CMOS to TTL converter is mandatory at these interfaces.

✓ The interfacing devices should make use of standard **data transfer schemes** for the efficient exchange of data.

Data Transfer Schemes

- In a typical microcomputer, data transfer takes place between any two devices:
  - microprocessor and memory
  - microprocessor and I/O devices
  - memory and I/O devices
- For effective data transfer between these devices, the timing parameters of the devices should be matched.

Data Transfer Schemes…II

For example:

- ✓an I/O device may be slower than the processor due to which, it cannot send data to the processor at the expected time.

- ✓slow memories can be interfaced using additional hardware to introduce wait states in machine cycles.

Several data transfer schemes have been developed to solve these interfacing problems.

Data Transfer Schemes…III

Broadly, we can have two types of data transfer

- ❑ Programmed data transfer
- ❑ Direct Memory Access (DMA) data transfer

Both schemes require hardware and software for their implementation.

Data Transfer Schemes…IV

Programmed data transfer

- ✓ a memory resident subroutine requests the device for data transfer to or from one of the processor registers.

- ✓ Used when a relatively small amount data are to be transferred.
  - ➢ *usually one byte or word of data is transferred at a time.*

E.g. Hex keyboard, 7-segment LED, ADC, etc.

Data Transfer Schemes…V

Programmed data transfer…II

- ✓ We can divide programmed data transfer in to three categories
  - ❑ Asynchronous data transfer
  - ❑ Synchronous data transfer
  - ❑ Interrupt driven data transfer

Programmed Data Transfer

Asynchronous data transfer

✓ These are transfers taking place at irregular intervals.

✓ Mostly used in low speed data transmission.

Data transfer between the microprocessor and the Peripherals is primarily asynchronous.

Since devices are not synchronized, the data transfer takes place under several conditions:

Programmed Data Transfer…II

Asynchronous data transfer…II

1. Unconditional:

   The microprocessor assumes that a peripheral is always available.

2. Polling

   The microprocessor is kept in a loop to check whether data are available.

3. Interrupt

   The microprocessor is interrupted from its normal execution of program by an I/O device.

Programmed Data Transfer…III

Asynchronous data transfer…III

4. With ready signal:

When peripheral response time is slower than the microprocessor execution time, READY signal is used.

5. With handshake signals

- Handshake signals are signals exchanged prior to data transfer.
- Ensure readiness of the peripheral and to synchronize timing of data transfer

Programmed Data Transfer…IV

Synchronous data transfer

- ✓ Is the simplest of all data transfer schemes.
- ✓ The processor does not check the readiness of the device. The I/O device or peripheral should have matched timing parameters.
- ✓Mostly used in high speed data transfers

Programmed Data Transfer…V

Interrupt-driven data transfer

- ✓ Is the best method of data transfer for effectively utilizing the processor time.
- ✓ When the IO device is ready, it will interrupt the processor.
- ✓Upon receiving an interrupt request the processor will complete the current instruction execution and serve the request after the acknowledge cycle.

DMA Data Transfer

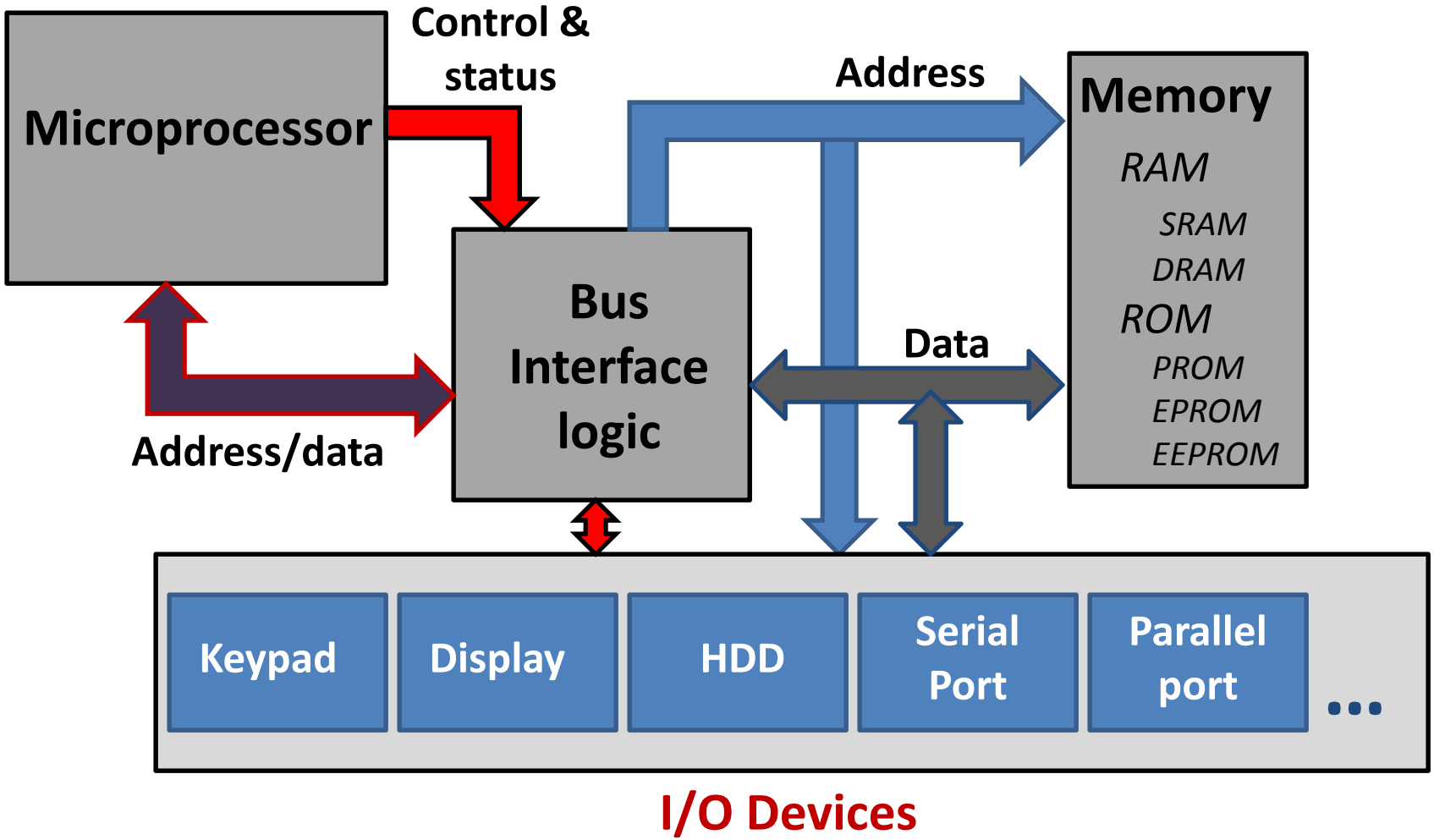
- ✓ DMA is preferred when a large block of data is to be transferred.
- ✓ The processor is forced to hold state by an I/O device until the data transfer between the device and the memory is completed.
- ✓ Usually employed for transferring data between the microprocessor and peripheral mass storage devices like hard disk and CRT controller.

DMA Data Transfer

We can have 3 types of DMA data transfer schemes:

1. *Cycle stealing DMA.*
2. *Block or Burst mode DMA.*
3. *Demand transfer mode DMA.*

Typical Microcomputer BD



Microcomputer

The figure shows the complete microcomputer board:

- ✓ Microprocessor (8086, 8088,…)
- ✓ Semiconductor memory (RAM, ROM,…)
- ✓ I/O devices and their controllers
- ✓ Bus interface controller

  made of gates, buffers, decoders, muxs …

In the coming lectures we will discuss the details of interfacing these different devices with the microprocessor