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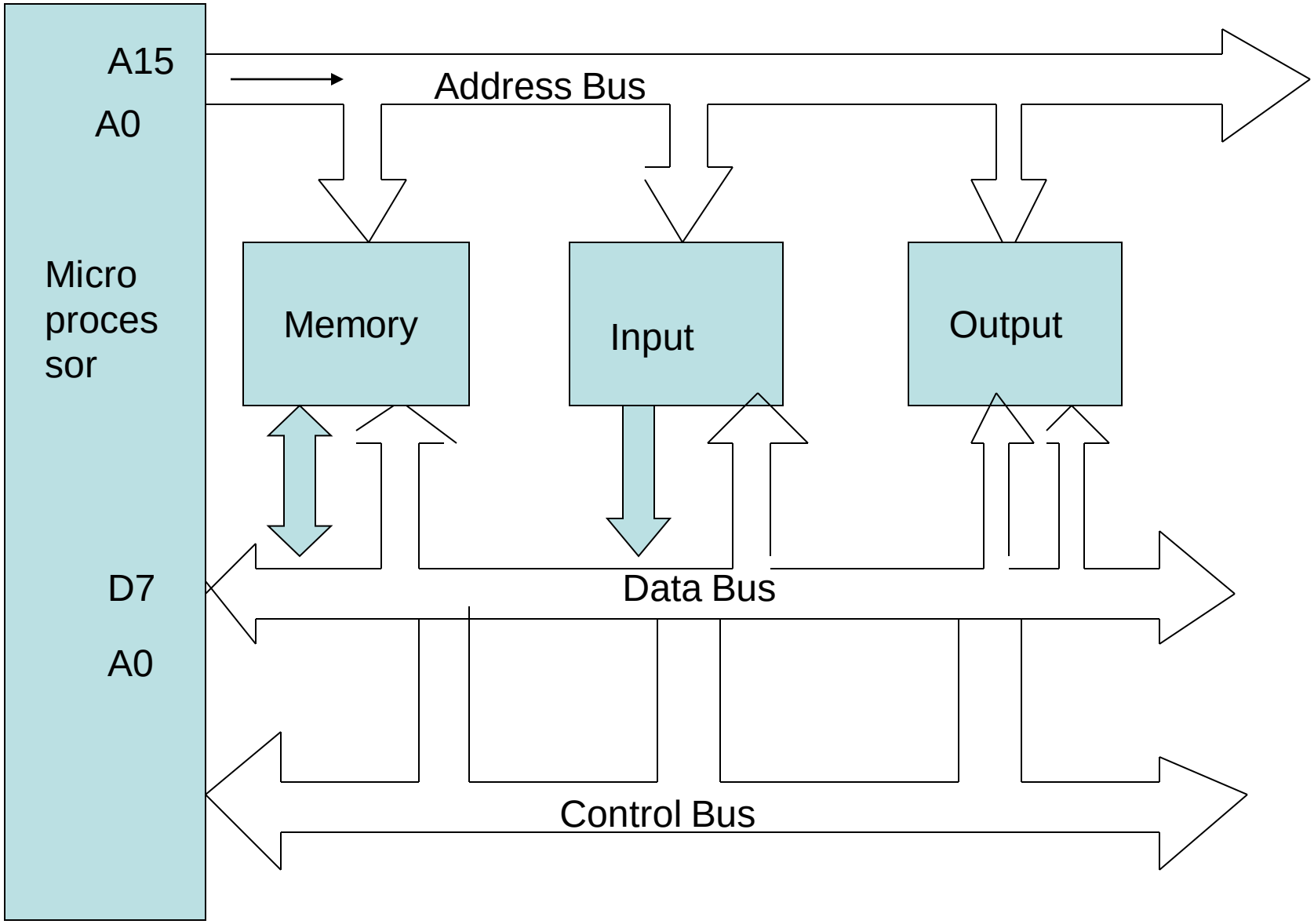
Input Output Organization

Memory Bus

- Memory Bus Basically Contain address bus , Data bus and control bus.

- Figure..



Block diagram of memory bus

Data Bus

- It is a bidirectional bus which allows the transfer of data between the microprocessor and memory or peripheral devices.

- In 8085 it is 8-bit bidirectional bus , which carry 8-bit of information at a time.

Address Bus

- It is a Unidirectional bus which carries address of memory location or port no. of the peripheral devices.
- In the 8085, address bus is 16-bit.
- The no. of line in the address bus also determines the total amount of memory accessed by the microprocessor.

Control Bus

- It consists of various single lines that carries synchronization signals which acts as an handshake signal between the microprocessor and peripheral devices.

- As an example the microprocessor sends the appropriate signal to activate the memory device in order to read or write the data.

- There are four types of commands that interface may receive.
  - Control Command
  - Status Command
  - Output Data
  - Input Data

1.Control Command

- A Control Command is issued to active peripheral and to inform it what to do.

2.Status Command

- This Command is used to test various status condition in the interface and in the peripheral.

3.Output Data

- Data output command causes the interface to respond by transferring the data from the I/O into one of its register.

4.Input Data

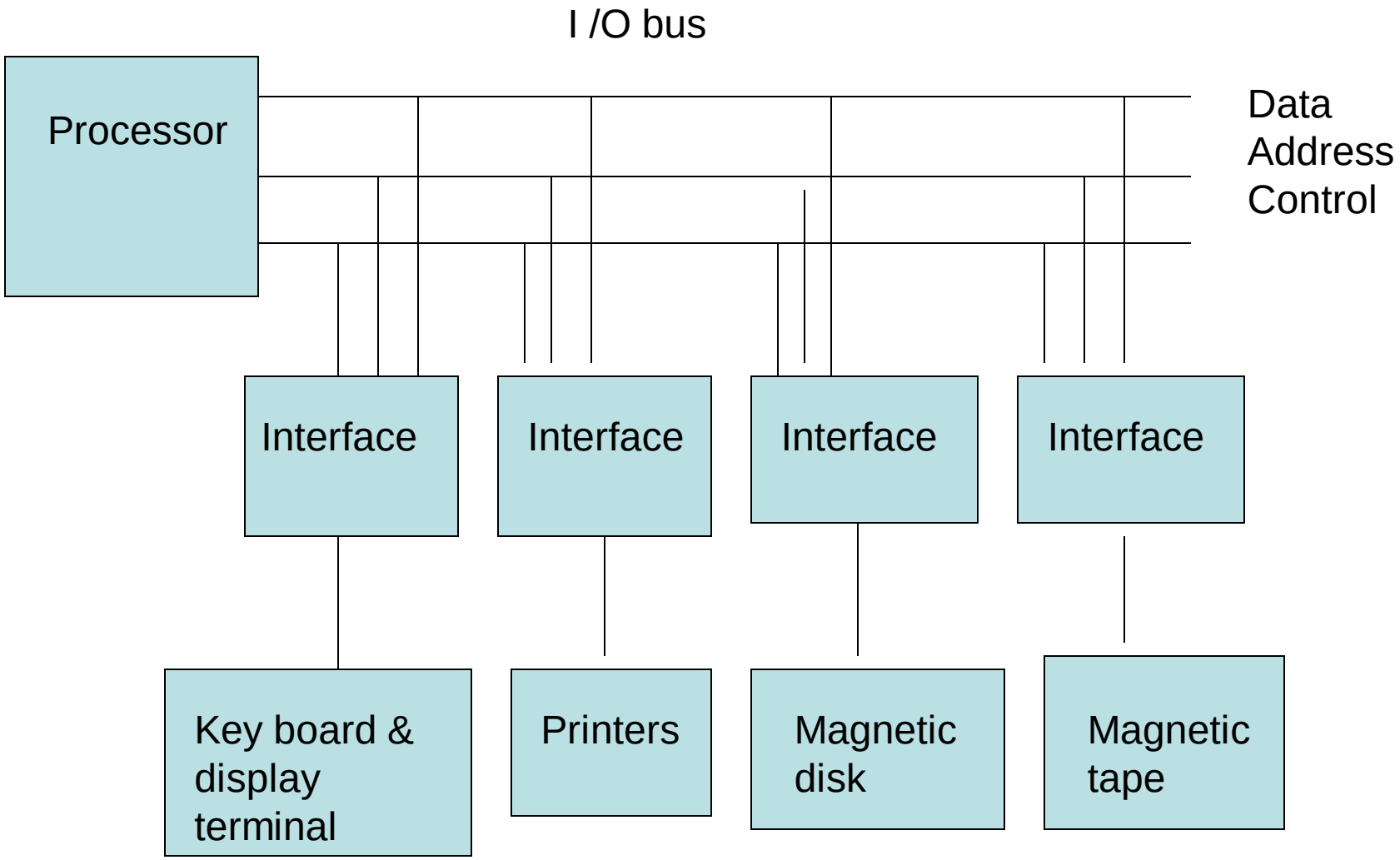
- This command is opposite of data output in this case the interface receives an item of data from the peripheral and place it in it’s buffer register.

Input / output Bus

- It is a group of wires known as and provides the communication path between microprocessor or CPU to peripheral devices.
- Connecting all the devices on a single path or bus is called command bus approach.
- To make the complete system using a microprocessor or CPU ,we need to interface the microprocessor with the memory and other input/output devices.

- This interfacing is Achieved by mean of connecting no. of lines between the microprocessor CPU to peripheral devices.

- The specific group of lines called bus which actually transfer the bits from the microprocessor or CPU to peripheral devices.


I /O bus
Processor
Data
Address
Control
Interface
Interface
Interface
Interface
Key board &
display
terminal
Printers
Magnetic
disk
Magnetic
tape

- The I/o bus consists of data line, address line and control line. Each peripheral device is connected with it an interface unit.
- The communicate with particular device the processor places a device address on the address line.
- When the interface detects its own address, it activates the path between the bus line and device that control.

Input / Output versus Memory Bus

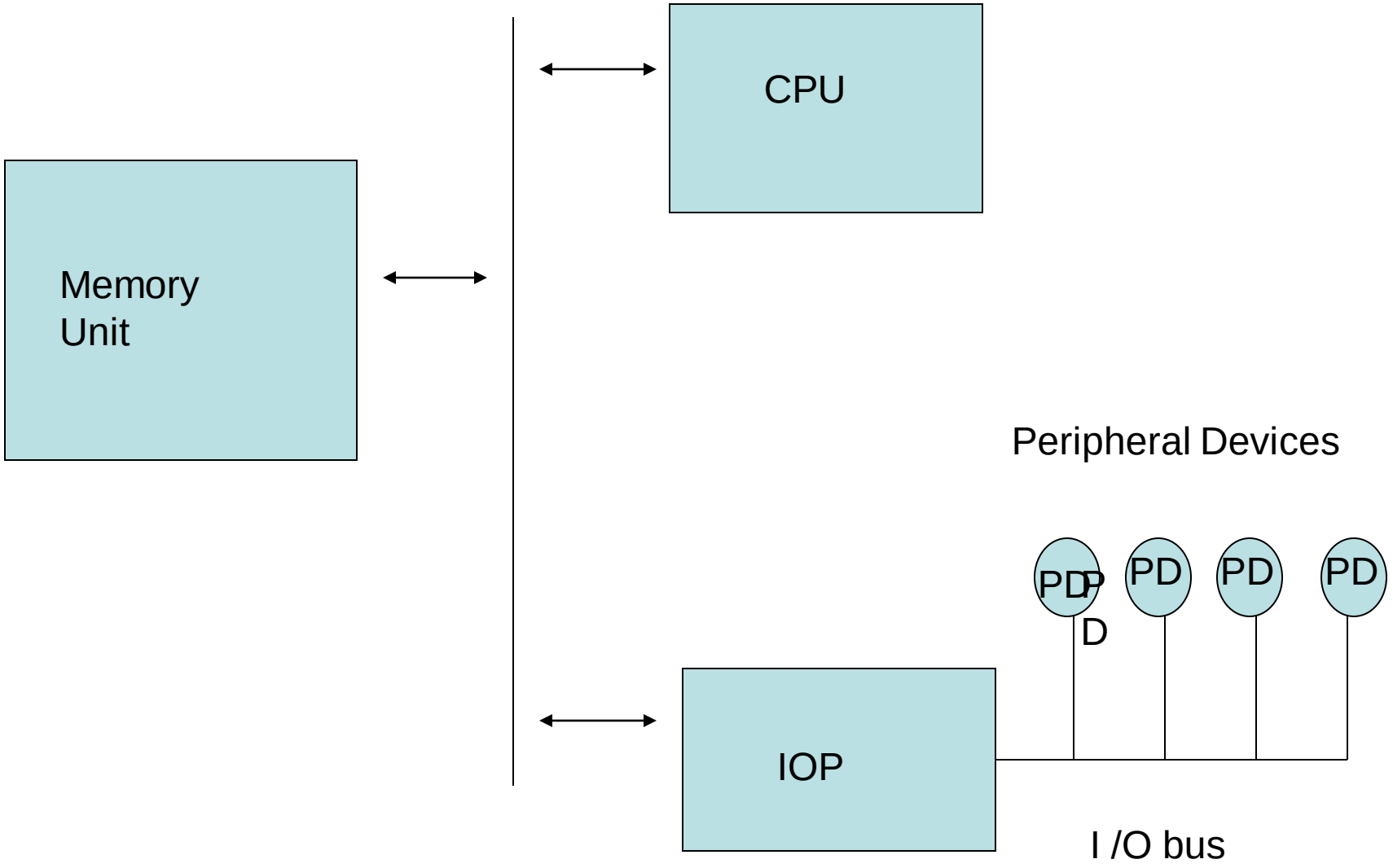
- In addition to communicating with I/O the processor must communicate with memory unit.
- Like the I/O bus, the memory bus contain data bus, address bus, control bus and read/write control lines.
- There are three ways that computer buses can be used to communicate with memory and I/O.

- 1. Use to separate buses, one for memory and other for I/O.
- 2. Use one common bus for both memory and I/O bus have separate control lines for each.
- 3. Use one common bus for memory and I/O with common control lines.

Input/output Processor (IOP)

- The I/O processor (IOP) is similar to a CPU except that is designed to handle the details of I/O processing.
- Unlike the DMA controller that must set up entirely by the CPU the IOP can fetch and execute its own instructions.
- IOP instructions are specially designed to facilitate I/O transfer.

- In addition IOP can perform other processing task, such as arithmetic logic, branching and code translation.
- In IOP the computer is divided into three modules as follows:
- 1. The memory unit
- 2. CPU
- 3. The Input Output processor



Block Diagram of computer with processor

- In most of the computer system CPU is Master and IOP is Slave.
- CPU is assigned the task of initiating all operation but I/O instructions are executed in IOP.
- Instructions that is read from memory by an IOP are called commands.

Direct Memory Access (DMA)

- The transfer of data between a fast storage device such as magnetic disk and memory is often limited by the speed of the CPU.
- Removing the CPU from the path and peripheral device manage the memory buses directly would improve the speed of transfer.
- This transfer technique is called Direct Memory Access (DMA).

- Direct Memory Access is a sophisticated input/output technique in which a DMA controller replaces the CPU and takes care of the access of input/output device and the memory.
- Direct Memory Access (DMA) is a feature of modern computers that allows hardware subsystem within the computer to access system memory for reading and or writing independently of the Central Processing Unit.

- Many hardware systems are use DMA which including disk drive controllers, graphics cards, network cards and sound cards.

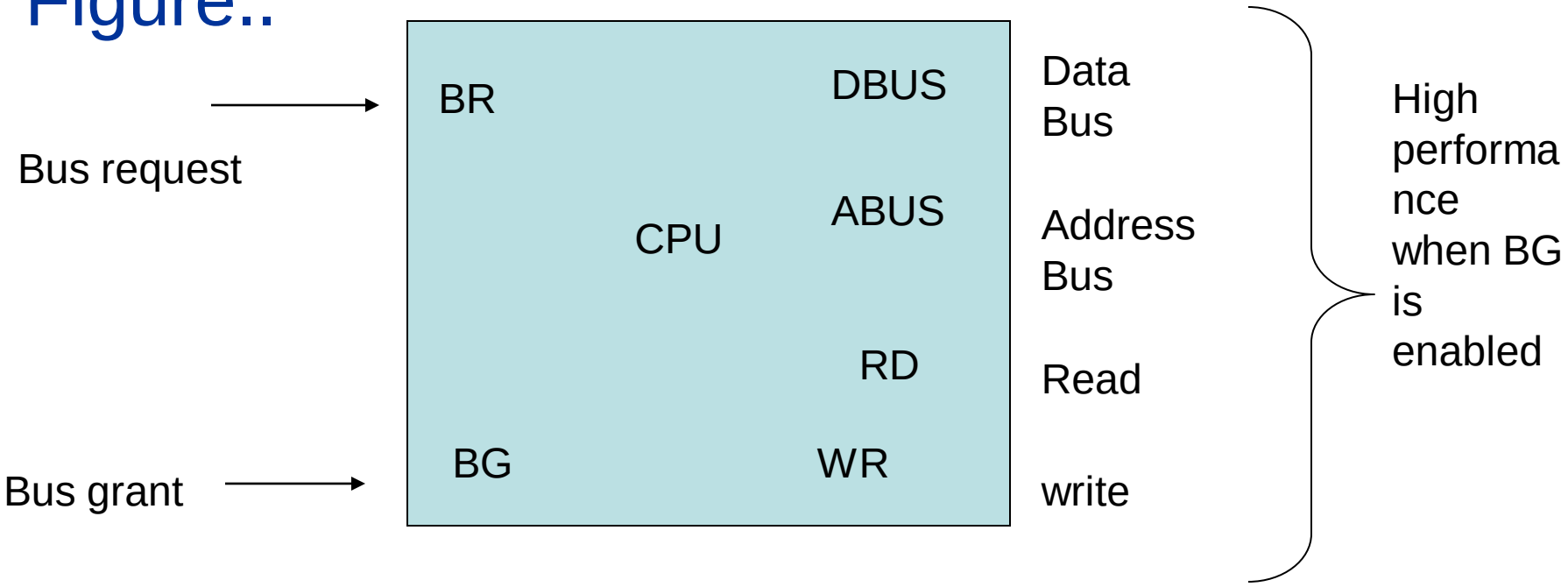
- Central Processing Unit often limited data transfer speed between secondary memory and main memory.

Advantage of DMA

- Without DMA, using programmed input/output (PIO) mode. The CPU is typically fully occupied for the entire duration of the read or write operation and is unavailable to perform do other work.

Working of DMA

- DMA controller control the buses and the data transfer directly between the I/O device and memory.
- Figure..



➢ DMA Controller :

- The DMA controller needs the usual circuit of an interface to communicate with CPU and I /O device.
- An addition is need an address register a word count register and a set of address lines.

-> Address Register : The address register contains the address to specify the desire location in memory .

- This register in incremented after each word is transfer to memory.

-> Word count register : This register holds the number of words to be transferred.

- This register is decremented by after each word transfer and internally tested for zero.
- It is also store the number of word that need to be read or written into memory.

-> Control register : The control register specifies the mode of transfer means read or written.

- The register to which the data in the data bus need to be transferred is done by register selected input

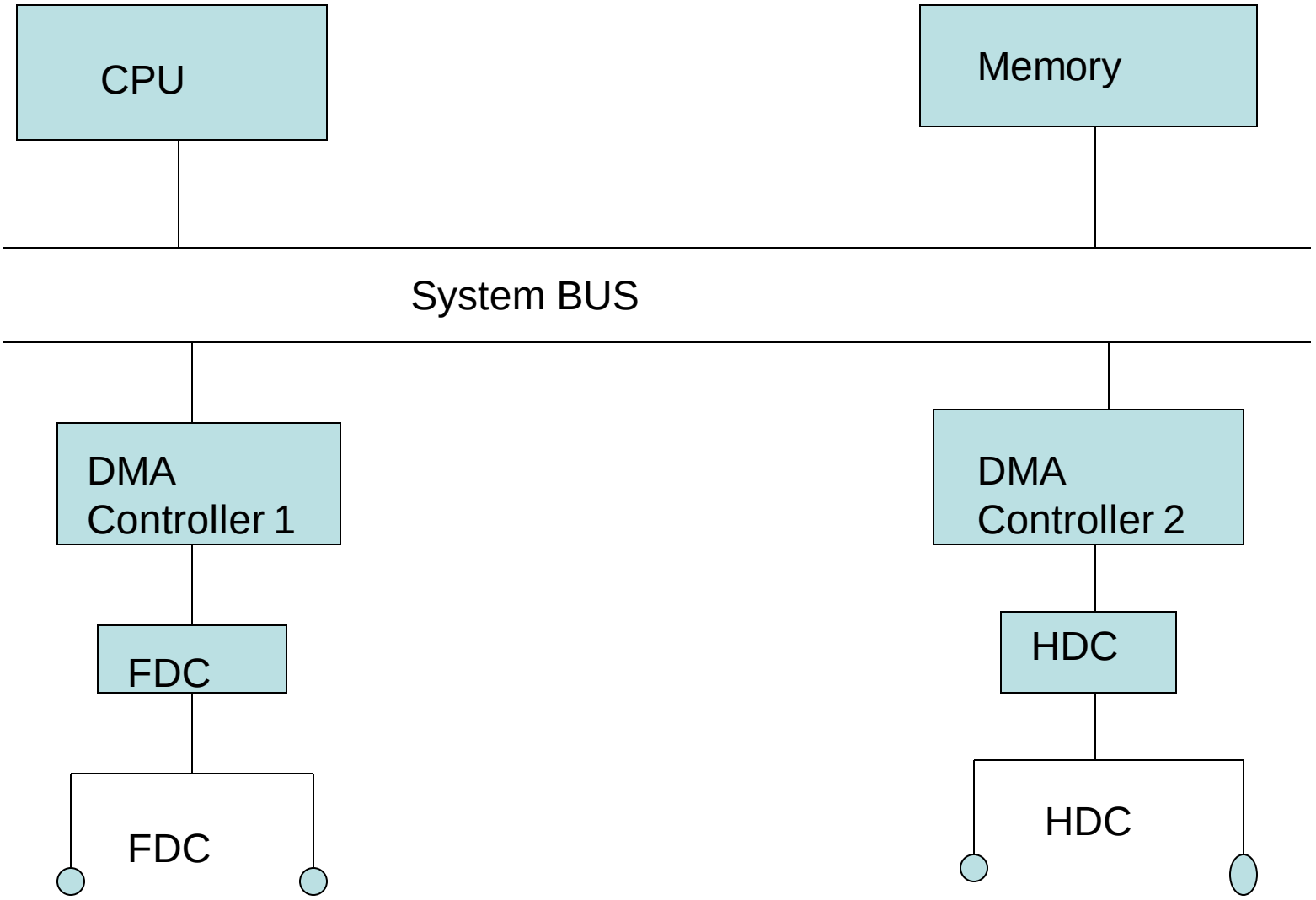
➢ Types of DMA Controller :

- DMA controller are of the two types :

- Independent DMA controller
- DMA controller having multiple DMA channels

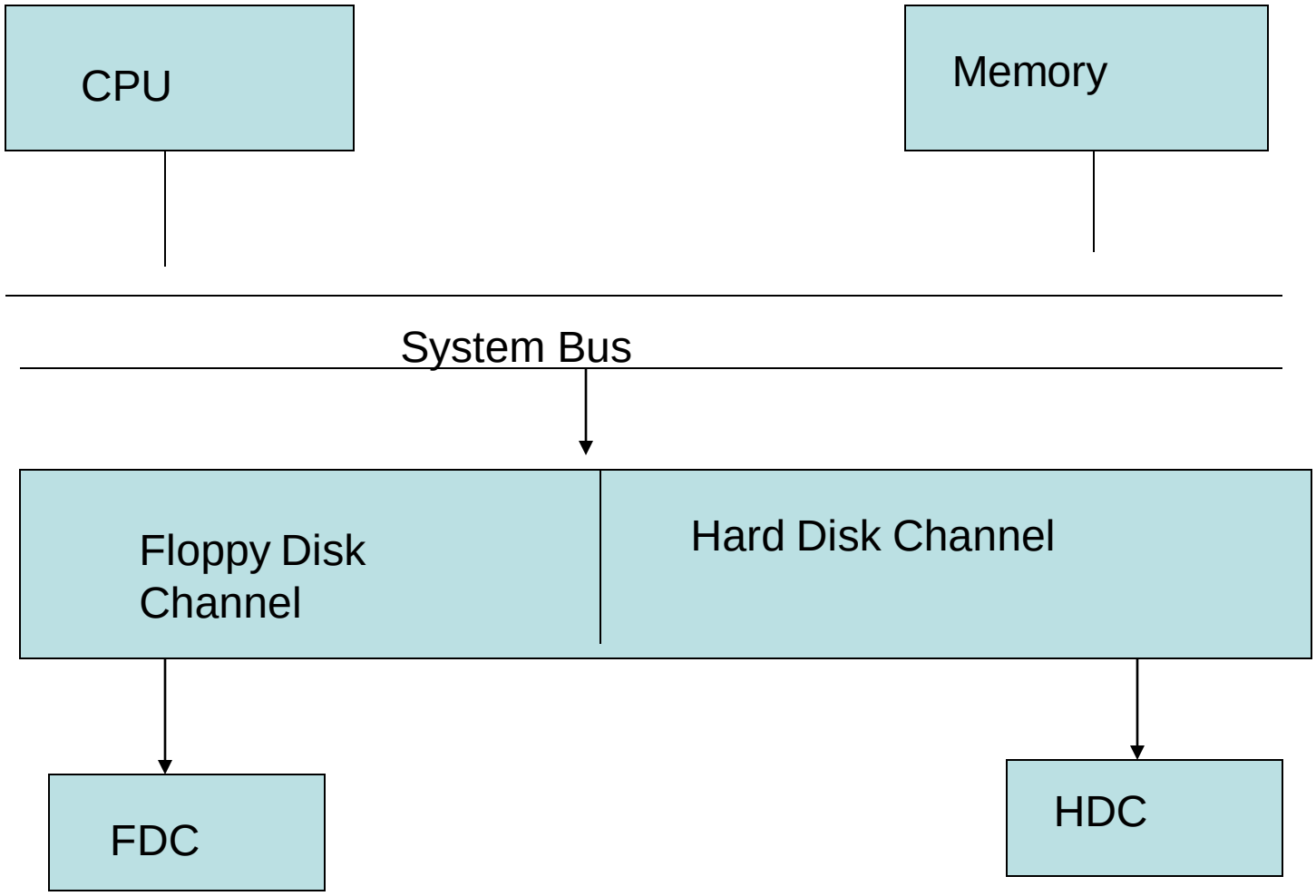
-> Independent DMA controller : Here for each I /O devices a separate DMA controller is used.

- A set of register to hold several DMA parameter is kept in each DMA controller.
- Here arrangement is show were FDC (Floppy Disk Controller) and HDC (Hard Disk Controller).


CPU
Memory
System BUS
DMA Controller 1
DMA Controller 2
FDC
FDC
HDC
HDC

-> DMA controller having multiple DMA channels : In this type of controller only one DMA controller control various peripherals.

- This control has multiple section & channels.
- Each channels is for one I /O device in this case , the software deals each channels in the same way.


CPU
Memory
System Bus
Floppy Disk Channel
Hard Disk Channel
FDC
HDC