Microprocessor & Interfacing
Lecture 29
8259
Programmable Interrupt Controller--2

ECS DEPARTMENT
DRONACHARYA COLLEGE OF ENGINEERING

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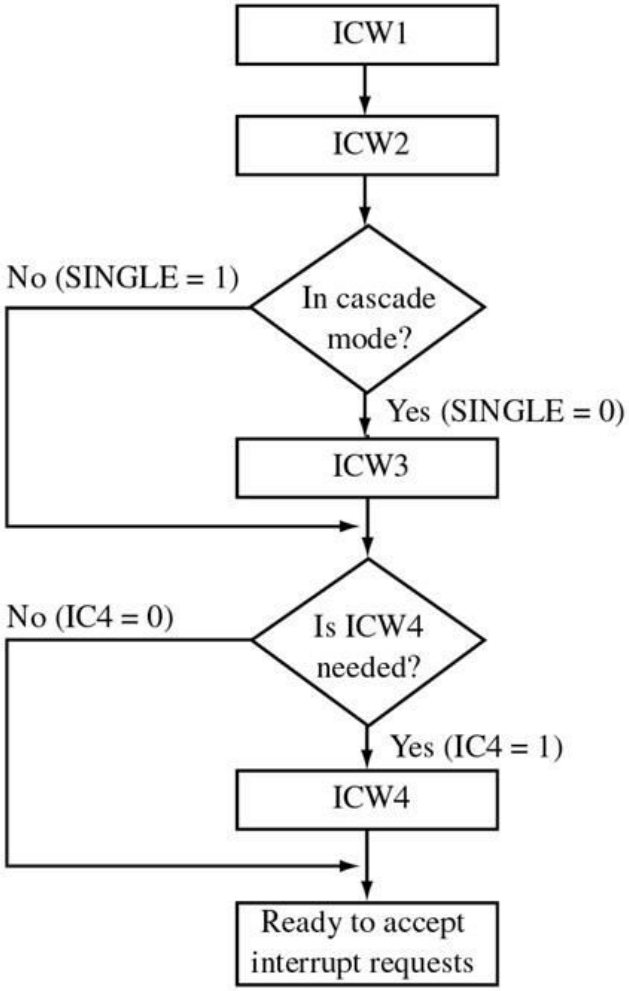
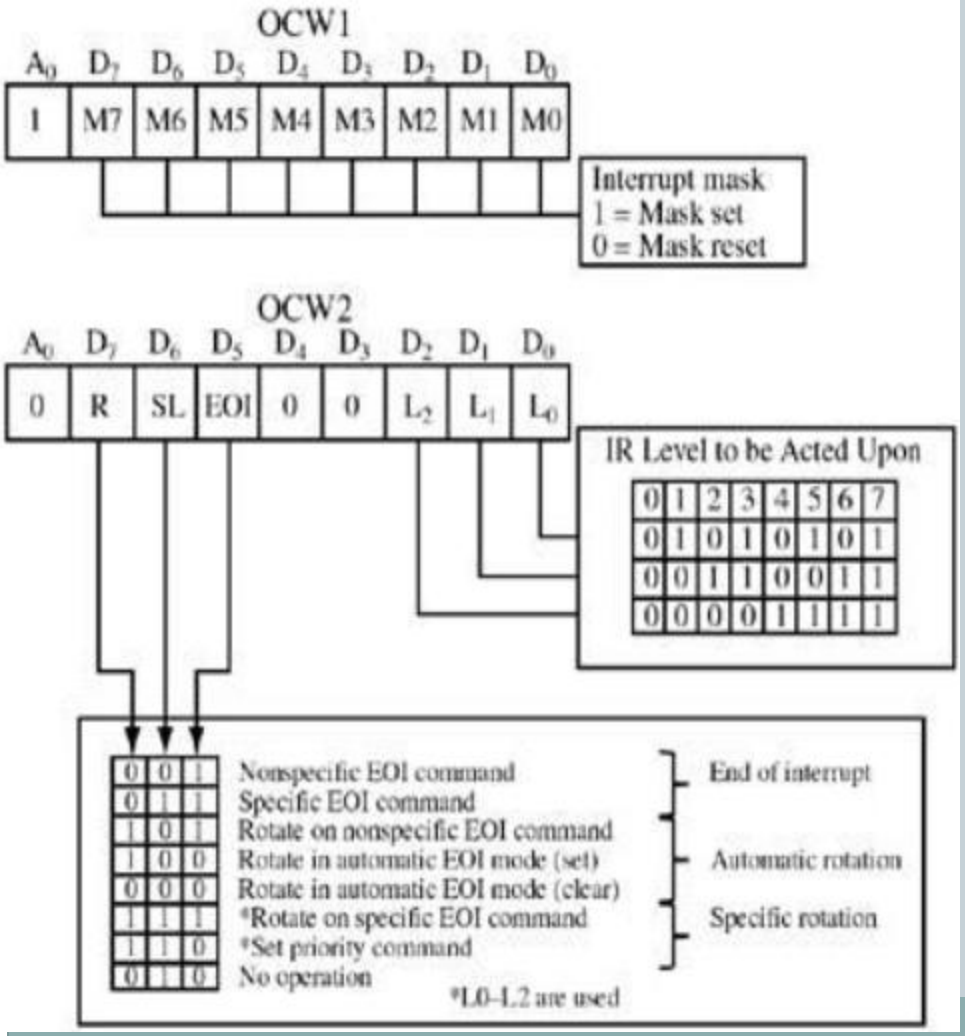
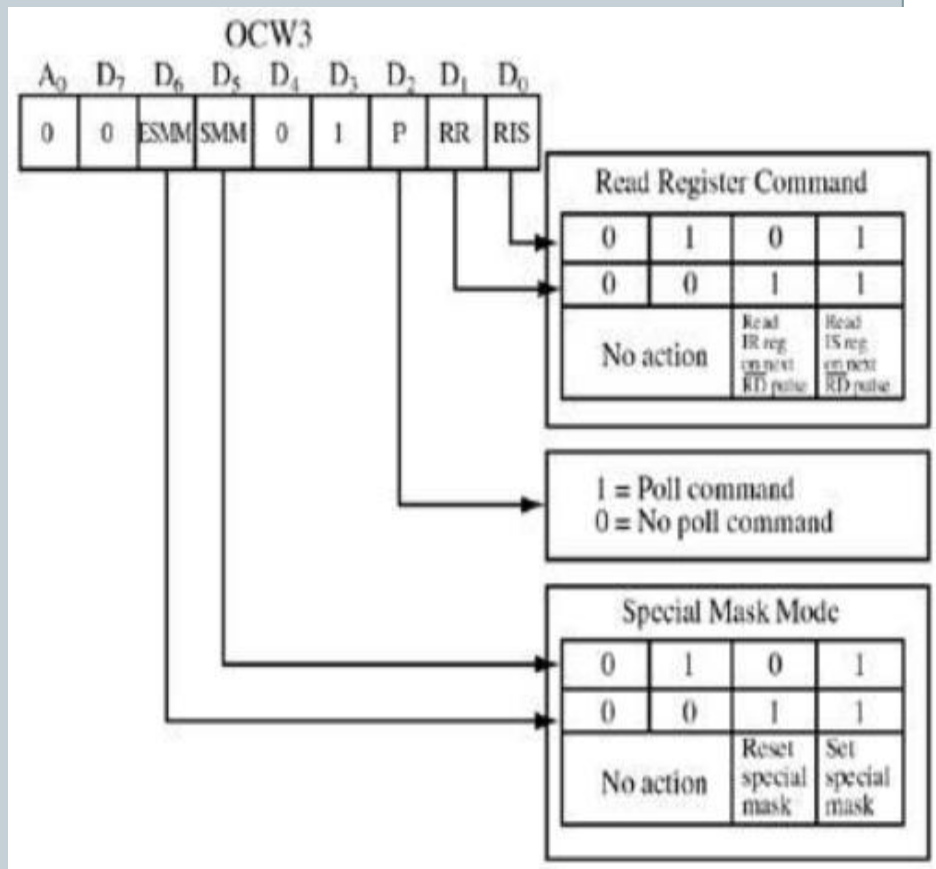
Modes

- Fully Nested mode
- Special Fully Nested mode
- Nonspecific Rotating
- Specific Rotating
- Special Mask
- Polling

8259A Initialization Sequence



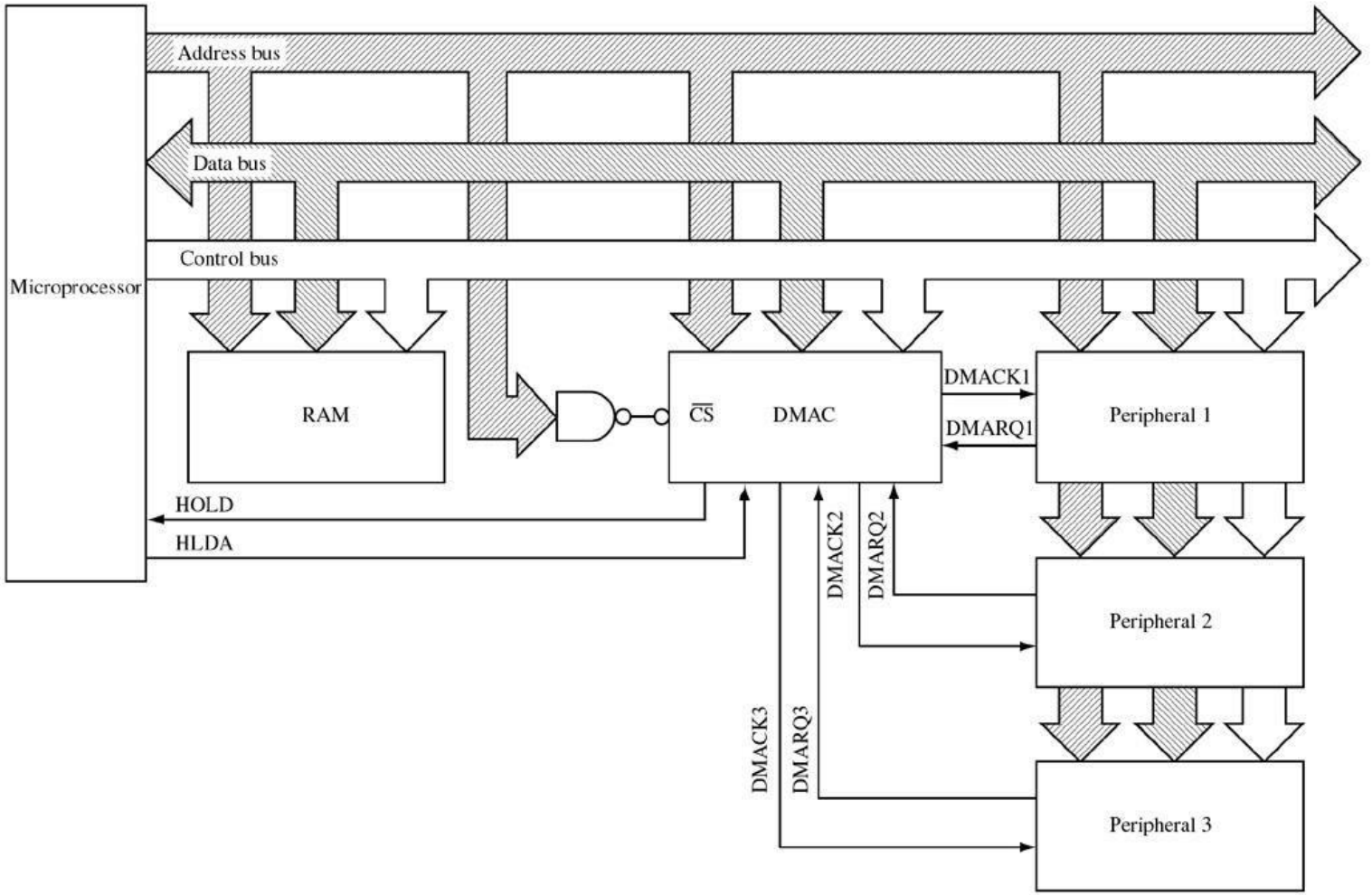

OCW1
A0 D7 D6 D5 D4 D3 D2 D1 D0
1 M7 M6 M5 M4 M3 M2 M1 M0
Interrupt mask
1 = Mask set
0 = Mask reset
OCW2
A0 D7 D6 D5 D4 D3 D2 D1 D0
0 R SL EOI 0 0 L2 L1 L0
IR Level to be Acted Upon
0 1 2 3 4 5 6 7
0 1 0 1 0 1 0 1
0 0 1 1 0 0 1 1
0 0 0 0 1 1 1 1
0 0 1 Nonspecific EOI command
0 1 1 Specific EOI command
1 0 1 Rotate on nonspecific EOI command
1 0 0 Rotate in automatic EOI mode (set)
0 0 0 Rotate in automatic EOI mode (clear)
1 1 1 *Rotate on specific EOI command
1 1 0 *Set priority command
0 1 0 No operation
End of interrupt
Automatic rotation
Specific rotation
*L0-L2 are used


OCW3
A0 D7 D6 D5 D4 D3 D2 D1 D0
0 0 ESMM SMM 0 1 P RR RIS
Read Register Command
0 1 0 1
0 0 1 1
No action
Read IR reg on next RD pulse
Read IS reg on next RD pulse
1 = Poll command
0 = No poll command
Special Mask Mode
0 1 0 1
0 0 1 1
No action
Reset special mask
Set special mask

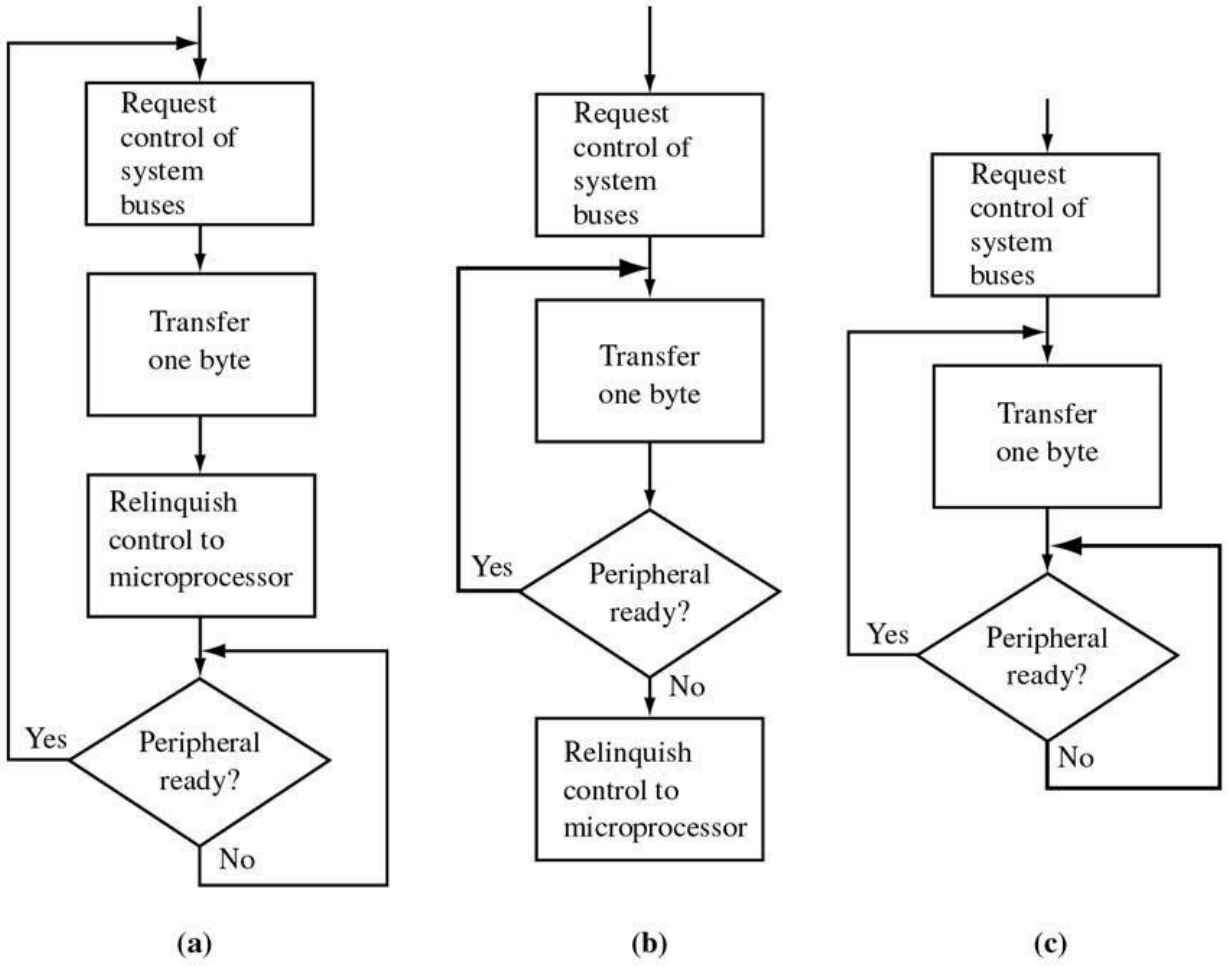
DMA

- Direct Memory Access.
- In memory-memory or memory-peripherals communication, the processor is a “middleman” which is not really needed.
- Used with HOLD HOLDA signals.
- DMA requires another processor - The DMA Controller or DMAC- to generate the memory and I/O addresses.
- 8237 is a DMAC.
- In IBM PC, 8237 was used to speed up the read or write operation by the slow 8088 processor.
- Nowadays, It is usually used by sound cards and by memory controllers to generate row address for refreshing.

DMA Controller allows the peripheral to interface directly with memory without processor intervention



Modes of DMA Operation: a) byte, b) burst, c) block



I/O Summary

- Three ways to synchronize the processor to data rate of peripherals:

1- Polling: which provides a fast response but it the processor recourses are dedicated to one peripheral.

2- Interrupt approach: is much more efficient. the processor only services the peripheral when data is required. Requires high software overhead.

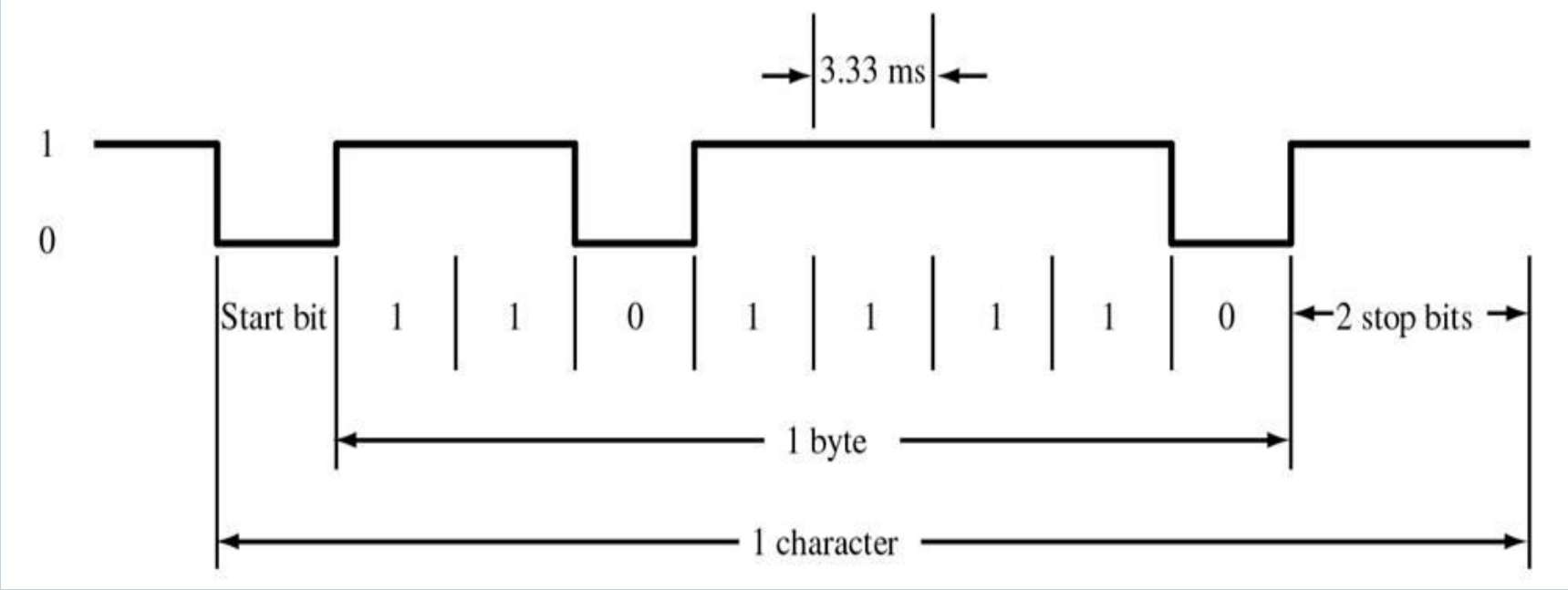
3- DMA is a third solution but it increases the complexity of the hardware system.

Serial I/O

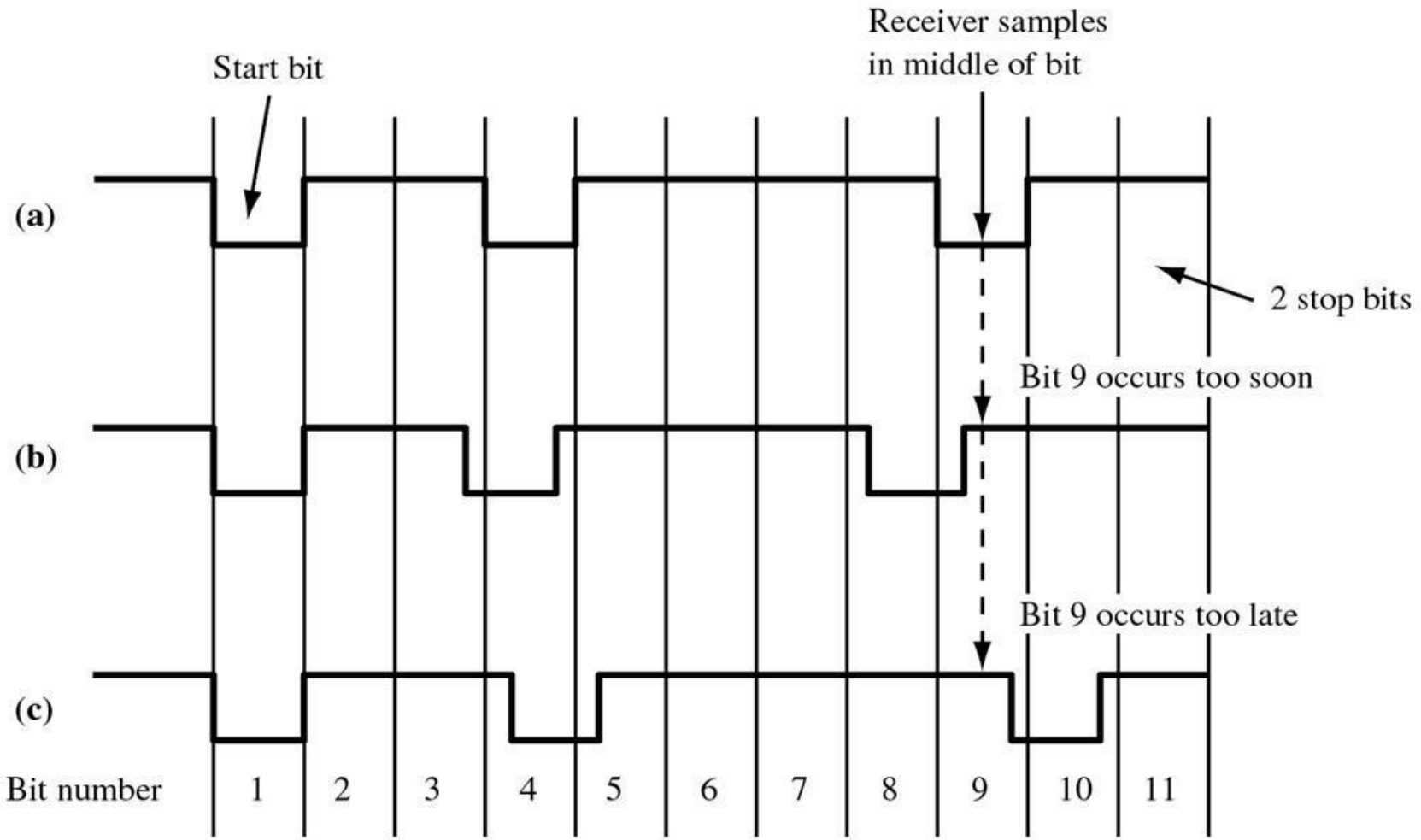
- Microprocessors are by nature parallel machines. They transmit/receive data in parallel bits (8,16,32,64).
- It is required sometimes to send the data serially (one bit at a time).
- Serial transmitting is slower but requires less wires and it is easier to send it for long distances.

Synchronous vs Asynchronous

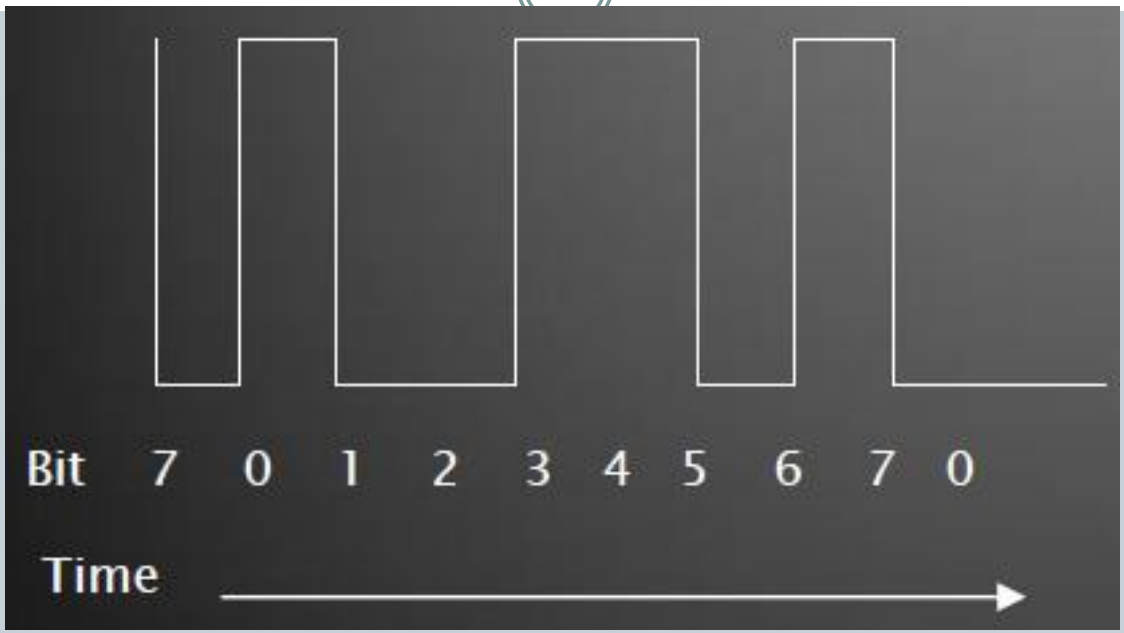
- Asynchronous : Start bits, Stop bits, and Data
- Ex: the data byte is 7BH:



a) Serial Data transmitted at proper rate
b) Data rate too fast
c) Data rate too slow

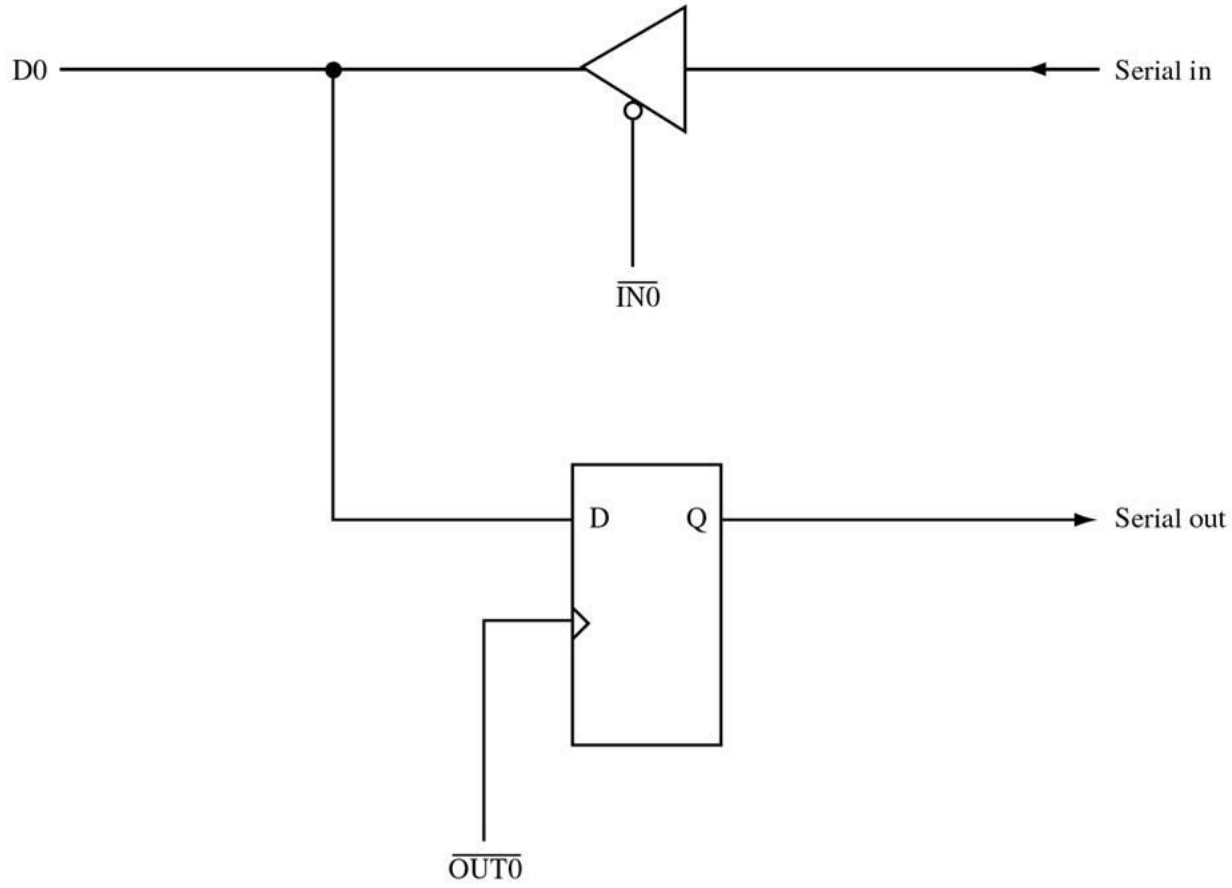


Serial frame (Synchronous)



- No start or stop bits, timing synchronized with special ASCII characters (SYN)

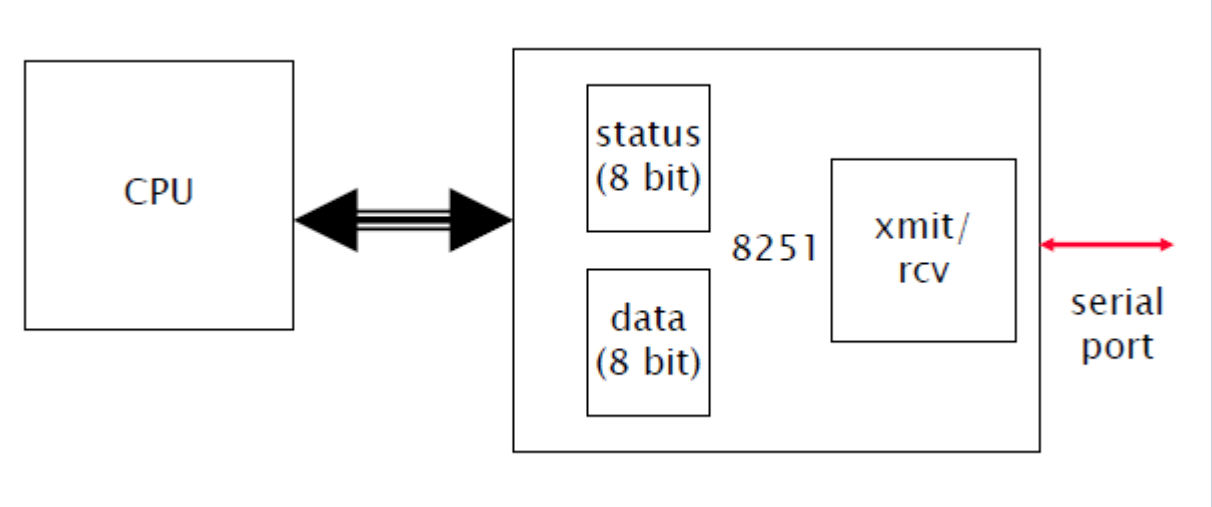
One-bit input and output port (with appropriate software this circuit can function as a serial I/O channel



UART/USART

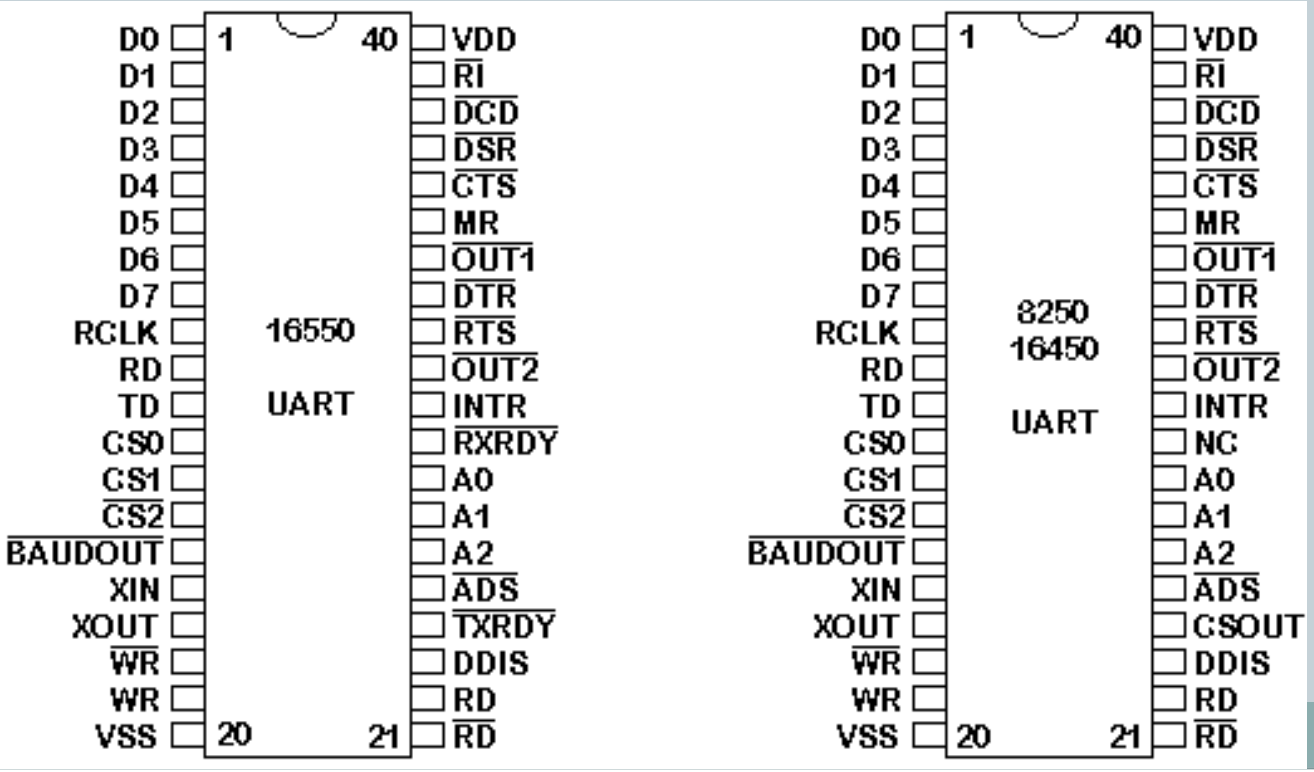
- Writing a program compatible with all different serial communication protocols is difficult and it is an inefficient use of microprocessor.
- UART:
  - Universal Asynchronous Receiver/Transmitter chip.
- USART:
  - Universal Synchronous/Asynchronous Receiver/Transmitter chip.
- The microprocessor sends/receives the data to the UART in parallel, while with I/O, the UART transmits/receive data serially.
- So, the UART appears to the microprocessor to be a conventional parallel port.
- 8251 functions are integrated into standard PC interface chip.

UART-CPU Interface



UART/USART

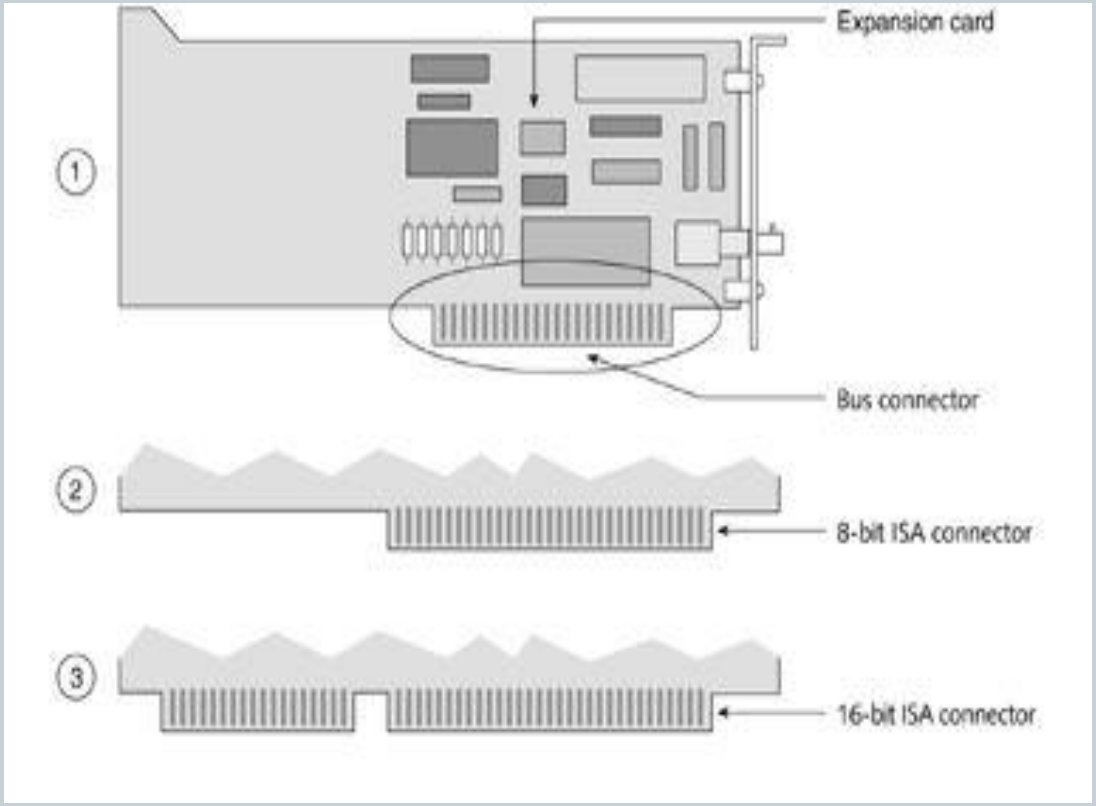
- 8251 USART
- 8250/16450 UART is a newer version of 8251.
- 16550 is the latest version UART.

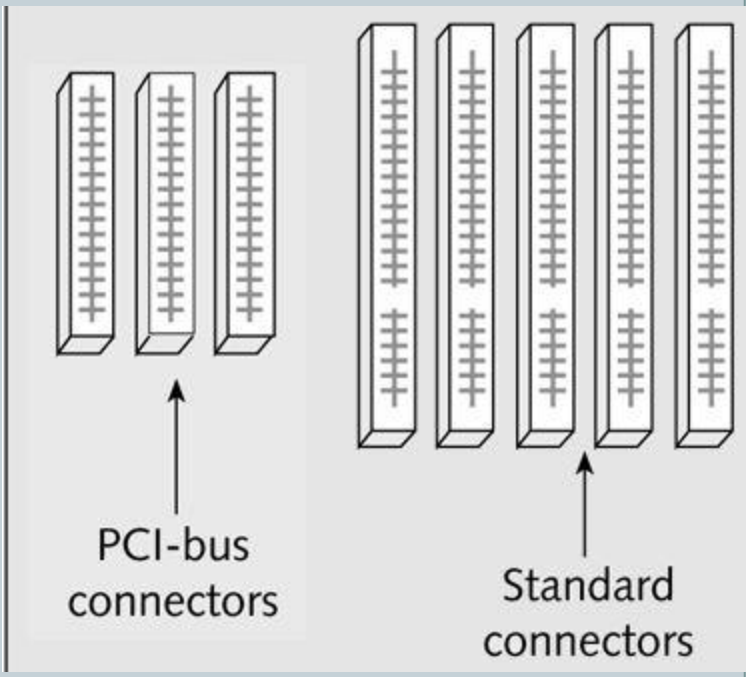


Bus Standards

- ISA (Industry Standard Architecture)
  - 8 or 16 bit, fast disappearing
- PCI (Peripheral Component Interconnect)
  - 32 bit, still widely in use

	ISA	EISA	VL-Bus	PCI
Data path width in bits	8 or 16	32	32	32 or 64
Data bus speed in MHz	5.33 or 8.33	8.33	33	33 or 66
Data throughput in MB/sec	5.33 or 8.33	33	132	132 or 264
Maximum number of slots	8	8	2	4
Bus masters supported	No	Yes	Yes	Yes
Parity checking	No	No	No	Yes


Expansion card
1
Bus connector
2
8-bit ISA connector
3
16-bit ISA connector


PCI-bus connectors
Standard connectors

Graphics Card

- Old cards are ISA or PCI
- Now: AGP (Accelerated Graphics Port)
  - Connects directly to CPU and RAM
  - Fast: 66 MHz on a 32-bit bus
  - No other devices sharing same bus

USB

- Is there any thing going to replace serial ports, parallel ports and some expansion cards?
- Maybe: USB (Universal Serial Bus)
- Features:
  - One type of device cable. USB also standardizes connectors and cables. USB cables have two connectors: an A connector and a B connector. The A connector is the end that goes into the computer, and the B connector goes into the device. The total cable length between devices must not exceed 5 meters, or 16 feet.
  - Operating System support. USB driver support is built into the latest versions of the Windows and Apple operating systems, but Windows 98, Windows 2000, MAC OS 8.1 or higher offer much more USB support.

Cont..

- Two device speeds. Low speed (1.5 Mbps) is mostly used for input devices such as mice and keyboards, while high speed (up to 12 Mbps) is used mostly for video/audio capture devices and storage devices.
- Hot pluggable. Devices can be attached to and detached from the computer without turning off the system. No jumper or IRQ settings are necessary.
- Plug-and-Play. Once the device is connected to the computer, the system automatically recognizes the device connected and installs the appropriate drivers.
- 127 peripherals. USB makes it possible to simultaneously use and connect up to 127 devices to a single bus. The computer typically has 2 USB ports, so USB hubs are used to connect additional devices to the computer. USB hubs have multiple USB ports for connection of USB devices and for daisy chaining one or more hubs.

Cont..

- Bus-powered and self-powered. USB supports both buspowered and self-powered devices. Good examples of buspowered and self-powered devices are USB hubs. USB hubs can draw power either from the host device (bus-powered) or from an external AC power supply (self-powered). Each downstream port on a bus-powered hub typically supplies up to 100 mA. On the other hand, each downstream port on a self-powered hub typically supplies up to 500mA.