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SERIAL ASYNCHRONOUS TRANSFER & PROGRAMMED IO

By: Vishvadeep Gothi

VISHVADEEP GOTHI SIR

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**ME from IISc Bangalore
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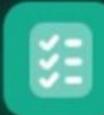
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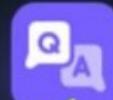
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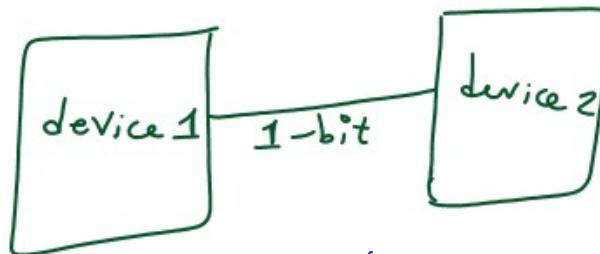
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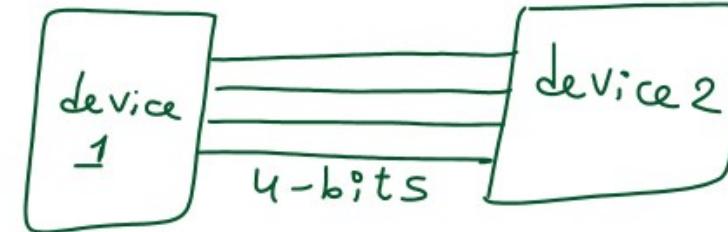
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Serial vs Parallel Transfer



Serial (less costly,
slow)



Parallel (more costly,
fast)

④ devices are within the same computer.

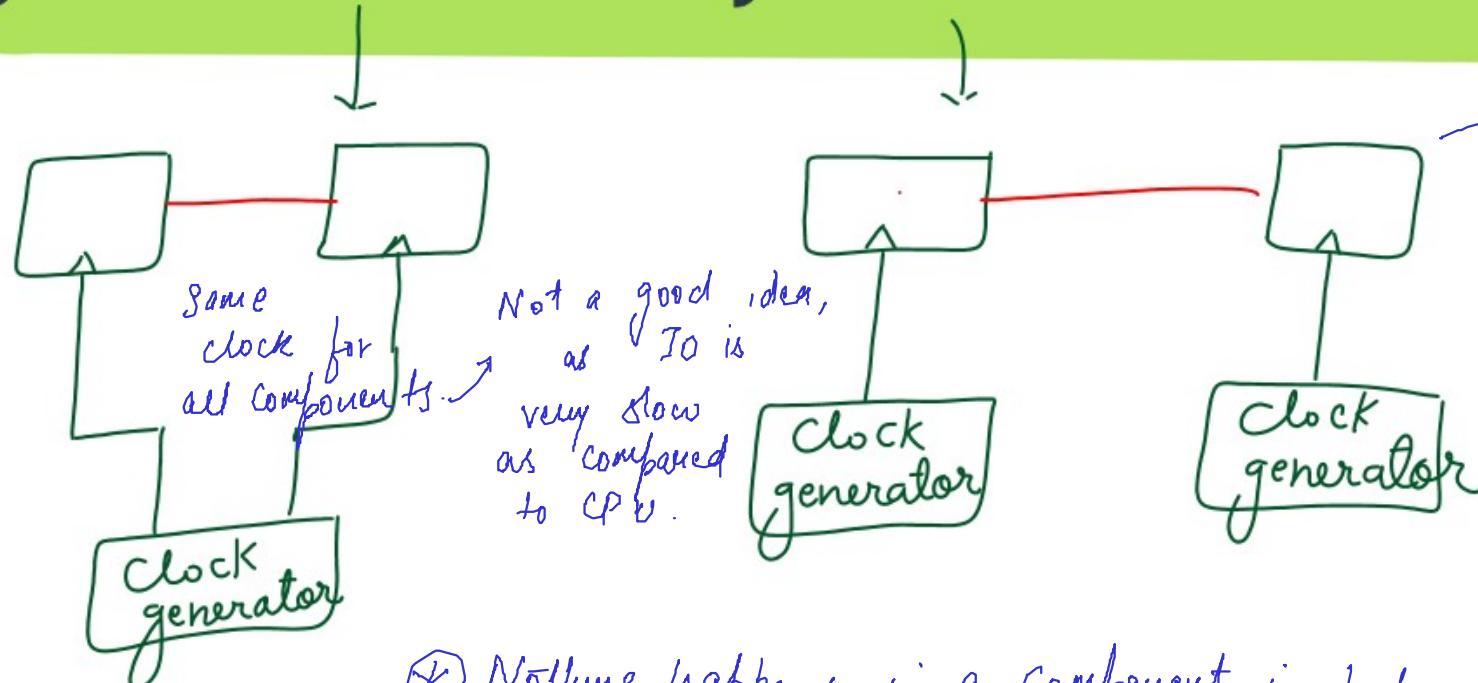
④ In Computer Networks, we use different kinds of channels in which a line may contain multiple bits at
 ↳ single ↳ the same time. !!!



→ See Bandwidth - Delay Product for further information

④ Within a computer, generally, only 1 bit may be present on a line.
at any given time.

Synchronous vs Asynchronous Transfer

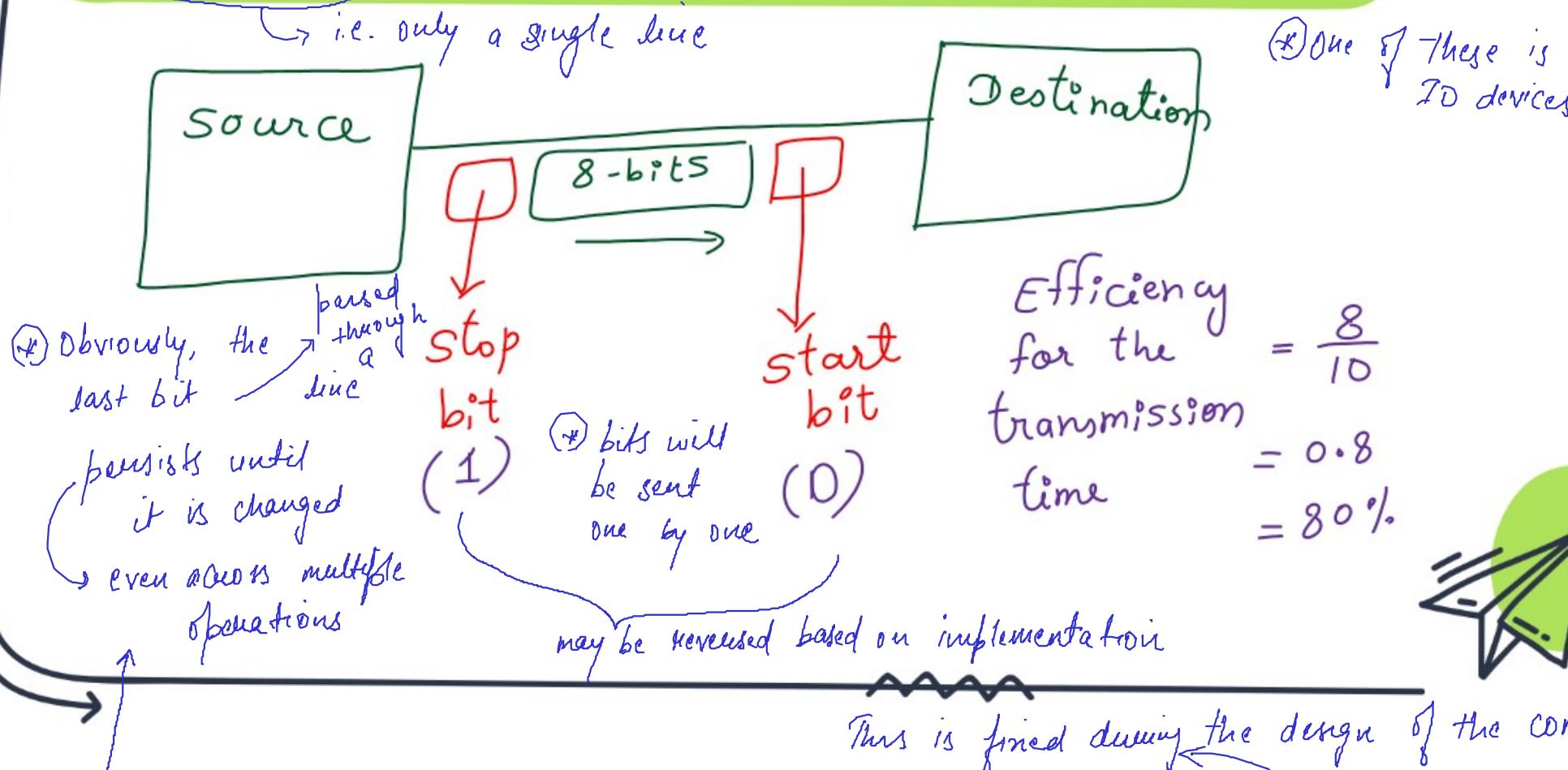


→ other methods of synchronization are neg.
different clocks for different components according to their speeds.

(*) Nothing happens in a component in between two clock pulses.



Serial Asynchronous Transfer



Serial Asynchronous Transfer

- X No transfer means '1' state
- X '0' (start bit) detected means transmission started
- X Character bits follow start bit
- X After last bit of character '1' (stop bit) will be sent

*and it will
persist .*



Ans = 800 char/sec

Question

How many 8-bit characters can be transmitted per second over 9600 bits/second serial communication link using a parity synchronous mode of transmission with 1 start bit, 8 data bits, 2 stop bits and 1 parity bit?

$$\text{Bits for 1 character} = 1 + 8 + 2 + 1 = 12 \text{ bits}$$

$$\text{chars/sec} = \frac{9600}{12} = 800 \text{ char/sec}$$

→ assuming that the bits are getting transferred one by one.



Ans = 4800

Question

An asynchronous serial communication is employing 8-character bits, 1 parity bit, 2 start bits and 1 stop bit. To maintain a rate of 400 char/sec the minimum transfer rate should be required is _____ bits/sec?

$$\text{bits per character} = 8 + 1 + 2 + 1 = 12 \text{ bits}$$

$$\text{for 400 chars} \Rightarrow 400 * 12 \text{ bits} = 4800 \text{ bits/sec}$$

(*) Again, assuming bit by bit transfer.



Question

~~How many~~ 8-bit characters can be transmitted using a parity synchronous mode of transmission with 1 start bit, 8 data bits, 2 stop bits and 1 parity bit. What is the efficiency of the transmission line?

$$\text{Efficiency} = \frac{\text{Data or character bits}}{\text{Total bits per char}} = \frac{8}{8+1+2+1} = \frac{8}{12}$$

\downarrow
Required to be sent

$$= 0.66$$
$$= 66.67\%$$



Types / Modes of Transfer → with I/O devices.

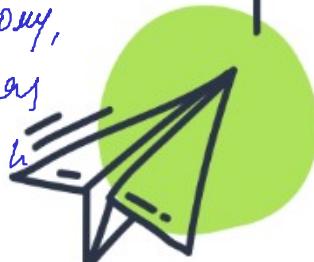
- Programmed I/O or Program controlled I/O
- Interrupt Initiated I/O
- Direct Memory Access (DMA)

For e.g., transferring
kernel from hard disk to RAM

Between I/O & Memory

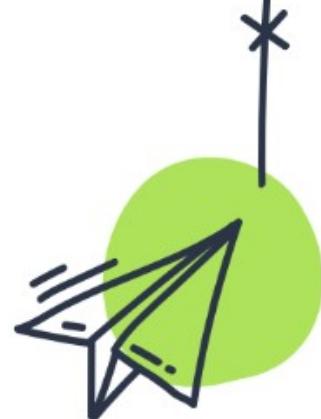
b/w CPU &
I/O

For transfer between
I/O and memory,
the data has
to go through
the CPU!



Modes of Transfer

1. Programmed IO **or** Program Controlled IO → also known as polling
2. Interrupt Driven IO **or** Interrupt Initiated IO
3. Direct Memory Access (DMA)



Programmed IO



Programmed IO

1. There is no any provision through which IO can inform to CPU about data transfer
↳ directly
2. IO sets its own status and waits
3. CPU runs program periodically and checks the status of each device one-by-one
4. If any device has its status set, then CPU performs data transfer for it.



⇒ wastage of CPU time.



Time Required in Programmed IO



status Reg.

By default
status
reg. size \Rightarrow 1 byte

$$\text{register} = \text{time to read status of I/O device by CPU} + \text{time taken by CPU to check if status flag is set or not almost 0} + \text{Data transfer time from device to CPU}$$

depends on I/O speed



Ans = 1.1 usec

Question

Consider a device which operates with 20MBPS operating speed. The device is operating on program control mode of IO and it has to transfer data of 20B from it. The data is transferred byte wise. Size of status register is 2Bytes. Total time needed to perform the data transfer is _____ microseconds?

$$\text{Time} = \frac{\text{Time to read } 2B \text{ status Reg.}}{\text{Data transfer time}}$$

$$= 2 * 0.05 + 20 * 0.05 \\ = 1.1 \text{ usec}$$

for 20MB, time = 1 sec

$$1 B - 11 - = \frac{1 \text{ sec}}{20 M}$$

$$= 0.05 \text{ usec}$$

- (+) Rates in powers of 10
- (-) Data in powers of 2.



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Interrupt
IO

Types of
Interrupt

Daisy
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DMA



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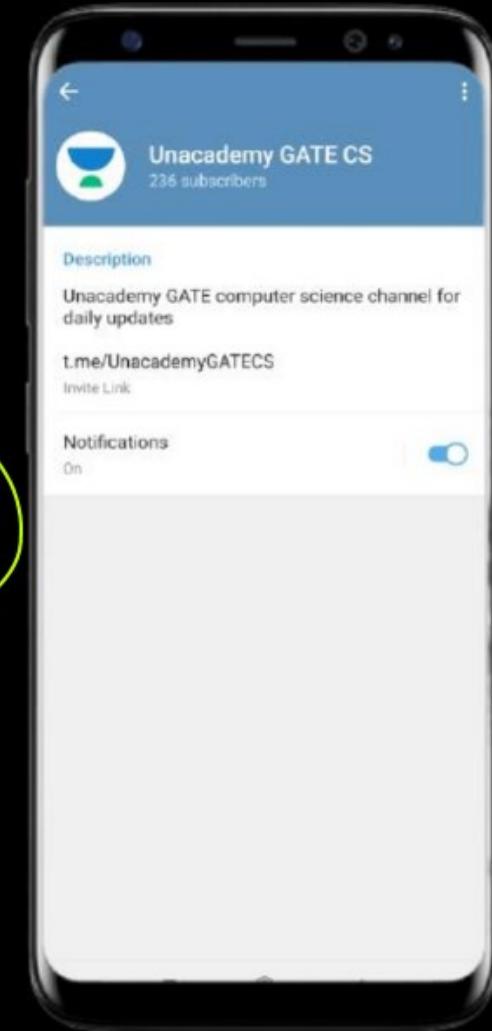
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