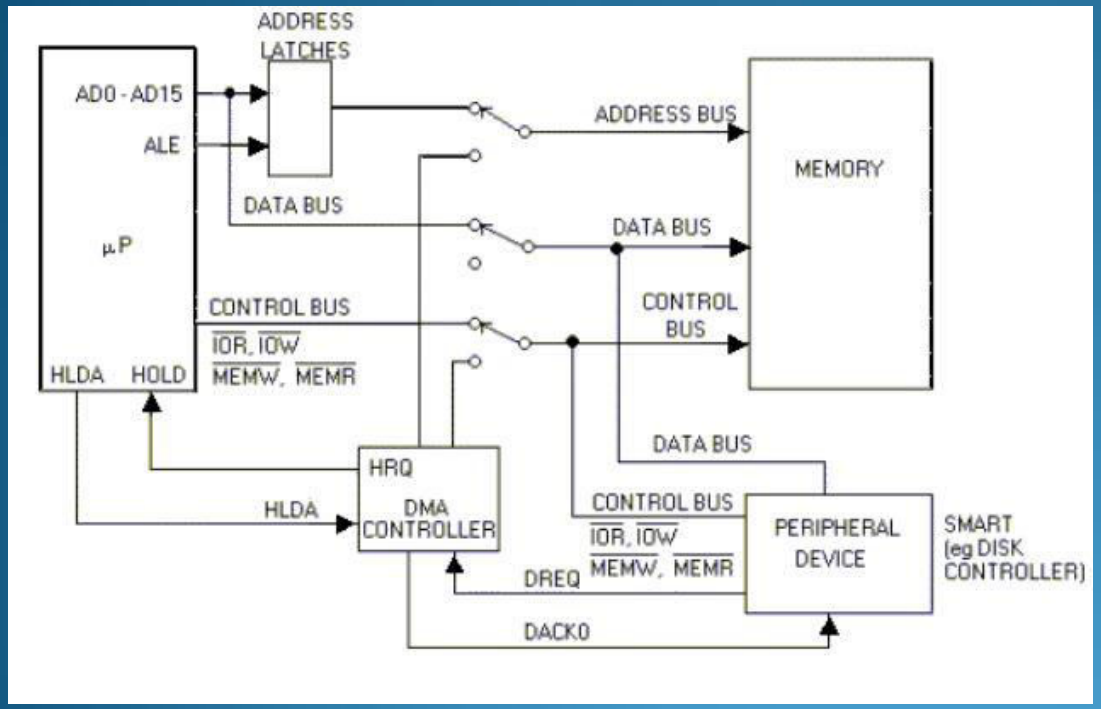
# DIRECT MEMORY ACCESS

## AND ITS OPERATIONS




MR. Venkateshan R
Assistant Professor
BCA Department

**VET First Grade College**
**JP Nagar 2nd Phase**
**Bangalore**

VASAVI EDUCATIONAL TRUST

# Short Brief About DMA

- **“DIRECT MEMORY ACCESS (DMA)** IS A FEATURE OF COMPUTERIZED SYSTEMS THAT ALLOWS CERTAIN HARDWARE SUBSYSTEMS TO ACCESS MAIN SYSTEM MEMORY INDEPENDENTLY OF THE CENTRAL PROCESSING UNIT (CPU).”

- Direct memory access (DMA) is a means of having a peripheral device control a processor's memory bus directly.”

- memory while the microprocessor is temporarily disabled.
- I/O devices are connected to system bus via a special interference circuit
- known as “DMA Controller”.
- In DMA, both CPU and DMA controller have access to main memory via a
- shared system bus having data, address and control lines.
- A DMA controller temporarily borrows the address bus, data bus, and control
- I/O port and a series of memory locations.
- The DMA transfer is also used to do high-speed memory-to memory transfers.
- DMA transfer can be done in two ways.

# DMA vs. NO DMA

| Without DMA | With DMA |
| --- | --- |
| •When the CPU is using programmed input/output, it is typically fully occupied for the entire duration of the read or write operation, and is thus unavailable to perform other work. | •The CPU initiates the transfer, does other operations while the transfer is in progress, and receives an interrupt from the DMA controller when the operation is done. |

This feature is useful any time the CPU cannot keep up with the rate of data transfer, or where the CPU needs to perform useful work while waiting for a relatively slow I/O data transfer.

# DMA Initialization

- DMA controllers require initialization by software. Typical setup parameters include the base address of the source area, the base address of the destination area, the length of the block, and whether the DMA controller should generate a processor interrupt once the block transfer is complete.

# Types of DMA transfer

- DMA Transfer Block
- Cycle Stealing

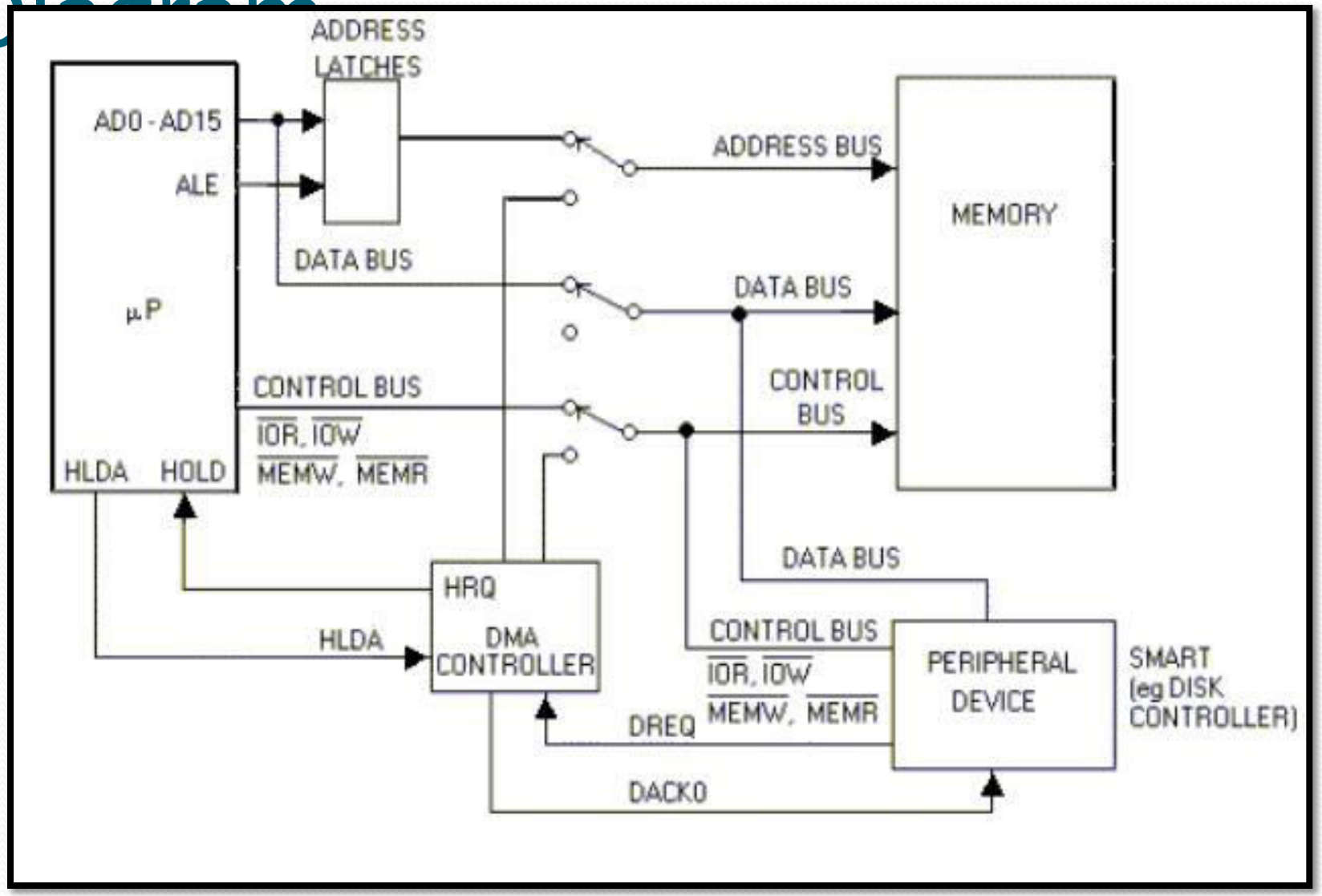
# DMA Transfer Block

- n this DMA mode , DMA controller is master of memory bus.
- This mode is needed by the secondary memory like disk drives, that have data transmission and are no to be stopped or slowed without any loss of data transfer of blocks.
- Block DMA transfer supports faster I/O data transfer rates but the CPU remains inactive for relatively long period by tieing up the system bus.

# Cycle Stealing

- In this method, system allows DMA controller to use system bus to transfer one word, after which it should return back control of bus to CPU.
- This method reduces maximum I/O transfer rates
- It also reduces interference of DMA controller in CPU memory access
- It is completely eliminated by designing DMA interface so that system bus cycles are stolen only when CPU is not actually using system bus.
- This is also called as Transparent DMA

# DMA Data Tranfer: Block Diagram



# Data Transfer: Block Components

- Two control signals are used to request and acknowledge a DMA transfer .
- The HOLD signal is a bus request signal which asks the microprocessor to release control of the buses after the current bus cycle.
- The HLDA signal is a bus grant signal which indicates that the microprocessor has indeed released control of its buses by placing the buses at their high-impedance states.
- DREQi (DMA request): Used to request a DMA transfer for a particular DMA channel.
- DACKi (DMA channel acknowledge): Acknowledges a channel DMA request from a device.

# DMA Data Transfer

- Data transfer technique directly between memory and I/O device
- Steps:

  1. I/O device asserts DRQ signal.

  2.DMA controller sends HOLD signal to CPU

  3.CPU sends HLDA back to DMA controller

  4.DMA controller give DMA acknowledgment back to I/O.

# DMA Data Transfer

5.DMA controller places memory address on address bus

6.DMA controller updates memory address register and word counter register

7.When DC register becomes zero ,DMA controller sets HOLD=0

8.Data transfer process terminates and processor regain control of system bus.

# Advantages of DMA

- DMA allows a peripheral device to read from/write to memory without going through the CPU
- DMA allows for faster processing since the processor can be working on something else while the peripheral can be populating memory.

# Disadvantages of DMA

- DMA transfer requires a DMA controller to carry out the operation, hence cost of the system increases.
- Cache Coherence problems.

# THANK YOU