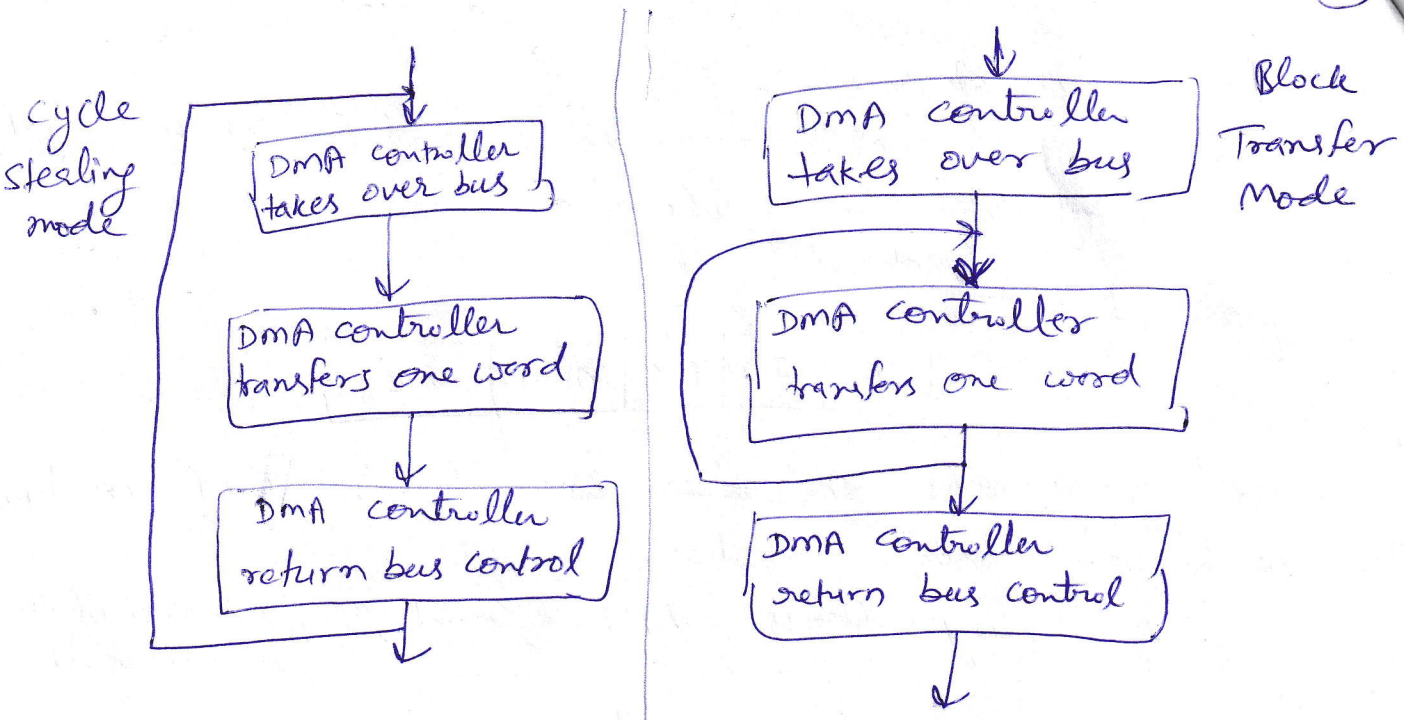


Other Applications of DMA

→ Other then data transfer to/from high-speed peripheral devices, DMA can be used in some other areas as well:

- High-speed memory-to-memory block move
- Refreshing dynamic memory systems, by periodically generating dummy read requests to the columns.

Some Examples on I/O transfer

Q.1. Suppose we want to read 2048 bytes in programmed I/O mode of transfer. The bus width is 32 bits. Each time an interrupt occurs, it takes 4 μsec to service it (ie, transfer 32 bits). How much CPU time is required to read 2048 bytes?

Ans.

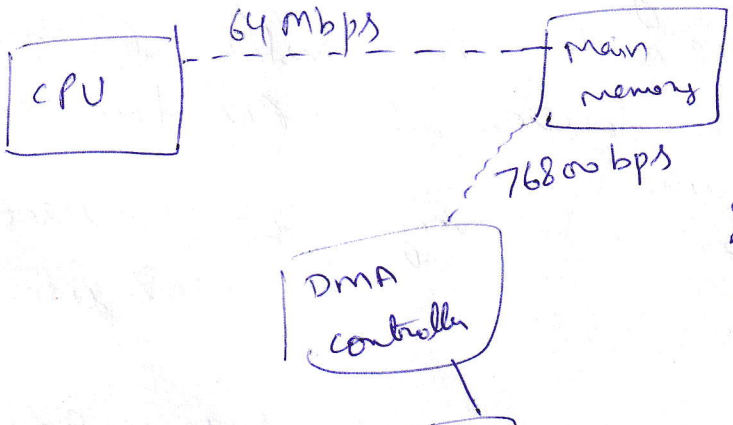
Transfer 4 bytes in 4 μsec

1 " " $\frac{4}{4}$ 1 μsec

∴ 2048 —— $\frac{4}{4} * 2048$ μsec

= 2.048 msec

Ques. 2 A DMA module is transferring bytes to main memory from an external device at 76800 bps. The CPU can fetch instructions at a rate of 2 million instructions per seconds. Assume instruction size is 32 bits. How much will the processor be slowed down due to DMA activity?



2M
$2 \times 10^6 \times 32$ bits
= 64 Mbps

In one second
CPU: 64×10^6 bits
DMAC: 76800 bits

$$\text{slowdown} = \frac{76800}{64 \times 10^6} \times 100\ \%$$

Ans. 0.12 %

Ques 3 A DMA controller transfers 32-bits word to memory using cycle stealing. The words are assembled from a device that transmits bytes at a rate of 2400 bytes per second. The CPU is fetching and executing instructions at an average rate of 1 million instructions per second. By how much time will the CPU be slowed down because of the DMA transfer?

In one second

CPU : 1 M words

DMAC : $\frac{2400}{4}$ = 600 words

slowdown : $\frac{600}{1M} \times 100\% = 0.06\%$

Ques 4. Consider a system employing interrupt-driven I/O for a device that transfers data at 8 KB/s on a continuous basis. The interrupt processing takes about 100 usec and the I/O device interrupts the CPU for every byte.

While executing the ISR, the processor takes about 8 usec for the transfer of each byte. What is the fraction of CPU time consumed by the I/O device?

Overhead for every byte = 100 usec + 8 usec

= 108 usec

1 second

8KB ⇒ Total overhead = 8000 × 108 usec

= 8 ——

= 800 msec = 0.8